

## Initial Environmental Examination (IEE) on

Connection of Northern Kachin State to the 230kV National Grid

Package 1- 230kV Transmission System Bamaw - Nabar



Final Report

November, 2018

**UNION RESOURCES & ENGINEERING CO., LTD.**

## Initial Environmental Examination (IEE) on

Connection of Northern Kachin State to the 230kV National Grid Package  
1- 230kV Transmission System Bamaw - Nabar

To:

**Director General**

**Environmental Conservation Department,**

**Ministry of Natural Resources and Environmental Conservation**

**Nay Pyi Taw, the Republic of the Union of Myanmar**

Dated: 10<sup>th</sup>, November 2018

**Subject: Commitment Letter for comply and follow the Environmental Management Plan that mentioned in the IEE report that prepared for IEE report of 230kV Transmission System Bamaw-Nabar (Package-1)**

Dear Sir,

We refer to the captioned IEE report, which has been prepared and finalized by Resource & environment Myanmar Co., Ltd. in compliance with IEE procedure (December 2015) and other relevant laws/rules and formally submitted to the Environmental Conservation Department.

We believe, to the best of our knowledge at the time of writing, that;

- The IEE report is accurate and complete, and;
- The IEE report has been prepared in strict compliance with applicable laws, rules, regulations and procedures in force.

We hereby undertake that;

UREC in respect of the “**Construction of 230kV Transmission System Bamaw0Nabar (Package-1)**” will at all times comply fully with: (i) any and all commitments and obligations as set forth in the ESIA report which has been reviewed by Review Team of MONREC, and (ii) any and all plans and the various components thereof, including without limitation, impacts avoidance, mitigation, and remediation measures, and with respect to both (i) and (ii), including but not limited to such commitments, obligations, plans and measures related to the development, construction, commissioning, operation and maintenance of the project, and any circumstance in which work done or to be done, or services performed or to be performed, in connection with the projects development, construction, commissioning, operation and maintenance is carried out our intended or required to be carried out by any contractor, subcontractor or other party.

When the proposed project will be constructed and operated in Myanmar, UREC will comply and follow the Environmental Management Plan that mentioned in the IEE report that prepared by Resource & Environment Myanmar Co., Ltd.

Besides, UREC will submit the Environmental Monitoring Report during construction and operation of the proposed project to Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation.

With best regard!



Dong Fan  
Managing Director  
Union Resources & Engineering Co., Ltd.



## **Resource and Environment Myanmar Ltd.**

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### **DECLARATIONS**

#### **DECLARATION - EIA Experts**

**Resource & Environment Myanmar Co., Ltd. (REM);** a local environmental consultant firm, conducted environmental impact assessment and prepared IEE report for Union Resources and Engineering Co., Ltd. (UREC) in compliance with IEE Procedure (December 2015) and other relevant laws/rules and formally submitted to the Environmental Conservation Department (ECD) for final approval.

We do state, to the best of our knowledge at the time of report preparation, that

- To our knowledge, all information contained in this report is accurate and a truthful representation of all findings as relating to the project, and ;
- The IEE Report has been prepared in strict compliance with all applicable laws, rules regulations and procedure in force.

We also consulted to UREC to undertake that;

UREC in respect of the “Package1-230kV Transmission System Bamaw-Nabar project” will at all times comply fully with (1) any and all commitments and obligations as set forth in the IEE Report which has been reviewed by Review Team, and (2) any and all plans and the various components thereof, including without limitation, impact avoidance, mitigation, and remediation measures, and with respect to such commitments, obligations, plans and measures related to the development, construction, commissioning, operation and maintenance of the project, and any circumstance in which work done or to be done, or services performed or to be performed, in connection with the project’s development.

Signed: (Zaw Naing Oo)

Date: 10-11-2018

Director

For: **Resource & Environment Myanmar Co., Ltd. (REM)**



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## **Executive Summary**

### **1. Project Description and Project Size**

The Project, as one of the key projects in the “North-to-South Power Transmission Project” of Myanmar Electric Power Enterprise, aims to transmit the electric power generated by Tapaing Hydropower Plant to central Myanmar and supply the power load center in South Myanmar after connected to the 230kV National Grid, developing the 230kV transmission system that covers the whole nation. The Project, mostly located in Sagaing Region, the north-central Myanmar, consisting of two 230kV substations and two 230kV double circuit transmission lines (290 miles in total), includes the survey, design, supply, construction, installation and commissioning on EPC basis.

For connection of Northern Kachin State to 230kV National Grid, this project includes the construction of 230kV transmission line between Bamaw and Nabar with the length of about 121 km, two newly -built 230kV/66kV substations and one extended substation aiming at power supply for area along the Northern Mandalay to Kachin State. Situated in the northern region of Mandalay, the Project Area has the better natural condition with the average temperature of 20°C and 33.9° C in January and April respectively.

Main construction contents in Package 1 are as follows:

Package1-230kV Transmission System Bamaw-Nabar:

1. 230kV double circuit line Bamaw-Nabar with estimated length of 75miles (121km);
2. New Bamaw 230/110/66kV substation with 2×100MVA230/110kV step-up transformers,1×50MVA 110/66kV transformer, two 230kV line feeders, one 110kV line feeder and three 66kV line feeders.
3. New Nabar 230/66kV substation with 2×50MVA transformers, 6×230kV line feeders and three 66kV line feeders.
4. Replacement of conductor ACSR“IBIS” with ACCC“LATEDO” on single circuit existing 110kV line Tapein 1-Bamaw with length of 22 miles(35km).

The location of the 230 kV transmission system and the power transmission line system package 1 and the location of sub-stations and transmission line route are shown in Figure 2-1 and 2-2.

This report intends to assess the Initial Environmental Examination (IEE) of the proposed power transmission line and two substations. Detailed project description is provided in Chapter 1.



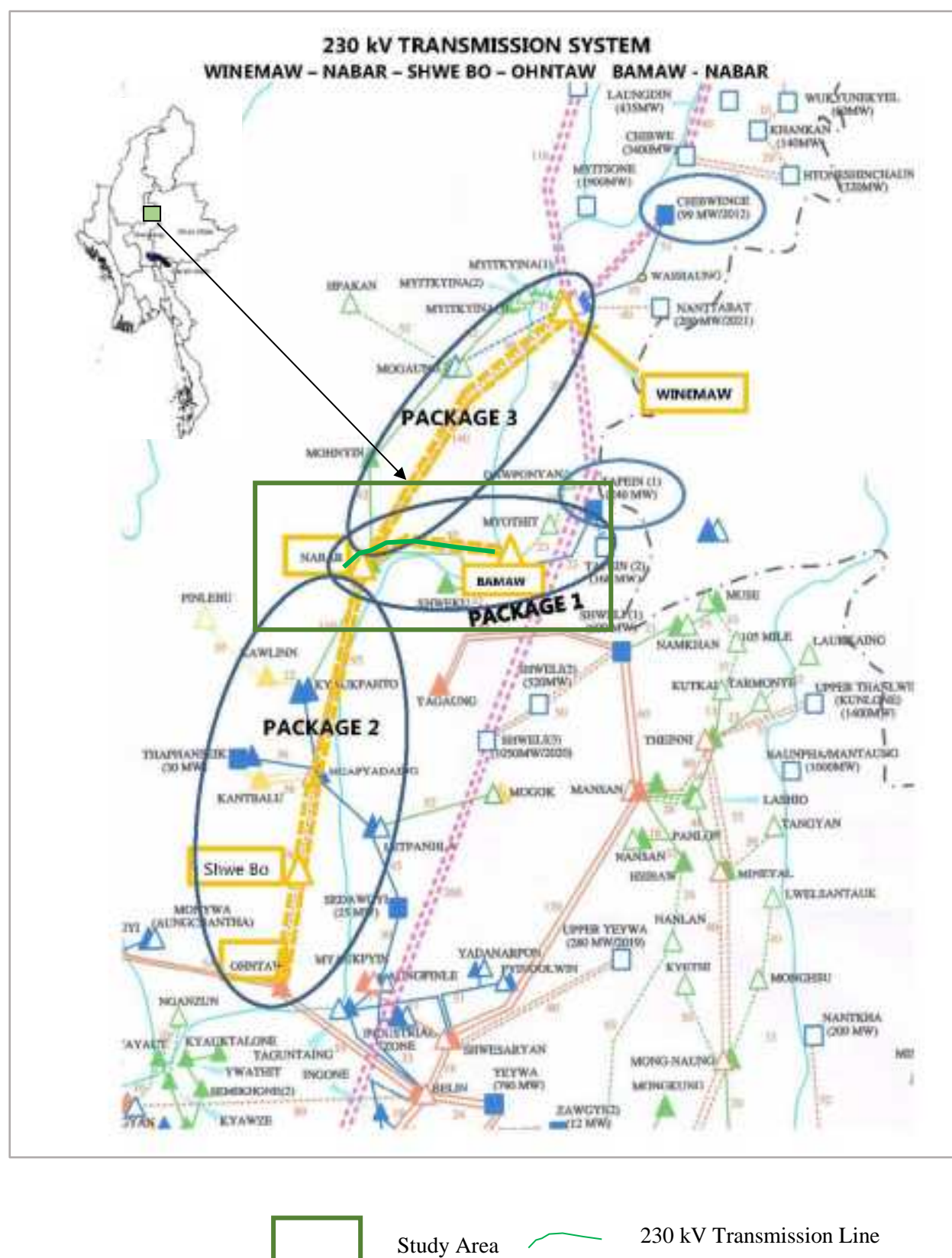


Figure. 2-1: The location of the 230 kV transmission system and the power transmission line system package



Figure 2-2: Location of Substations and transmission line route between Nabar and Bhamo (Bamaw)



## 2. Identification of the Project Proponent

**Project Owner:** Union Resources & Engineering Co., Ltd.  
**Address:** No.35, Pyay Road, 7 Quarter, Mayangone Township, Yangon,  
Union of Myanmar  
**Email:** travis1256@hotmail.com  
**Contact Person:** Mr. Travis Liu, Deputy Chief Representative  
**Website:** <http://www.urec.com.cn>

## 3 Identification of the IEE Experts

### Leading Organization - Resource & Environment Myanmar Co., Ltd. (REM)

(REM) is located in the city of Yangon, Myanmar, in the country it is a leading resources and environment consulting firm that composed of geoscientists, engineers, biologist, botanist, socio-economic experts, cultural heritage experts, environmental engineers and physical resources management specialist.

**Address:** No. 702 B, Delta Plaza, Shwegonedaing Road,  
Bahan, Yangon.

**Telephone:** 959-73013448

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**Email:** [service@enviromyanmar.net](mailto:service@enviromyanmar.net)

**Contact Person:** Mr. Thura Aung

**Designation:** General Manager



### Secondary Organization - Sustainable Environment Myanmar Co., Ltd. (SEM)

**Address:** B 503 Delta Plaza, Shwegondaing Road, Bahan,  
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**Website:** <http://sustainablemyanmarsem.com>



The SEM provides Environmental & Social/Health Impact Assessment service for development projects in Myanmar. SEM has resources and capacity to handle environmental management issues as per the provisions of Environmental Conservation Laws 2012 including, EIA, ESMP, environmental monitoring and auditing.

## 4. Legislation and Guidelines

The present ESIA report has been prepared in accordance with the requirements and regulations of the Ministry of Natural Resources and Environmental Conservation (MONREC). The project proponent, UREC shall comply the all National Laws that related to the project activities. UREC will follow and comply the National Environmental Quality (Emission) Guidelines. The detailed descriptions of related laws, regulations and standard which shall follow and comply by UREC are described in Chapter 4.

## **5. Description of the Surrounding Environmental and Social Conditions**

The proposed transmission line route between Bamaw and Kathar is located on the eastern bank of Ayeyarwady River and the line route between Kathar and Nabar is located on the western bank of Ayeyarwady River. The eastern portion of the alignment is located in a flat area and average elevation is about 100 meter above sea level while the western portion is located in the hilly and highly dissected with moderate to steep slope. The route of transmission line is generally occupied by flat topography with Alluvium near the Bamaw (Bhamo) area and highly undulating with hilly terrains that occupied by ultrabasic rock and older Pre-Cambrian sediments and metamorphosed sediments between Shwegu and Kathar area. Another formation is Cretaceous clastic and carbonate rocks chiefly consists of sandstone, limestone and shale. Between Kathar and Nabar area, the transmission line passes through the Pre-Cambrian rocks again. According to the land use mapping, approximately 88 % of land within the RoW consists of degraded deciduous forest and the rest area is occupied by agricultural land including paddy field and plantation. Three major habitat types were observed namely (1) mixed vegetation with scattered trees, (2) rice field and rubber plantation and (3) aquatic habitat. According to the literature survey followed by field survey, there is no threatened plant and animal species in the proposed substations and along the 230 kV transmission line areas. There is no protected area within immediate distance from TL route and substations. The biodiversity survey report is presented in Appendix-9 of this ESIA report.

The proposed transmission line will pass through four townships namely Bamw (Bhamo), Shwegu, Kathar and Indaw which occupy one state and one region, namely Kachin and Sagaing. There are about 40 villages around the transmission line. The installation of towers along the ROW will affect some farmland and agricultural land that owned by the 40 villages in four townships. Farmland, plantation, forest and reserved forests are involved along the proposed transmission line route.

Land use of all affected villages includes cultivated land, virgin land, non-cultivated land and forest land. In our survey 17925 acres of paddy land, 5005 acres of farm land, 206 acres of orchard land, 10 acres of plantation land, 301 acres of community forest and 2105 acres of grazing land. The main crops are paddy, corn, bean and vegetables. Cows and buffalos are mainly used in agricultural works. Chicken, pig and goats are important livestock for home consumption and one of the income sources of their livelihood.

Most of the villages have primary school, sub-middle school and three villages have high school. Total of nine villages have rural health center and sub-rural health center. The others 33 villages have no health center and they drive 15minutes to 30 minutes to nearest health center by motorbike. Over 50% of household have government electricity, about 30% of house used solar and others are used battery, generator and lamp.

## **6. Identification and Assessment of Potential Environmental Impacts and Environmental Impact Mitigation Measures**

The environmental impacts from the activities related to construction and operation of the transmission line and two substations. The impacts are based on the project description provided by the client, existing available data and similar past projects.

The transmission line design will involve approximately 296 towers, based on approved transmission line route by Department of Power Transmission and System Control, Ministry

of Electricity and Energy. Land acquisition for Bamaw and Nabar substation have been completed and the land is own by Ministry of Electricity and Energy. Land acquisition and crop compensation for some part of the transmission line route, the ministry will settled out with land owners during construction phase. The potential environmental and social impact assessment for the present project will be assessed only for environmental and social impact without land acquisition. Besides, the evaluation of potential environmental and social impacts arising from the project activities will be assessed during both construction and operation phase only and there is no consideration for decommissioning phase because the source of electric power is come from hydropower which is sustainable and green energy.

The components of the present project will include the Right of Way (RoW), the transmission line, transmission towers, access roads and worker camps. No spoil areas are required as excavated material will be used for back fill and embankments at tower sites. During construction phase, the construction footprint will be confined to within 150 ft. (about 50 meter), except for the construction of external roads required in remote parts of the RoW. Vegetation below 3 m will be retained within the RoW where land is not required for tower footprints or access. The consideration and selection of the transmission line route was based on engineering principles and environmental factors, such as slope, geological condition for foundations and other obstructions.

In summary, project activities will include;

#### Construction Phase

- Clearing of vegetation for the RoW
- Earthworks for the installation of the transmission towers
- Construction of towers and stringing
- Rehabilitation of RoW areas not required to be permanently cleared and
- Construction of worker camp

#### Operation

- Vehicle travel within the RoW for maintenance works
- Maintenance of RoW, including repairs to transmission lines and trimming vegetation
- Road maintenance.

#### Potential Impacts

The potential environmental impacts can be understood to be in the following areas:

**Table 6-1: Potential Environmental and Social Impacts**

Impact	Construction				Operation
	Activities	Casting & Foundation	Erection of Tower	Stringing	Power Transmission
Soil		☑	-	☑	-
Waste disposal		☑	-	-	-
Aesthetics		☑	☑	-	-
Surface water quality		☑	-	-	-
Hydrology		☑	-	-	-
Biodiversity (Impacts on Flora and Fauna)		☑	-	☑	☑
Traffic and transport		☑	☑	☑	-
Atmospheric emissions/ dust		☑	-	-	-
Noise and Vibration		☑	-	☑	-
Socioeconomics		☑	-	☑	☑
Land use		☑	-	-	-

Economy and Livelihoods	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Electromagnetic fields	-	-	-	<input checked="" type="checkbox"/>
Community Health and Safety	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Occupational Health and Safety	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Hazards due to Natural disasters	-	-	-	<input checked="" type="checkbox"/>
Major accident risks	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

## 6.1 Construction Phase Impact

### Soil Quality

#### *a) Potential Impacts*

The most significant potential impacts will be due to change to soil structure and soil quality as a result of excavation or compaction. The magnitude and extent of the impacts are likely to vary according to the characteristics of the soil and the types of construction activity. Foundation pits will be backfilled by the excavated soils which will resemble the order of the original soil layers.

Compaction of soil during backfilling might lead to temporary effects on natural infiltration of rainwater, but these impacts are temporary, localized and marginal.

Removal of vegetation and trees during construction of foundation, especially on the slopes would render soil vulnerable to erosion. The socio-economic aspect of crop clearing is discussed in next sub section. Also, stringing activities can cause larger damage to crop if carried out during flowering/fruit bearing season.

Movement of workers through adjoining fields during construction can damage fresh crops. Loose soils and construction material if placed in adjoining fields will lead to damage of existing crop and contamination of soil. The excavated if kept uncovered and unprotected will be rendered vulnerable to loss from erosion.

#### *b) Mitigations*

The suggested mitigations to minimize impact on vegetation and soil include means to protect excavated soil material from erosion and contamination by placing them away from streams of water along the slope or in direct line of local drainage. Loose soil should be kept covered till the time of backfill and the excess soil should be removed after casting activities are complete. The construction activities shall be planned in non-monsoon months which will minimize any rainwater run-off or any loss due to infiltration.

Construction materials will be stored within the footprint of the site to avoid any kind of damage or contamination of soil/crop of adjoining fields. Movement of material and manpower shall be restricted to existing roads/tracks or as agreed upon with the stakeholders to avoid creation of new roads/tracks.

### Waste Disposal

#### *a) Potential Impacts*

There is potential for spread of construction debris to areas outside that marked for construction. The debris generated from construction activities can be carried along with small springs, rivulets and rivers flowing in proximity of the tower. Construction debris can also contaminate wells, canals etc. in proximity of the activity.

#### *b) Mitigations*

Any construction debris generated at the site will be removed from the site immediately after the completion of construction activities and the site will be leveled as original. Workers will

be strictly instructed about random disposal of any waste generated from the construction activity.

Arrangements will be made to collect and prevent littering by workers on site.

### **Aesthetics and Visual Impact**

#### ***a) Potential Impacts***

The visual impacts and change of landscape due to construction activity will be for a short period of 15-30 days. However route of towers and transmission line are expected to cross highways/roads, and other transmission line which may lead to change of landscape resource and character due to introduction of manmade features leading to visual intrusion and loss of visual amenity.

The cumulative impact due to already existing towers can hamper the aesthetic value of the area.

#### ***b) Mitigations***

The route is planned after a series of survey to avoid habitation and forest areas. The clearing of trees will be kept to minimum and wherever possible, trimming of trees will be adopted *vis-à-vis* felling of trees. The lattice structure of towers provide sufficient see through effect which diminish the visual impact on the aesthetics of the area. The area being hilly terrain with undulations restrict the view of many towers in a single view, moreover the height of tower do not appear to be significant with reference the terrain.

### **Surface Water Quantity and Quality**

#### ***a) Potential Impacts***

Water consumption will not have any impact on water requirement of the area as the water availability is in excess however, there is potential for wastage of water at site. There is potential for contamination of surface water bodies due to runoff from construction activities close to them. Also, construction along the slopes can affect small changes in the surface drainage pattern of the area.

Impacts to surface water quality can occur from erosion and sediment run off, discharge of inadequately treated sewage and domestic waste and release of hazardous materials.

The pollution sources are stated as follows:

#### **Erosion and Sediment**

Sources of erosion and sediment run off include:

- Erosion and sediment run off from construction activities that expose or move soil (including clearing of vegetation and earthworks)
- Release of sediment laden effluent during construction, for example soil waste from drilling activities
- Erosion and sediment released from stream bed and river bank disturbance at river course crossings

Erosion has the potential to lead to deposition of sediment and increased turbidity of water which can limit photosynthesis, suffocate benthic fauna and more broadly degrade aquatic habitat.

#### **Hazardous Materials**

Hazardous materials that may be used in the construction work:

- Paints and solvents
- Petroleum products such as oils, fuels and grease
- Concrete curing and repair compounds and
- Contaminated waste material.

There is potential for hazardous materials to be released to the environment, particularly during storage and handling and equipment/vehicle maintenance.

***b) Mitigations***

Optimal use of water will be planned and followed at construction site. Construction activities in proximity of water bodies will ensure prevention of runoffs. At the river crossing the horizontal clearance (the distance between the towers) will be greater than the maximum river width at high flood levels and the vertical clearances will be according to the statutory requirements.

The rivers crossings along the route are small and will not affect any change to the span of towers.

Any groundwater encountered during excavation will be pumped out and the source will be prevented from any kind of runoff from the adjoining areas.

For impact on water quality, the following general water quality management measures will be implemented.

**Erosion and sediment**

- Clearing and earthworks will be undertaken in the dry season wherever possible to minimize erosion and subsequent release of sediment.
- The period of soil exposure will be minimized by phasing clearing and construction activities and covering exposed area by sand bags or canvas sheet. Exposed areas of river banks will be covered immediately and preferably by replanted with locally native tree species like woody vegetation.
- If vegetation clearing is required on river banks, vegetation will be cut near or at ground level to leave root mass in the ground. This helps to reinforce soil stability and reduce erosion.
- Stockpile materials will be located at least 30 meter away from steep slopes, water courses or drainage paths
- Water quality will be monitored regularly.

**Hazardous Material**

- All fuel and hazardous material storage will be adequately banded to prevent any spillage problem
- Only minimal chemicals, hazardous substances and fuel will be stored on site works
- Discharge of oil contaminated water into the environment is prohibited.

**Hydrology**

***a) Potential Impacts***

Impacts to hydrology may include the following:

- Clearing of vegetation may speed the movement of surface run off
- Earthworks required for tower footprints, access roads, stockpiles areas and other infrastructure may alter the flow of surface run off and
- Construction of access roads may involve in-stream works which may alter water flows.
- Temporary diversion of rivers for in-stream works (potentially required for access road construction) impacting hydrology, aquatic biota, and potentially access of villagers to water resources.

***b) Mitigations***

- Wherever possible, construction will occur during the dry season
- Earthworks will be undertaken to minimize changes to surface water flows and to avoid collecting standing water.



- If river diversion is expected to alter flows to an extent that would lower the downstream water level, local people will be informed of changes to water levels, including expected extent and duration of change.

## **Biodiversity (Flora and Fauna)**

### ***a) Potential Impacts***

The scale of land use changes (approximately 556 ha (1370 acres) including land limited to vegetation below 3 m) of land to be cleared. Out of all, 64.4 ha (159 acre) are agricultural land and, are not expected to have a major impact on Biodiversity. Power transmission line rights-of-way often reduce and fragment forests; indirectly, they occasionally facilitate further deforestation by improving physical access.

Anticipated impacts to biodiversity due to construction include:

- Temporary disturbance of habitat in areas required to facilitate construction. Temporary disturbance will mainly be associated with construction areas surrounding tower pads, any required access tracks to tower locations and temporary stockyards, workers camps and mobile offices.
- Disturbance and displacement of resident fauna due to noise, light and /or vibration as a result of construction activities (excavation, drilling, clearing, and vehicle movement).
- Fauna mortality due to vehicle/machinery strike, hunting, poaching and collection for trade due to the creation of access roads within and outside of the RoW.

The biodiversity survey assessed the impact of the above items on biodiversity as having minor or negligible significance, however impacts to IUCN listed threatened species and nationally listed restricted species was assessed as having moderate significance.

### ***b) Mitigations***

- Implement the mitigation measures proposed in relation to hydrology, water quality, air quality and noise and vibration.
- Follow the law and rules against logging outside the approve construction areas and against wildlife hunting and poaching will be imposed on project staff, workers and all contractors and personnel engaged in or associated with the Project, with penalties levied for anyone caught carrying and using animal snares and traps, including fines and dismissal and prosecution under the Forest Law, 1992 and Protection of Wild Life and Wild Plants and Conservation of Natural Areas Law 1994.
- The project owner shall be directly responsible for dissemination to its staff and workers of all rules, regulations and information concerning these restrictions as well as the punishment that can expected if any staff or workers or other person associated with the Project violate rules and regulations.
- The planned clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing;
- Disturbed areas shall be rehabilitated as soon as possible following construction activities.
- Construction contractor will establish biological resource management program and management plan to manage the construction activities to be conducted and monitor compliance with relevant permits and environmental regulations in order to prevent potential impacts to terrestrial ecology, in particular, vegetation and wildlife.
- Construction and domestic waste will be appropriately stored and disposed of to avoid attracting native and alien species to the construction areas;
- Oil, chemical and solid waste will be stored, and handled and disposed according to local municipal law

- Construction vehicles and machinery will be maintained in accordance with industry standard to minimize unnecessary noise generation.
- Traffic signs will be installed on all roads throughout construction areas depicting speed limits.
- Commitment will be made to raise awareness of values of natural habitat areas to construction work force and make arrangements for restriction of poaching.
- Speed limit to maximum of 40 km/hr for construction vehicles will be enforced to minimize potential for fauna strike.
- Minimizing vegetation clearance of RoW as much as possible and ensuring the clearance not beyond designated area.
- Commitment will be made to raise awareness of values of natural habitat areas to construction work force and make arrangements for restriction of poaching.
- Leaving ground vegetation and shrub within RoW unless disturbance to access.
- Carrying out all vegetation clearance in consultation with Department of Forest.
- Disposing of chopped trees in accordance with guidance of Department of Forest.
- Rehabilitating borrow pits or stockpile areas after completion of construction.
- Prohibiting forest extraction by contractor employees.
- Prohibit using herbicide for clearing vegetation.
- Hunting wild animals will be strictly prohibited to apply all staff.
- In areas with concentrations of vulnerable bird species, the top (grounding) wire should be made more visible with plastic devices. Electrocution (mainly of large birds of prey) should be avoided through bird-friendly tower design.
- Surveying to identify the exact location of rare plants and animals which are known to be present in the project area.
- Modification of the route, special construction techniques, or limiting construction time to specific seasons.
- Managing transmission line ROWs to provide habitat for endangered/threatened resources, including osprey nesting platforms built on top of transmission poles.

### **Atmospheric Emissions/ Dusts**

#### ***a) Potential Impact***

As the construction of transmission line involves limited groundwork, the potential for dust generation is low and short lived. The increase in traffic volumes during the construction of the transmission line is expected to be occasional and negligible. Hence, it is considered that the contribution to pollutant concentrations arising from the construction activities and traffic is small and insufficient to cause any increase in the stipulated air standards or existing concentrations.

#### ***b) Mitigations***

Notwithstanding the potential of atmospheric emissions from construction and related activities the environmental impact of the project is low; the following mitigation measures will further reduce the impact of emissions, leading to insignificant impacts:

- Sprinkling of water on dust generating areas;
- Restricting the speed limits of vehicles during movement on unpaved roads; and
- Covering of vehicles carrying loose soil/construction material.
- Applying preventive maintenance system
- Checking vehicle and equipment inspection daily
- Stopping dust generating activities in high wind



- Applying good site practice and house keeping
- Turning off the engine while not in use
- Optimizing construction schedule to minimize time that vehicles are in operation
- Covering load-carrying platform properly when carrying earth/sand

## **Noise and Vibration**

### ***a) Potential Impacts***

There is potential for disturbance to habitations, schools, temples in proximity of the towers due to construction related activities.

During erection of tower there can be disturbance from noise of workers.

Also, during stringing there is potential for disturbance from continuous operation of tractors.

### ***b) Mitigations***

Construction activities will be concentrated and done sequentially so that no area is prone to extensive duration of noise impacts. For example though it might take anywhere between 3 to 6 months to complete tower erection and stringing exercise, the actual construction only happens for about 15-30 days.

There will be minimum lag period between laying of foundations and erection of the tower. Most of the work is done manually instead of cranes and other heavy equipment, which will reduce the potential for noise impacts.

Construction activity will be undertaken only during daytime. There will be some noise generated from the movement of tractors and trailers transporting the materials and equipment but the traffic volumes are expected to be occasional and insignificant. The followings are the additional mitigation measures.

- Ensuring all noise emitting activities to be kept distance from the residential area
- Inspecting all noise emitting equipment on a daily basis
- Shutting down all engines while not in use
- Limiting night work including transportation of material
- Maintaining ambient noise level below 55 dBA
- Considering a schedule of on-site activities for reducing the potential for the simultaneous occurrence/overlap of especially noisy activities.

The process of stringing of cables will produce only human voices, which might be audible to residents in very close proximity of the operations. However, again these impacts will be localized and short lived.

## **Social Issues and Management**

### **Involuntary Resettlement (Construction)**

The area in which transmission line location is carefully selected with the principle of avoiding relocation as possible as it can be. As a result, there is no household fall within the transmission line corridor as per current proposed transmission line design.

### ***Land Take /Right of Use***

#### **Impact 1**

Land will be used for permanent facilities like foundation, pylons etc. (Currently the interruptions due to use of land should be compensated. The rates for land are agreed on a negotiated basis.). The project will alter land use by:

- Temporarily removing land uses from areas required for access roads, and other temporary infrastructure
- Permanently converting a small area of land to use for lattice towers

- Permanently limiting the types of land uses allowable within the RoW to those compatible with the transmission line, including:
  - Prohibiting dwellings
  - Prohibiting growth of vegetation greater than 4.5 m
  - Allowing growth of low growing crops, except in areas previously consisting of natural habitat and
- Opening access to additional land through the creation of new roads.

The changes in land use and the effects these changes have on communities will vary throughout the project area. The level of impact will depend on the current level of utilization, availability of alternative resources and diversity of the local economy.

The scale of land use changes (approximately 556 ha (1370 acres) including land limited to vegetation below 3 m) of land to be cleared. Out of all, 64.4 ha (159 acre) are agricultural land and, are not expected to have a significant impact on the social conditions of the surrounding communities.

#### **Suggested Mitigation**

- Ensure that negotiations for compensation are free and fair. Also ensure that the compensation rates are at par with the market rates.
- It also needs to be ensured that the opportunity cost of such land is considered when deciding the compensation amount.

#### **Impact 2**

There may be some changes in the alignment to take into account any specific requirement along the route which may result in some deviations from the original route profile.

#### **Suggested Mitigation**

- Inform landowners about the change in the route. Release land not required after re-routing to the landowners

#### **Impact 3**

Damages to community and private/individual property during construction activities.

The analysis of alternatives has to be done by the project proponents and community or private property resources have at best been avoided in the transmission line corridor. Wherever such private resources have been impacted, the compensation has to be negotiated and included in the compensation amount.

#### **Suggested Mitigation**

- Ensure that the construction activities are to be so planned that any use of community and individual property is either avoided or prior permission sought before use.
- Any unforeseen use and/or damage to property or structures etc. needs to be immediately compensated.

#### **Impact 4**

Economy and Livelihoods

Construction of the transmission line and associated infrastructure will provide employment opportunities to local people and may have a positive impact on the local economy and livelihoods. In addition, employment in the project, and associated training, is expected to improve the skills and experience of local people in construction projects, including an improved working knowledge of health and safety practices.

Mitigation Measures

The following measures should be implement to maximize the benefits of the project to the economy and livelihoods:

- UREC will carefully manage labor conditions

- The construction contractor will hire local people during construction where local people have the required skills and experience. It is acknowledged, however, that much of the labour, especially skilled labour, will come from outside the project area and
- Training in health and safety and technical areas will be provided to all personnel.

## **Potential Health Impacts and Proposed Management**

### **Community Health Impacts**

Presence of labour in the area, even for short duration, can create local conflicts (Health impacts including risks of sexually transmitted diseases on the community).

### **Suggested Mitigation**

A public health education campaign will be provided, addressing: hygiene, disease prevention (including transmission pathways and symptoms of relevant diseases) and basic health promotion. The program will be designed and implemented in consultation with district and local health authorities.

Commit to meet Electricity Law and other Myanmar regulation requirements as well as international conventions on labour, especially on issues of child and forced labour, working conditions, collective bargaining, non-discrimination and equal opportunity, complaint and grievance mechanism as well as occupation health and safety.

### **Occupational Health and Safety**

Construction activities present health and safety risks to personnel, including:

- Accident and injury while working
- Spread of transmissible diseases between worker and
- Contraction of disease due to poor sanitation and environmental conditions in work and accommodation areas.

### ***Mitigation Measures***

The following measures will be implemented:

- Health Awareness Training will be mandatory for all personnel and will address both on-the-job safety and health awareness
- Clean drinking water will be provided to all camps and work areas
- Adequate sewage treatment will be provided
- First aid kits will be readily accessible by workers and first aid teams will be specifically trained and assigned in groups of two to three persons to the different sites and
- Vector control of mosquitoes and other pests will be managed including by minimizing mosquito breeding habitat and providing mosquito nets and other barriers.

## **Archeological, Historic and Cultural Effects**

### ***1) Potential Impacts***

Temporary migration of workers may influence local cultural and create social tension.

Along the route of the power transmission line, there are a number of historic districts which are based on a variety of distinctive languages and cultural traditions of ethnic minorities. The nature and scale of the construction is such that it will not have a disturbing, effect on these historic districts. The local peoples express the opinion that the construction and the existence to the power transmission line will not disrupt their way of life and they raised no objection to the construction.

The collection of primary baseline data indicates that the construction of the Proposed Power Transmission Line by MOEE will have minimal adverse impact on the cultural heritage along the construction route. However, as the Kachin State and Sagaing Region is the platform of 15<sup>th</sup> Century Shan History, it is recommended that the developer and its subcontractors to

report the cultural materials that find while excavating during the construction of power line facilities.

## **2) Mitigation Measures**

- The contractor will consult with local authorities to learn of any traditional practices and rules that need to be followed and to coordinate in the enforcement of laws and regulations.
- A code of conduct will be established and enforced to reduce the potential for conflict between local residents and migrant workers.
- Any entertainment venues or recreational facilities in the vicinity of the project shall be operated strictly according to the local village values and traditions and
- Local employment will be prioritized.

## **Traffic and Transport**

### ***a) Potential Impacts***

Power transmission line from Bamaw and Nabar runs cross the Ayeyarwaddy River and pass through low hill mountain that situated no residential areas so impact on traffic system by the project would be low. Moreover, there can be traffic problems in on local roads while vehicles of the construction work move around.

Access can be disrupted during construction, at individual land owner level, and at the community level when village/ link roads are damaged/used beyond capacity for transportation and construction related activities.

(Developer or its subcontractor has wherever possible tried to avoid any access routes to avoid any disruption or inconvenience to the individual/community. Wherever such access is mandatory the negotiations have been done with the affected landowner by the construction contractor).

### ***b) Suggested Mitigation***

- Avoid using community /village roads for project activities. Alternative roads should be constructed and used. All access roads have to be fully restored after use.
- Transportation schedules will be arranged to avoid peak hours of road usage.
- Traffic signs will be installed for all roads throughout construction areas.
- Relevant traffic regulations will be implemented throughout construction areas.
- In cases where heavy loads are required to be transported, some segments of roads and bridges may be reinforced to withstand the load.
- In the event that stringing conductors present a possible risk to traffic temporary barriers (such as bamboo scaffolds) will be constructed across the roads and rivers to protect the public and property.

## **Potential Hazards**

IFC Performance standard 2 highlights the need for safe and healthy work environment taking into account inherent risks in its particular sector and specific classes of hazards with respect to the project, including physical, chemical, biological, and radiological hazards. The performance standard highlight the need to prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards.

### ***a) Activity***

All construction related works.

### ***b) Potential Impacts***

During construction physical injury can result from workers slipping along the slopes; road accidents, accident to workers during erecting of towers and other occupational hazards.

Stringing activity around low tension/ high tension wires and other electrical units can be a potential hazard if proper planning is not followed. Workers at times are not accustomed to use of Personal Protection Equipment, their attitude to avoid PPE may result in accident/hazard.

Pits dug along roads /tracks close to habitations can lead to potential accidents for people and domestic animals in the proximity.

#### ***b) Mitigations***

The staff of contractors involved in the construction activities will be trained about the mandatory precaution and safety practices prior to commencement of construction activity.

All required Personal Protection Equipment will be used by the workers at site and their use will be supervised. Safety harness will be ensured for workers while erection of tower. Vehicle movements to follow the traffic norms and maintain a safe speed while moving through the hilly tracts.

Stringing activities near low tension wires/high tension wires and other electrical utilities will be done after proper shutdown of the line/utilities with prior information and permission.

All excavation activities will be conducted in supervision of the site contractor with prior information to the nearby inhabitants. Proper signage will be provided in places where excavated pits are close to road or hilly tracts.

The design of the towers will adhere to the Proper Standards (i.e. IFC standard and Indian Standard), which will ensure sufficient safety margins to reduce the risk from wind and seismic activities. Extreme weather conditions could affect the transmission line though the very high wind speed is rare. Hence the risk of natural impacts is low.

## **6.2 Operation Phase Impacts**

### **Soils**

No impacts of any significance are predicted on vegetation and soil due to operation of the transmission line. Any spillage of Aluminium oxide paint during operation and maintenance of the transmission line towers may impact soil quality. Low frequency of painting as well as involving experienced personnel with mitigations like prior spread of sheets underneath the tower structure while painting.

### **Waste Disposal**

No significant waste is anticipated to be generated during operation of the transmission line.

### **Aesthetics and Visual Impact**

There will be no additional visual impact due to operation of transmission line as the will only involve transmission of electricity through the established network.

### **Surface Water and Hydrogeology**

Transmission line infrastructure may have the following impacts to water quality during the operational period.

- The presence of hardstand areas (i.e. tower pads) has the potential to impact water quality through the operational phase by reducing infiltration, thereby increasing overland flows carrying pollutants to watercourses. Given the small area of tower pads (about 100 m<sup>2</sup>) this impact is expected to be minor.

### ***Mitigation Measures***

- Drainage of hardstand areas will be designed and constructed to retain surface runoff and facilitate infiltration to a level similar to pre-construction flows.

### **Biodiversity**

Anticipated impacts to biodiversity during operation include:

- Permanent loss of 2.96 ha (73 acres) of habitat and modification of 556 ha of habitat within the corridor footprint.
- The RoW may interrupt the continuity of forest habitat (mostly degraded deciduous forest), as vegetation heights will be limited to below 3 meter, however the maintenance of vegetation in the understorey and midstorey is likely to continue to allow arboreal species to move through the landscape.
- Disturbance and displacement of resident fauna due to noise as a result of electricity transmission and noise and light as a result of maintenance activities.
- During operation, mortality of avifauna (birds and bats) may occur due to collision with the transmission line and electrocution. Avian collisions could occur in large numbers if lines are located in daily flyers, or if avifauna are travelling during low light conditions.

### ***Mitigation Measures***

- Within the RoW, vegetation trimming will be restricted to that required to safely operate the transmission line. Groundcover and midstorey vegetation will be retained wherever practicable.
- The project shall implement landscaping and re-vegetation after completion of construction in suitable areas and
- Vegetation management will be made to raise awareness of values of natural habitat areas to personnel work force and arrangements will be made for restriction of poaching and forest product collection.
- Commitment will be made to raise awareness of values of natural habitat areas to personnel work force and arrangements will be made for restriction of poaching and forest product collection.
- Hunting wild animal will be strictly prohibited and
- Transmission line will be designed to minimize risk of electrocution, including maintain a 1.5 meter spacing between energized components and grounded hardware, or covering energized parts.

### **Air Quality**

Operation and maintenance can affect air quality by:

- The emission of ozone from transmission lines when in active corona, however ozone emitted from transmission lines not known to carry any health risk and
- Air pollution due to burning of vegetation for RoW management.
- The operation of the transmission line will not contribute to any atmospheric emissions directly and hence the predicted impacts are negligible. Green House Gas emissions from the transmission line operation will be limited to fuel consumption in vehicle used for the maintenance activities. The project on the whole being a hydroelectric power project will potentially prevent the emission of GHG which would have otherwise been generated for power generation of similar capacity. The GHGs generated from the project will be negligible.

### ***Mitigation Measures***

Vegetation will not be burnt for maintenance. Mechanical method will be used to trim tall and encroaching vegetation.

### **Noise**

#### ***a) Potential Impacts***

Once operational, noise from energized overhead lines can be produced by a phenomenon known as ‘Corona Discharge’ (a limited electrical breakdown of the air). Conductors are designed and constructed to minimize corona effects, although, under certain conditions this can be audible as a ‘hissing’ sound, sometimes accompanied by a low frequency hum. However, noise due to Corona Discharge is negligible for transmission line up to 230 kV grade.

Another noise source could be generated during maintenance of the towers, though it will be infrequent and extremely low.

#### ***b) Mitigations***

Conductors designed and constructed to minimize corona effects will be chosen for transmission.

It is highly unlikely that the corona discharge noise will exceed the normal background noise levels in the area and furthermore, such noises are restricted to certain weather conditions.

### **Social Issues and Management**

#### **Economy and Livelihoods**

Ongoing maintenance of the RoW, particularly vegetation management, can provide employment to local residents.

### ***Mitigation Measures***

- Local people will be employed for suitable roles wherever possible and
- Appropriate health and safety measures will be undertaken to protect all project personnel.

#### **Community Health and Safety**

Community will have concerns about its safety and possibility of any accidents like electrocution, skin diseases etc.

(The project proponents through select consultations with relevant stakeholders have tried to allay all fears related to health impact.)

Electrocution due to contact with high voltage electricity or items in contact with high voltage electricity (such as tools, vehicles or ladders).

#### **Suggested Mitigation**

- Evaluate possible risks and ensure that these are addressed and minimized.
- Communicate about the technical aspects of the transmission line construction and operations, and allay fears about accidents or any other health concerns.
- Use simple diagrams and pamphlets in local language for this purpose.
- Train land owners about safety issues and action to be taken in case of risks.
- Demonstrate that MOEE and its contractors are very concerned about health and safety of workers as well as the community.
- Signs and barriers will be installed to prevent access to high voltage areas.
- Grounding conducting objects will be installed near transmission lines.

#### **Occupational Health and Safety**

Hazards relevant to project personnel include:



- Exposure to EMF at levels higher than those experienced by the general public.
- Electrocution due to contact with high voltage electricity or items in contact with high voltage electricity (such as tools, vehicles or ladders).
- Working at height on towers.

### ***Mitigation Measures***

#### **Electromagnetic fields**

- An EMF safety program will be developed prior to operation which: identifies potential levels of exposure; provides training for all workers; delineates zones appropriate for public access and those restricted to appropriately trained workers; defines measures to limit exposure time, such as through work rotation; and provides personal monitoring equipment for workers.
- Ensure compliance of safe practices and implementation of safety manual
- Provide and ensure use of personal protective equipment (PPEs) like, safety goggles, gloves, safety harness, helmets, gumboots etc.
- Securing the workplace, wherein all lines are shut down prior to maintenance work, use of PPE and procedures for emergencies and compensation procedures in case of accidents.
- Prior training of the workers regarding health and safety procedures is essential.

#### **Electrocution**

- Transmission lines will be deactivated and grounded prior to work on, or near, transmission lines.
- Live work will only be conducted by trained workers.

#### **Working at heights**

- Fall protection measures will be implemented including provision of appropriate fall protection equipment, training in use of equipment, training in climbing techniques, and rescue of fall-arrested workers.
- All equipment, including hoisting equipment, power tools and tool bags, will be properly rated and maintained.

## **7. Result of the Public Consultation and Public Disclosure**

Public consultation and public participation activities were undertaken with various stakeholders along the transmission line corridor. The following stakeholder meetings and focus group meetings have been organized as part of the public consultation requirements foreseen by the national IEE approval process:

**Table 5-1: Stakeholders Meetings**

Stakeholder Group	Date and Place	Consultation Activity
Stakeholders including Township General Administration Department, others related Department, Media, NGO, Parliament Member, UREC, MOEE and REM	14-6-2017 (10:00 am-12:00pm)	Consultation and discussion at Indaw Township's Hall
	14-6-2017 (2:00 pm-4:00pm)	Consultation and discussion at Katha Township's Hall
	22-7-2017 (10:00am-12:00pm)	Consultation and discussion at Shwegu Township's Hall
	27-6-2017 (10:00am-12:00pm)	Consultation and discussion at Bamaw Township's Hall



Focus Group Meetings (between the 14th and 27th June 2017) were held during the IEE investigation of the IEE procedure to introduce to the relevant stakeholders (heads of the villages and the residents) from 42 villages. The proposed Project, its scope, informs the public about the anticipated impacts and the planned mitigation measures were disclosed and collected their feedback. The consultation findings have been incorporated into the development of this IEE report.

## **8. Environmental Management Plan and Monitoring Plan**

Environmental management for the Project aims to minimize the negative impacts of the transmission line construction and at the same time, enhance the positive and beneficial impacts. These mitigation measures are an overview only, based on the potential impacts identified in this IEE.

Prior to construction, an Environment and Social Management and Monitoring Plan for the Construction Phase (ESMMP-CP) will be prepared which provides further detail on the implementation of the environmental management. The ESMMP-CP will include a series of sub-plans specific to environmental themes identified in this IEE. The construction contractor will develop a suite of Site- Specific ESMMPs which address specific segments of the RoW, based on site conditions (e.g. proximity to villages, waterways and natural habitats).

Successful implementation of Environmental Monitoring Plan depends on regular monitoring, documenting and reporting. Monitoring in the construction period can be categorized in the following:

- At Contractor level, monitoring to ensure on a day to day basis that mitigation measures are fully implemented with construction activities and that results observed comply with the contractual obligations.
- At Owner level, routine inspections to ensure that monitoring results provided by the Construction Contractor are corrected, to provide the necessary environmental coordination and interface with the Contractors, and to provide a comprehensive picture of the current environmental situation and efforts at site level.

Environmental management plan include (1) Roles and responsibilities for implementation of EMP (2) Environmental management measures (3) Environmental monitoring program (4) Indicative budget for implementation of the EMP. Detailed EMP is provided in Chapter 8.

## **9. Conclusion and Recommendation**

The IEE identified risks to the environment and local communities, including impacts to biodiversity, water quality, traffic and community health and safety. Management actions outlined in this document will be refined and developed further into the appropriate ESMMP-CP documentation that will be implemented to avoid and minimize the identified impacts.

The proposed transmission line project has been categorized as a Category B project (as per the IFC criteria: Category B - Applies to projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures;) due to the following reasons:

- The transmission line project is a linear project that runs for about 121 km requiring land as “right of way” of about 24.8 m either side of the centre of the proposed transmission line;
- The project during operation phase will have low potential of pollution;
- There is no displacement of families due to the project;
- The project will have some adverse social and environmental impacts; however, they are few in number, restricted to the corridors of right of way;
- Impacts caused during construction phase are mostly reversible except that of revenue and forest lands that are taken as right of way for the transmission line.

## စီမံကိန်း အကျဉ်းချုပ်

### ၁။ စီမံကိန်းအကြောင်းအရာဖော်ပြချက် နှင့် စီမံကိန်းအရွယ်အစား

မြန်မာ့လျှပ်စစ် စွမ်းအားလုပ်ငန်းမှ ဆောင်ရွက်နေသည့် မြောက် မှ တောင်သို့ လျှပ်စစ်ပို့လွှတ်ရေး (North-to-South Power Transmission) စီမံကိန်းမှ အဓိကစီမံကိန်း တစ်ခုအနေဖြင့် ယခုစီမံကိန်းသည် တာပိန် ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံမှ မြန်မာနိုင်ငံအလယ်ပိုင်းသို့ လျှပ်စစ်ဓာတ်အား ထုတ်လွှတ်သွားရန် ရည်ရွယ်ထားပါသည်။ ထို့နောက် တစ်နိုင်ငံလုံးကို လျှပ်စစ်ဓာတ်အား ထောက်ပံ့ပေးနိုင်သော 230 KV လျှပ်စစ်ဓာတ်အားလိုင်းစနစ်အဖြစ် တိုးမြှင့်နေသည့် 230 KV မဟာဓာတ်အားလိုင်းနှင့် ချိတ်ဆက်၍ လျှပ်စစ်ပမာဏ ပိုလိုအပ်သော ဗဟိုဌာနဖြစ်သော မြန်မာနိုင်ငံ တောင်ပိုင်းဒေသများသို့ ထောက်ပံ့ ပေးသွားပါမည်။ စီမံကိန်းသည် မြန်မာနိုင်ငံ အလယ်ပိုင်းဒေသနှင့် မြောက်ဘက်ပိုင်းတွင် တည်ရှိနေသော စစ်ကိုင်းတိုင်းဒေသကြီးတွင် တည်ရှိပါသည်။ 230 KV လျှပ်စစ်ဓာတ်အားပေးစက်ရုံခွဲ နှစ်ခု နှင့် 230 KV double circuit transmission lines နှစ်ခု ( စုစုပေါင်း ၂၉၀ မိုင် အရှည်ရှိသော) ပါဝင်ပြီး စမ်းသပ်တိုင်းတာခြင်း၊ ပုံစံ၊ အထောက်အပံ့၊ ဆောက်လုပ်ခြင်း၊ တပ်ဆင်ခြင်း နှင့် မြန်မာ့လျှပ်စစ်ဓာတ်အား ဖြန့်ဖြူးရေး သဘောတူညီချက်နှင့်အညီ လုပ်ငန်းအပ်နှံခြင်းတို့ ဆောင်ရွက်သွားမည်။

ယခုအစီရင်ခံစာသည် အဆိုပြုထားသည့် လျှပ်စစ်ဓာတ်အားလိုင်းနှင့် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံနှစ်ခု (power transmission line and two substations) အတွက် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှု ဆန်းစစ်ခြင်း ဆောင်ရွက်သွားရန် ရည်ရွယ်ပါသည်။

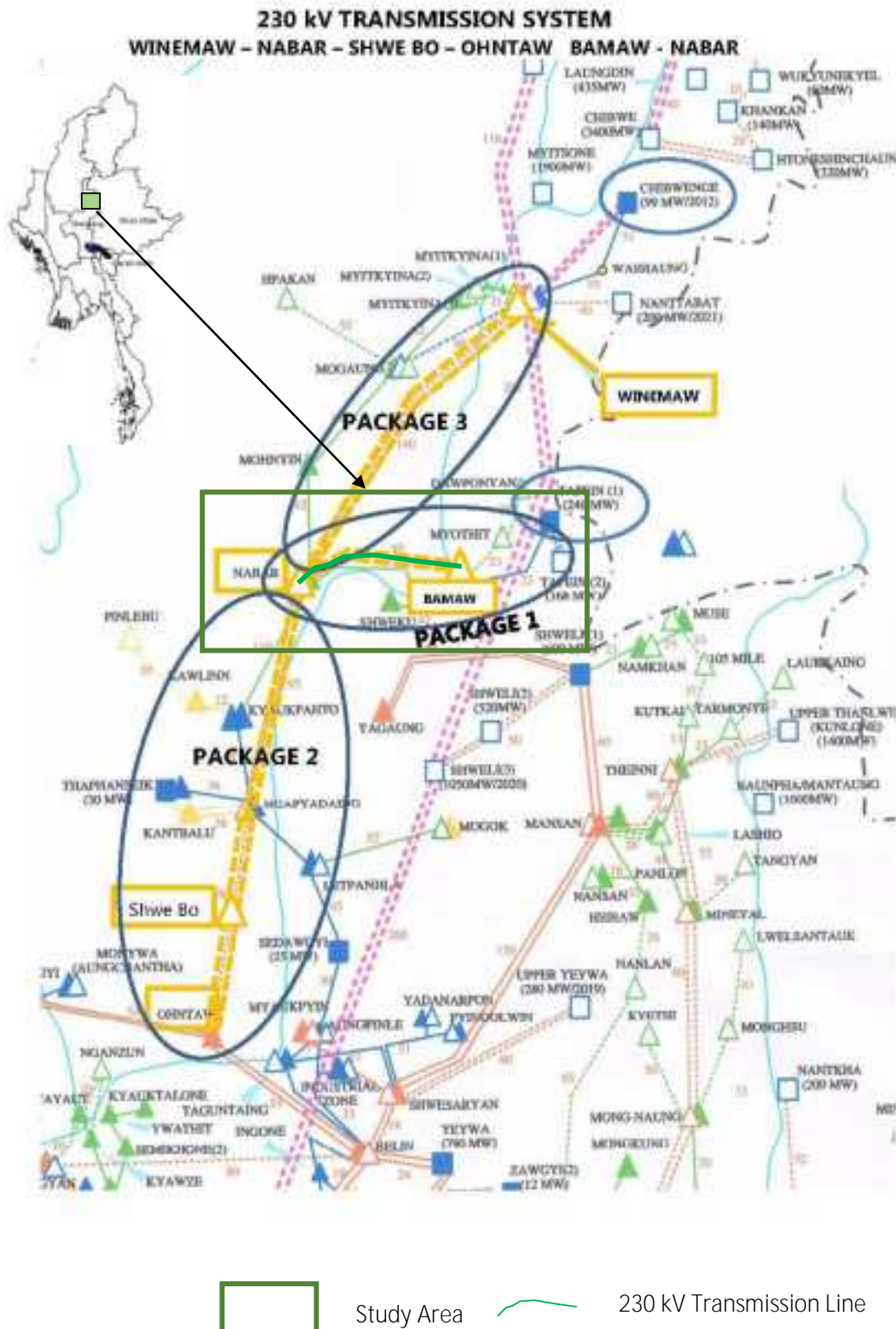
စီမံကိန်းတွင် ကချင်ပြည်နယ်မြောက်ပိုင်းမှ 230 KV မဟာဓာတ်အားလိုင်းသို့ ဆက်သွယ်ရန်အလို့ငှာ ဗန်းမော်နှင့် နဘားအကြား 121 ကီလိုမီတာ အရှည်ရှိသည့် 230 KV လျှပ်စစ်ဓာတ်အားလိုင်း အကောင်အထည်ဖော်ဆောင်ရန်၊ မန္တလေးတိုင်းဒေသကြီး မြောက်ပိုင်းမှ ကချင်ပြည်နယ် တစ်လျှောက် အတွက် နေရာများတွင် လျှပ်စစ်ဓာတ်အားထောက်ပံ့ပေးရန် ရည်ရွယ်၍ 230KV/66KV ရှိသည့် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံခွဲ အသစ်နှစ်ခု နှင့် တိုးချဲ့လျှပ်စစ်ဓာတ်အားပေး စက်ရုံခွဲတစ်ခု ကို တည်ဆောက်ရန် ရှိပါသည်။ မန္တလေးတိုင်းဒေသကြီး၏ မြောက်ပိုင်းတွင်တည်ရှိသော စီမံကိန်းနေရာသည် ပိုမိုနက်ောင်းမွန်သော သဘာဝပတ်ဝန်းကျင် အခြေအနေရှိပြီး အပူချိန်မှာ ဇန်နဝါရီလတွင် 20°C နှင့် အေပရာယ်လတွင် 33.9°C အသီးသီးရှိပါသည်။

ပထမပိုင်းတွင် ပါဝင်သော အဓိကဆောက်လုပ်ရေး လုပ်ငန်းများမှာ အောက်ပါအတိုင်းဖြစ်သည်။

ဗန်းမော်-နဘား Package1-230KV လျှပ်စစ်ဓာတ်အားလိုင်း စနစ်

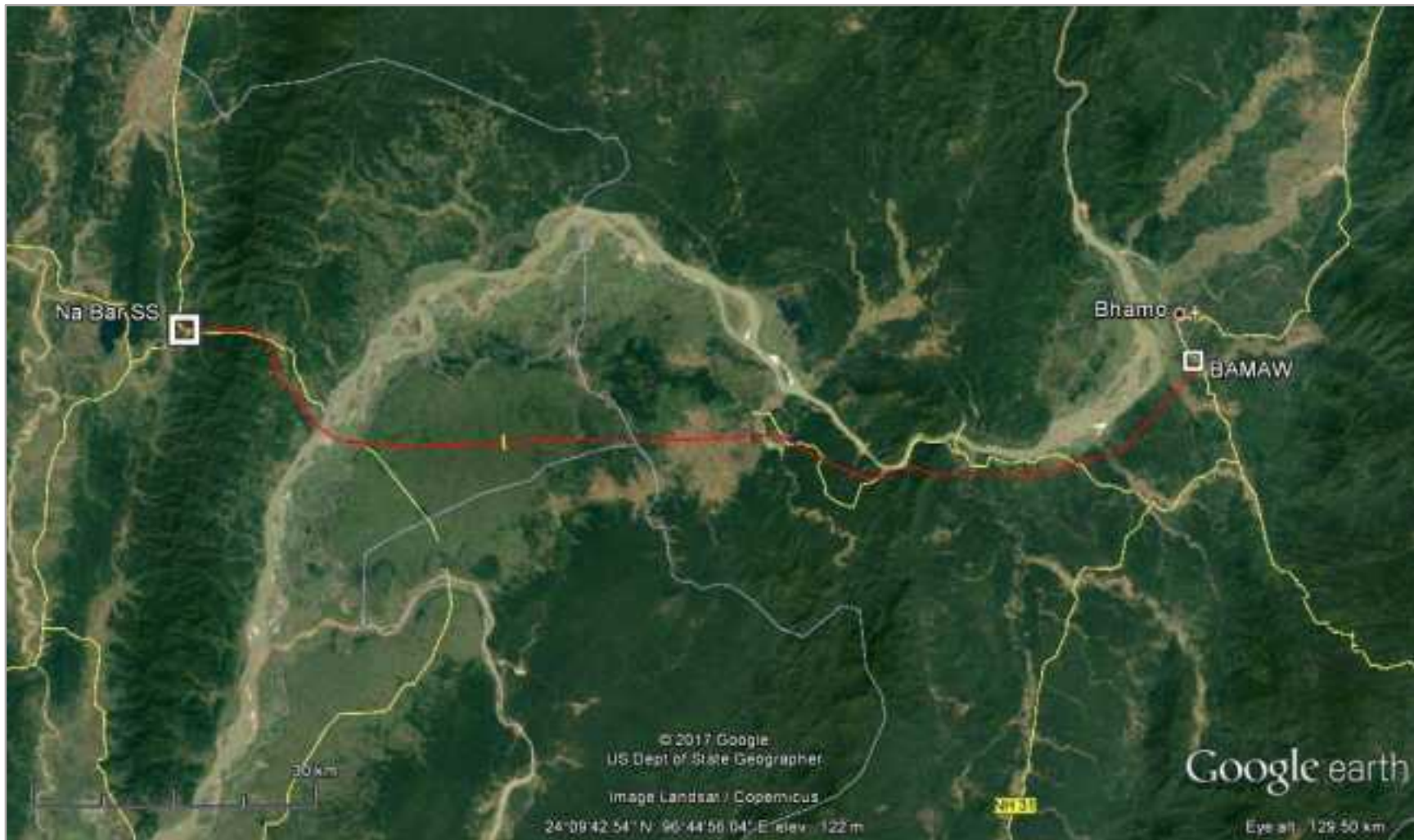
- (၁) မှန်းခြေ 75 မိုင် ( ၁၂၁ ကီလိုမီတာ) အရှည်ရှိသည့် ဗန်းမော်-နဘား 230KV double circuit လိုင်း
- (၂) 2×100MVA 230/110kV transformers ၊ 1×50MVA 110/66kV transformer ၊ 230kV line feeder နှစ်ခု ၊ 110kV line feeder တစ်ခု နှင့် 66kV line feeders သုံးခုပါသော 230/110/66kV ဗန်းမော် လျှပ်စစ်ဓာတ်အားပေး စက်ရုံခွဲအသစ်
- (၃) 2×50MVA transformers ၊ 6×230kV line feeder နှင့် 66kV line feeder သုံးခု ပါသော 230/66kV နဘား လျှပ်စစ်ဓာတ်အားခွဲ စက်ရုံသစ်
- (၄) အရှည် 22 မိုင် (၃၅ ကီလိုမီတာ) ရှိသော 110kV လိုင်း တာပိန် ၁ ဗန်းမော်တွင် single circuit ရှိ conductor ACCC“LATEDO”ကို ACSR“IBIS” ဖြင့် အစားထိုးခြင်း

လျှပ်စစ်ဓာတ်အားလိုင်းစနစ် နေရာ၊ package 1 လျှပ်စစ်ဓာတ်အားလိုင်း စနစ် နေရာ၊ လျှပ်စစ်ဓာတ်အားပေး စက်ရုံခွဲများ နေရာ၊ လျှပ်စစ်ဓာတ်အားလိုင်း လမ်းကြောင်းများ စသည်တို့ကို ပုံ ၂-၁ နှင့် ၂-၂ တို့တွင် ပြသထားပါသည်။ စီမံကိန်းအကြောင်းအရာ အသေးစိတ်ကို အခန်း (၁) တွင် ဖော်ပြပေးထားပါသည်။



ပုံ ၂-၁။ ။ ၂၃၀ ကေဗီ ဓါတ်အားလိုင်းစနစ် နှင့် လျှပ်စစ်ဓာတ်အားလိုင်း လမ်းကြောင်းများ၏ တည်နေရာပြ မြေပုံ





ပုံ ၂-၂။ ။ ဗန်းမော် နှင့် နဘား အကြားရှိ လျှပ်စစ်ဓာတ်အားပေး စက်ရုံခွဲများ နှင့် လျှပ်စစ်ဓာတ်အားလိုင်း လမ်းကြောင်းများ ပြမြေပုံ

၂။ စီမံကိန်းအကောင်အထည် ဖော်ဆောင်သူ၏ အကြောင်းအရာ ဖော်ပြချက်

လုပ်ငန်းရှင်	- Union Resources & Engineering Co., Ltd.
လိပ်စာ	- အမှတ် (၃၅)၊ ပြည်လမ်း၊ (၇) ရပ်ကွက်၊ မရမ်းကုန်း မြို့နယ်၊ ရန်ကုန်မြို့၊ ပြည်ထောင်စု သမ္မတ မြန်မာနိုင်ငံတော်
အီးမေးလ်	- travis1256@hotmail.com
ဆက်သွယ်ရမည့် ပုဂ္ဂိုလ်	- Mr. Travis Liu, Deputy Chief Representative
အင်တာနက်စာမျက်နှာ	- <a href="http://www.urec.com.cn">http://www.urec.com.cn</a>

၃။ IEE ဆောင်ရွက်သည့် ကျွမ်းကျင်သူများ၏ အကြောင်းအရာ ဖော်ပြချက်

ဦးဆောင်အဖွဲ့အစည်း - သယံဇာတ နှင့် မြန်မာ့ပတ်ဝန်းကျင် ကုမ္ပဏီ လီမိတက် (REM)

သယံဇာတ နှင့် မြန်မာ့ပတ်ဝန်းကျင် ကုမ္ပဏီလီမိတက်သည် ဘူမိဗေဒပညာရှင်များ၊ အင်ဂျင်နီယာများ၊ ဇီဝဗေဒ ပညာရှင်များ၊ ရူက္ခဗေဒ ပညာရှင်များ၊ လူမှုစီးပွား ကျွမ်းကျင်ပညာရှင်များ၊ ယဉ်ကျေးမှု အမွေအနှစ် လေ့လာသည့် ကျွမ်းကျင်ပညာရှင်များ၊ ပတ်ဝန်းကျင်ဆိုင်ရာ အင်ဂျင်နီယာများ နှင့် သဘာဝ အရင်းအမြစ် စီမံခန့်ခွဲမှု အထူးကျွမ်းကျင် ပညာရှင်များဖြင့် ဖွဲ့စည်းထားပြီး နိုင်ငံအတွင်းရှိ ဦးဆောင်နေသော သယံဇာတနှင့် ပတ်ဝန်းကျင် အကြံပေး အဖွဲ့အစည်းတစ်ရပ် ဖြစ်သည်။ ၎င်းသည် မြန်မာနိုင်ငံရှိ ရန်ကုန်မြို့အတွင်းတွင် တည်ရှိပါသည်။

လိပ်စာ	သယံဇာတနှင့် မြန်မာ့ပတ်ဝန်းကျင် ကုမ္ပဏီ အမှတ် ၇၀၂ (ညာ)၊ ဒယ်လ်တာ ပလာဇာ၊ ရွှေဂုံတိုင်လမ်း၊ ဗဟန်းမြို့နယ်၊ ရန်ကုန်မြို့။
တယ်လီဖုန်းနံပါတ်	၉၅၉-၇၃၀၁၃၄၄၈
ကြေးနန်း	၀၁-၅၅၂၉၀၁
အီးမေးလ်	service@enviromyanmar.net
ဆက်သွယ်ရမည့် ပုဂ္ဂိုလ်	ဦးသူရအောင်
ရာထူး	အထွေထွေ မန်နေဂျာ
အင်တာနက်စာမျက်နှာ	<a href="http://www.enviromyanmar.net">www.enviromyanmar.net</a>



ဒုတိယအဖွဲ့အစည်း - Sustainable Environment Myanmar Co., Ltd. (SEM)

လိပ်စာ	တိုက်-ဘီ၊ ၅၀၃ (ဘယ်)၊ ဒယ်လ်တာပလာဇာ၊ ရွှေဂုံတိုင်လမ်း၊ ဗဟန်းမြို့နယ်၊ ရန်ကုန်မြို့။
တယ်လီဖုန်းနံပါတ်	+၉၅၉ ၂၆၁၃၂၈၉၁
အီးမေးလ်	<a href="mailto:services@sustainablemyanmar.com">services@sustainablemyanmar.com</a>
အင်တာနက်စာမျက်နှာ	<a href="http://www.sustainablemyanmar.com">www.sustainablemyanmar.com</a>



SEM ကုမ္ပဏီသည် မြန်မာနိုင်ငံအတွင်း ဖွံ့ဖြိုးတိုးတက်ရေး စီမံကိန်းများအတွက် ပတ်ဝန်းကျင်၊ လူမှုဝန်းကျင်၊ ကျန်းမာရေး စသည့် သက်ရောက်မှု ဆန်းစစ်ခြင်းများကို ဝန်ဆောင်မှုများ ဆောင်ရွက်ပေးပါသည်။ SEM သည် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း၊ ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ်၊ ပတ်ဝန်းကျင်ဆိုင်ရာ လေ့လာစောင့်ကြည့်ရေးနှင့် အရည်အသွေး ဆန်းစစ်ဆောင်ရွက်ချက်များ အပါအဝင် ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဥပဒေ ၂၀၁၂ ၏ ဖြည့်စွက်ချက်များအရ ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု ပြဿနာများကို ကိုင်တွယ်နိုင်စွမ်းရှိပါသည်။

#### ၄။ နည်းဥပဒေ နှင့် လမ်းညွှန်ချက်များ

ယခုပြုစုထားသော ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း အစီရင်ခံစာသည် သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဝန်ကြီးဌာနမှ သတ်မှတ်ထားသော စည်းမျဉ်းများနှင့် လိုအပ်ချက်များအရ ပြင်ဆင်ထားခြင်း ဖြစ်ပါသည်။ စီမံကိန်းအဆိုပြုသူ UREC သည် စီမံကိန်း ဆောင်ရွက်ချက်များနှင့် ဆက်စပ်သည့် အမျိုးသားဥပဒေများအားလုံးကို လိုက်နာ ဆောင်ရွက်ရပါမည်။ UREC သည် အမျိုးသား ပတ်ဝန်းကျင်အရည်အသွေး (ထုတ်လွှင့်မှု) လမ်းညွှန်ချက်များကို လိုက်နာ ဆောင်ရွက်သွားမည်။ UREC မှ လိုက်နာဆောင်ရွက်ရမည့် ဆက်စပ် ဥပဒေများ၊ စည်းမျဉ်းများ၊ စံချိန်စံညွှန်းများ အသေးစိတ်ကို အခန်း (၄) တွင် ဖော်ပြပေးထားပါသည်။

#### ၅။ ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင် - မူလစီးပွားရေးအခြေအနေ

အဆိုပြုထားသော ဗန်းမော် နှင့် ကသာ အကြားရှိ လျှပ်စစ်ဓာတ်အားလိုင်းသည် ဧရာဝတီမြစ်၏ အရှေ့ ဘက်ကမ်းတွင် တည်ရှိပြီး ကသာနှင့် နဘားအကြားရှိ ဓာတ်အားလိုင်း လမ်းကြောင်းသည် ဧရာဝတီမြစ်၏ အနောက်ဘက်ကမ်းတွင် တည်ရှိပါသည်။ လိုင်းအဖြောင့် အရှေ့ဘက်ပိုင်းသည် မြေပြန့်ဒေသတွင်ရှိပြီး ပျမ်းမျှအမြင့်သည် ပင်လယ်ရေမျက်နှာပြင်အထက် ၁၀၀ မီတာ ခန့်တွင်ရှိပါသည်။ အနောက်ဘက်အပိုင်းသည် တောင်ကုန်းဒေသနှင့် မတ်စောက်သော ဆင်ခြေလျှောရှိသည့် တောင်တန်းဒေသတွင် တည်ရှိပါသည်။ ဓာတ်အားလိုင်း လမ်းကြောင်းတလျှောက်၏ ဘူမိဗေဒကိုခြုံငုံကြည့်ရလျှင် ယေဘုယျအားဖြင့် ဗန်းမော် အနီးတွင် မြေပြန့်နုနုမြေဒေသ၊ ရွှေဂူနှင့် ကသာအကြားတွင် ဘေ့လွန်မီးသင့်ကျောက် နှင့် သက်တမ်းရင့် ပရီကမ်ဘရီယမ် သက်တမ်းရှိ ကျောက်များ နှင့် အသွင်ပြောင်းကျောက် များကို တွေ့ရပြီး၊ အလွန် မညီညာသော တောင်တန်းဒေသ လွှာတွန့်တောင်များ အဖြစ်တည်ရှိနေပါသည်။ အခြားကျောက်လွှာများ အနေဖြင့် Cretaceous သက်တမ်းရှိ ကျိုးပဲ့စ နှင့် သဲကျောက် (sandstone) ၊ ထုံးကျောက် (limestone) နှင့် သင်ပုန်းကျောက် ( shale) အများစုပါဝင်သော carbonate rocks တွေ့ရပါသည်။

ကသာနှင့် နဘားအကြားတွင် လျှပ်စစ်ဓာတ်အားလိုင်းသည် Pre-Cambrian rocks ကို နောက်တစ်ကြိမ်ထပ်၍ ဖြတ်သွားသည်။ မြေအသုံးချ မြေပုံအရ ဖြတ်သန်းသွားသော လမ်းကြောင်းရှိမြေ၏ ၈၈ ရာခိုင်နှုန်းခန့်သည် အရည်အသွေးနိမ့် ရွက်ကြွေတောများဖြစ်ပြီး ကျန်နေရာများသည် စပါးခင်း နှင့် ယာခင်းများဖြစ်သည့် စိုက်ပျိုးမြေများ ဖြစ်သည်။

အဓိက ကျက်စားရာအမျိုးအစား သုံးခုအနေဖြင့် (၁) သစ်ပင်များကျွဲပါးစွာ ပေါက်ရောက်နေသည့် ရောနှောသီးနှံ စိုက်ခင်း (၂) စပါးခင်းနှင့် ရာဘာစိုက်ခင်း (၃) ရေနေသတ္တဝါများ ကျက်စားရာနေရာ စသည်တို့ကို တွေ့ရပါသည်။



ကွင်းဆင်းလေ့လာခြင်းနှင့်အတူ ရှိနှင့်ပြီးသား သတင်းအချက်အလက် စစ်တမ်းကောက်ယူခြင်းအရ အဆိုပြုထားသော လျှပ်စစ်ဓာတ်အားပေးစက်ရုံခွဲများနှင့် 230 KV လျှပ်စစ်ဓာတ်အားလိုင်း တစ်လျှောက်တွင် မျိုးသုဉ်းရန် ခြိမ်းခြောက်ခံနေရသော အပင်နှင့် သတ္တဝါမျိုးစိတ်များ ရှိမနေပါ။ လျှပ်စစ်ဓာတ်အားလိုင်း လမ်းကြောင်းမှ လျှပ်စစ်ဓာတ်အားပေးစက်ရုံခွဲထိ တောက်လျှောက်တွင် ထိန်းသိမ်းကာကွယ်ထားသည့် နေရာများ ရှိမနေပါ။

ဖီဝါမျိုးစုံမျိုးကွဲ ကွင်းဆင်းလေ့လာခြင်း အစီရင်ခံစာကို ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း အစီရင်ခံစာ၏ နောက်ဆက်တွဲ (၉) တွင် ဖော်ပြထားပါသည်။

အဆိုပြု လျှပ်စစ်ဓာတ်အားလိုင်းသည် ကချင်ပြည်နယ်နှင့် မန္တလေးတိုင်းဒေသကြီးတွင်ရှိသော ဗန်းမော်မြို့နယ်၊ ရွှေဂူမြို့နယ်၊ ကသာမြို့နယ် နှင့် အင်းတော်မြို့နယ်များသို့ ဖြတ်သွားမည်။ လျှပ်စစ် ဓာတ်အားလိုင်းတစ်လျှောက် ရွာပေါင်း ၄၀ ခန့်ရှိနေပါသည်။ ဓာတ်အားလိုင်း လမ်းကြောင်းတစ်လျှောက် တာဝါတိုင်များ တပ်ဆင်ခြင်းမှ မြို့နယ် (၄) မြို့နယ်ရှိ ရွာပေါင်း (၄၀) မှ ပိုင်ဆိုင်ထားသော လယ်ယာမြေနှင့် စိုက်ပျိုးမြေအချို့ သက်ရောက်မှုရှိနိုင်ပါသည်။ အဆိုပြု လျှပ်စစ်ဓာတ်အားလိုင်း တစ်လျှောက်တွင် လယ်ယာမြေ၊ သီးနှံစိုက်ခင်း၊ သစ်တော နှင့် ကာကွယ်တောများ ရှိသည်။

သက်ရောက်မှုရှိသော ရွာများအားလုံး၏ မြေယာသုံးစွဲမှုများမှာ စိုက်ပျိုးမြေ၊ မြေလွတ်မြေရိုင်း၊ စိုက်ပျိုးရေး လုပ်ဆောင်ထားခြင်း မရှိသောမြေ နှင့် သစ်တောမြေများ ဖြစ်သည်။ လေ့လာစစ်တမ်း ကောက်ယူထားချက် အရ စပါးခင်း ၁၇၉၂၅ ဧက၊ ယာမြေ ၅၀၀၅ ဧက၊ ဥယျဉ်မြေ ၂၀၆ ဧက၊ သီးနှံစိုက်ခင်း ၁၀ ဧက၊ အစုအဖွဲ့ပိုင်သစ်တော ၃၀၁ ဧက၊ စားကျက်မြေ ၂၁၀၅ ဧက ရှိသည်။ အဓိက စိုက်ပျိုးသီးနှံများမှာ စပါး၊ ပြောင်း၊ ပဲ နှင့် ဟင်းသီးအရွက်များ ဖြစ်သည်။ စိုက်ပျိုးရေးလုပ်ငန်းများတွင် ကျွဲ၊ နွားများကို အဓိက အသုံးပြုလေ့ရှိသည်။ ကြက်၊ ဝက် နှင့် ဆိတ်ကို အိမ်တွင်းစားသောက်စရာအဖြစ် အရေးတယူ မွေးမြူကြပြီး ယင်းတို့သည် မွေးမြူရေးမှ ဝင်ငွေအဓိက ရရှိသော အကြောင်းရင်းလည်း ဖြစ်သည်။

ရွာအများစုတွင် မူလတန်းကျောင်း၊ အလယ်တန်းကျောင်းခွဲများရှိပြီး အထက်တန်းကျောင်းရှိသောရွာမှာ သုံးရွာသာရှိသည်။ ကျေးလက်ကျန်းမာရေးဌာန နှင့် ကျေးလက်ကျန်းမာရေးဌာနခွဲရှိသော ရွာမှာ စုစုပေါင်း (၉) ရွာ သာရှိသည်။ အခြား (၃၃) ရွာတွင် ကျန်းမာရေးဌာနမရှိပါ။ အနီးဆုံး ကျန်းမာရေးဌာနသို့ ဆိုင်ကယ်ဖြင့် သွားလျှင် ၁၅ မိနစ်မှ မိနစ် ၃၀ အထိကြာတတ်ပါသည်။ အိမ်ထောင်စု ၅၀ ရာခိုင်နှုန်းကျော်တွင် အစိုးရ လျှပ်စစ်မီးရှိပြီး ၃၀ ရာခိုင်နှုန်းမှ Solar မီးသုံးကြသည်။ အခြားသူများမှာ ဘက်ထရီ မီးစက်နှင့် မီးအိမ်များ သုံးကြသည်။

## ၆။ ဖြစ်လာနိုင်ဖွယ်ရှိသော ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများအား အကဲဖြတ် ဖော်ထုတ်ခြင်း နှင့် သက်ရောက်မှုများအား လျော့ပါးစေရေး နည်းလမ်းများ

လုပ်ဆောင်မှုများမှ ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများမှာ လျှပ်စစ်ဓာတ်အားလိုင်း နှင့် လျှပ်စစ်ဓာတ်အားပေး စက်ရုံခွဲ (၂) ခုဆောက်လုပ်ခြင်းနှင့် လုပ်ငန်းလည်ပတ်ခြင်း လုပ်ငန်းစဉ်များနှင့် ဆက်စပ်နေပါသည်။ လုပ်ငန်းရှင် လက်ရှိရှိနေသော အချက်အလက်နှင့် အလားတူ ယခင် စီမံကိန်းများမှ ရရှိထားသော စီမံကိန်း ဖော်ပြချက်အပေါ်တွင် သက်ရောက်မှုများကို အခြေခံပြုစုထားသည်။

လျှပ်စစ်နှင့် စွမ်းအင်ဝန်ကြီးဌာန၊ လျှပ်စစ်ဖြန့်ဖြူးရေးနှင့် ထိန်းချုပ်ရေး ဌာနမှ ခွင့်ပြု လျှပ်စစ်ဓာတ်အားလိုင်း လမ်းကြောင်းအရ လျှပ်စစ်ဓာတ်အားလိုင်း ပုံစံတွင် တာဝါတိုင် ၂၉၆တိုင်ခန့် ပါဝင်မည်ဖြစ်သည်။ ဗန်းမော်နှင့် နဘား လျှပ်စစ်ဓာတ်အားပေး စက်ရုံခွဲအတွက် မြေယာလျော်ကြေးပေးခြင်းမှာ လုပ်ဆောင်ပြီးဖြစ်၍ မြေမှာ လျှပ်စစ်နှင့် စွမ်းအင် ဝန်ကြီးဌာနပိုင် ဖြစ်သည်။ လျှပ်စစ်ဓာတ်အားလိုင်းလမ်းကြောင်း အချို့အတွက်

မြေယာလျော်ကြေးပေးခြင်းနှင့် သီးနှံနှစ်နှာကြေးအား ဝန်ကြီးဌာနမှ မြေယာပိုင်ရှင်နှင့် တိုင်ပင်၍ ဆောက်လုပ်ရေး ကာလတွင်း ဆောင်ရွက်ပေးသွားမည်ဖြစ်သည်။ လက်ရှိ စီမံကိန်းနှင့် ပတ်သက်၍ ဖြစ်လာနိုင်ဖွယ်ရှိသော ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာထိခိုက်မှု ဆန်းစစ်ခြင်းကို မြေယာလျော် ကြေးပေးဆောင်ခြင်း မပါဝင်သော ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုအတွက်သာ ဆောင်ရွက်သွားမည်။ ထို့အပြင် စီမံကိန်း လုပ်ငန်းစဉ်များမှ ဖြစ်လာနိုင်ဖွယ်ရှိသည့် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှု အကဲဖြတ်ခြင်းကို ဆောက်လုပ်ရေးနှင့် လုပ်ငန်းလည်ပတ်ကာလ၌သာ ဆောင်ရွက်သွားမည်ဖြစ်ပြီး ဖျက်သိမ်းမည့်ကာလကို ထည့်သွင်းစဉ်းစားသွားမည် မဟုတ်ပေ။ အဘယ်ကြောင့်ဆိုသော် လျှပ်စစ်စွမ်းအား အရင်းအမြစ်မှာ ရေရှည်တည်တံ့စိမ်းလန်းသော ရေစွမ်းအားမှ လုပ်ဆောင်ထားသောကြောင့်ဖြစ်သည်။

လက်ရှိ စီမံကိန်းတွင် လျှပ်စစ်ဓာတ်အားလိုင်း လမ်းကြောင်း၊ လျှပ်စစ်ဓာတ်အားလိုင်း၊ တာဝါတိုင်များ၊ လမ်းများနှင့် လုပ်သား နားနေဆောင်များ ပါဝင်မည်ဖြစ်သည်။ တာဝါတိုင် လုပ်ငန်းခွင်များတွင် တူးဖော်ထားသော အရာများအား မြေဖို့ရန်နှင့် မြေပြိုခြင်းမဖြစ်စေရန် တပ်ဆင်ဆောင်ရွက်ခြင်းများအတွက် တူးဖော်ရေးစက်ကိရိယာများ အသုံးပြုသွားမည် ဖြစ်သောကြောင့် စွန့်ပစ်ပစ္စည်းများစုပုံထားသည့် နေရာများ မရှိရန်လိုအပ်ပါသည်။ ဆောက်လုပ်ရေးကာလတွင်းတွင် ဆောက်လုပ်ရေးလုပ်ငန်းခွင်သည် လျှပ်စစ် ဓာတ်အားလိုင်း လမ်းကြောင်းတွင် လိုအပ်သော အပြင်လမ်းများ ဆောက်လုပ်ခြင်းမပါဘဲ ပေ၁၅၀ (မီတာ၅၀ခန့်) ကန့်သတ်ထား သည်။ တာဝါဆောက်လုပ်ခြင်းအတွက် မလိုအပ်သော လျှပ်စစ် ဓာတ်အားလိုင်း လမ်းကြောင်းရှိ ၃ မီတာအောက် အပင်များအား ထိန်းသိမ်းထားမည်ဖြစ်သည်။ လျှပ်စစ်ဓာတ်အားလိုင်း လမ်းကြောင်း သတ်မှတ်ခြင်းနှင့် ထည့်သွင်းစဉ်းစားမှုများကို ဆောက်လုပ်ရေး မူဝါဒများနှင့် ပတ်ဝန်းကျင်ဆိုင်ရာ သွင်ပြင်များဖြစ်သည့် တောင်စောင်းများ၊ အောက်ခြေနှင့် အခြားအတားအဆီးများ အတွက် ဘူမိဗေဒဆိုင်ရာ အခြေအနေများပေါ်အခြေခံ၍ လုပ်ဆောင်သွားမည် ဖြစ်သည်။

အကျဉ်းချုပ်အနေဖြင့် စီမံကိန်း လုပ်ငန်းစဉ်ပါဝင်မှုများမှာ-

#### ဆောက်လုပ်ရေး ကာလ

- လမ်းကြောင်းတလျှောက် အပင်များခုတ်ထွင်ရှင်းလင်းခြင်း၊
- တာဝါတိုင်တည်ဆောက်ရေးလုပ်ငန်းအတွက် မြေညှိခြင်းလုပ်ငန်းများဆောင်ရွက်ခြင်း၊
- တာဝါတိုင်တည်ဆောက်ခြင်းနှင့် ဓါတ်အားပေးကြိုးများသွယ်တန်းခြင်း၊
- လမ်းကြောင်းတစ်လျှောက် ပြန်လည်ထူထောင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ပေးခြင်း (အမြဲရှင်းလင်း နေရန် မလိုအပ်ပါ) နှင့်
- အလုပ်သမားတန်းလျားတည်ဆောက်ခြင်း။

#### လုပ်ငန်းလည်ပတ်စဉ်ကာလ

- လမ်းကြောင်းတစ်လျှောက် ထိန်းသိမ်းရေးလုပ်ငန်းများအတွက် ယာဉ်များသွားလာခြင်း၊
- ထိန်းသိမ်းရေးလုပ်ငန်းများတွင် တာဝါတိုင်များပြင်ဆင်ခြင်းနှင့် သစ်ပင်များ၏ကိုင်းများဖြတ်ခြင်း၊ ညှိခြင်းများပါဝင်ပါသည်။
- လမ်းများ ပြုပြင်ထိန်းသိမ်းခြင်းလုပ်ငန်းများဆောင်ရွက်ခြင်း၊

#### ဖြစ်ပေါ်နိုင်သည့် ထိခိုက်နိုင်မှုများ

စီမံကိန်းကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် ထိခိုက်မှုများကို အောက်ပါဇယားတွင် ဖော်ပြထားပါသည်။

**ဇယား ၆-၁။ ။ ဖြစ်ပေါ်နိုင်သော ပတ်ဝန်းကျင် နှင့် လူမှုဝန်းကျင်အပေါ်ထိခိုက်နိုင်မှုများ**

ထိခိုက်မှုများ	တည်ဆောက်ချိန်			လည်ပတ်ရေးကာလ
လုပ်ဆောင်ချက်များ	မြေသားလုပ်ငန်းများ	တာဝါတိုင်တပ်ဆင်ခြင်းလုပ်ငန်း	လျှပ်စစ်ကြိုးများသွယ်တန်းခြင်း	ခါတ်အားပို့လွှတ်ခြင်း
မြေဆီလွှာ	✓	-	✓	-
စွန့်ပစ်ပစ္စည်းများ	✓	-	-	-
မြေယာရှုခင်း	✓	✓	-	-
မြေပေါ်ရေအရည်အသွေး	✓	-	-	-
ဇလဗေဒ	✓	-	-	-
ဇီဝမျိုးကွဲ (အပင်နှင့်သတ္တဝါများအပေါ်ထိခိုက်နိုင်မှု)	✓	-	✓	✓
ယဉ်အသွားအလာနှင့်သယ်ယူပို့ဆောင်ရေး	✓	✓	✓	-
လေထုအတွင်းထုတ်လွှတ်မှု/ဖုန်မှုန့်	✓	-	-	-
ဆူညံမှုနှင့် တုန်ခါမှု	✓	-	✓	-
လူမှုစီးပွားရေး	✓	-	✓	✓
မြေအသုံးချမှု	✓	-	-	-
စီးပွားရေးနှင့် လူနေမှုဘဝ	✓	✓	✓	-
လျှပ်စစ်သံလိုက်စက်ကွင်း	-	-	-	✓
လူထုကျန်းမာရေးနှင့်ဘေးကင်းရေး	✓	✓	✓	-
လုပ်ငန်းခွင်ကျန်းမာရေးနှင့်ဘေးကင်းရေး	✓	✓	✓	-
သဘာဝဘေးအန္တရာယ်	-	-	-	✓
အဓိကမတော်တဆ	-	-	-	-
ထိခိုက်မှု	✓	✓	✓	✓

**၆.၁။ ဆောက်လုပ်ရေးကာလ သက်ရောက်မှုများ**

**မြေဆီလွှာ အရည်အသွေး**

**က) ဖြစ်လာနိုင်ဖွယ် ထိခိုက်မှုများ**

မြေသားတူးဖော်ခြင်းနှင့် မြေသားဖိသိပ်ခြင်းကြောင့် မြေဆီလွှာ ပုံစံနှင့် မြေဆီလွှာ အရည်အသွေး ပြောင်းလဲခြင်း ထိခိုက်မှုများ ဖြစ်လာနိုင်ပါသည်။ မြေဆီလွှာ ဂုဏ်သတ္တိနှင့် ဆောက်လုပ်ရေး လုပ်ငန်းစဉ်ပေါ်မူတည်၍ ထိခိုက်မှုများ၏ ပမာဏနှင့် ပြင်းအား ပြောင်းလဲသွားမည်ဖြစ်သည်။ အုတ်မြစ်ချခြင်းလုပ်ငန်းတွင် မူလမြေဆီလွှာများ ပြန်လည်ရရှိရန် တူးဖော်ထားသော မြေများ ပြန်လည် မြေဖို့မည်ဖြစ်သည်။ မြေဖို့ခြင်း လုပ်ဆောင်စဉ်အတွင်း မြေသား ကျစ်လစ်သိပ်သည်းခြင်းသည် သဘာဝမိုးရေ စိမ့်ဝင်မှုတွင်ထိခိုက်မှု ဖြစ်စေသော်လည်း ၎င်းမှာ ယာယီဖြစ်ပေါ်စေ၍ အခြားနေရာများ သို့လည်း ထိခိုက်မှုမရှိနိုင်ပါ။ အုတ်မြစ်ချခြင်းလုပ်ဆောင်စဉ် အပင်နှင့် သဘာဝပေါက်ပင်များ ရှင်းလင်းခြင်းသည် အဓိက တောင်စောင်းများတွင် မြေဆီလွှာ တိုက်စားမှု ဖြစ်ပေါ်စေသည်။ သီးနှံရှင်းလင်းခြင်း၏ လူမှုစီးပွားရေး အမြင်အား နောက်အခန်းတွင် ဆွေးနွေးတင်ပြထားသည်။

ထို့အတူ လျှပ်စစ်ကြိုးဆွဲခြင်းလုပ်ငန်းစဉ်သည် ပန်းပွင့်ရာသီ အသီးသီး ရာသီတွင် သီးနှံများအား ထိခိုက်မှုများစေပါသည်။

ဆောက်လုပ်ရေး ကာလအတွင်း လယ်ကွင်းများအနီးမှ လုပ်သားများ ဖြတ်သန်းသွားလာခြင်းသည် သီးနှံများအား ထိခိုက်စေနိုင်သည်။ မြေစာများနှင့် ဆောက်လုပ်ရေး ပစ္စည်းများအား လယ်ကွင်းများအနီး ထားပါက လက်ရှိ သီးနှံနှင့် မြေဆီလွှာ ပျက်စီးမှု ဖြစ်ပေါ်လာစေမည်ဖြစ်သည်။ တူးဖော်ခြင်း လုပ်ငန်းများတွင် ဖုံးအုပ်ခြင်း၊ ကာကွယ်ထားခြင်းမရှိပါက မြေဆီလွှာ တိုက်စားခြင်းကိုဖြစ်ပေါ်စေနိုင်သည်။

#### ခ) လျော့ချခြင်းများ

သဘာဝပေါက်ပင်နှင့် မြေဆီလွှာ ထိခိုက်မှုအား လျော့ချလိုပါက တူးဖော်ထားသော မြေများအား တောင်စောင်းတစ်လျှောက် စမ်းချောင်းများနှင့် ဒေသတွင်း ရေမြောင်းများ အဝေးတွင်ထားရှိခြင်းဖြင့် မြေဆီလွှာ တိုက်စားခြင်းနှင့် ညစ်ညမ်းခြင်းမှ ကာကွယ်နိုင်ပါသည်။ မြေစာများအား မြေဖို့မပြီးခင်ထိ ဖုံးအုပ်ထားရန် နှင့် မြေပိုများအား မြေဖို့ပုံသွင်းခြင်း ပြီးဆုံးပါက ဖယ်ရှားပစ်ရမည်ဖြစ်သည်။ ဆောက်လုပ်ရေး လုပ်ငန်းစဉ်များအား မိုးရွာသွန်းမှု နည်းပါးပြီး စိမ့်ဝင်မှုကင်းဝေးသည့် မုတ်သုံကင်းလွတ်သော ရာသီလများတွင် လုပ်ဆောင်ရန် အစီအစဉ်ဆွဲရမည်ဖြစ်သည်။

အနီးအနား လယ်ကွင်းများရှိ သီးနှံနှင့် မြေဆီလွှာ ညစ်ညမ်းခြင်းနှင့် ထိခိုက်မှုများမှ ရှောင်ကြဉ်နိုင်ရန် ဆောက်လုပ်ရေးပစ္စည်းများအား လုပ်ငန်းခွင်တွင်းသာထားရှိရမည်။ မူလလမ်းများပေါ်တွင် စက်ပစ္စည်းများ ရွေ့လျားမှုအား ကန့်သတ်ထားရန်နှင့် လမ်းသစ်ဖောက်လုပ်ခြင်းအား ဒေသခံပြည်သူများနှင့် ညှိနှိုင်းဆောင်ရွက်ပြီးမှသာ လုပ်ဆောင်ရပါမည်။ ကန့်ကွက်ပါက ဆက်လက်မလုပ်ဆောင်ရပါ။

#### စွန့်ပစ် ပစ္စည်း

##### က) ဖြစ်လာနိုင်ဖွယ် ထိခိုက်မှုများ

ဆောက်လုပ်ရေး လုပ်ငန်းခွင် ပြင်ပဧရိယာများတွင် လုပ်ငန်းမှ စွန့်ပစ်ပစ္စည်း ပျံ့နှံ့မှုများ ဖြစ်လာနိုင်သည်။ ဆောက်လုပ်ရေး လုပ်ငန်းခွင်မှ စွန့်ပစ်ပစ္စည်းများသည် တာဝါတိုင်အနီးရှိ စမ်းချောင်းငယ်များ၊ မြစ်ငယ်များနှင့် မြစ်ကြောင်းများ တစ်လျှောက် မျောပါသွားနိုင်သည်။ စီမံကိန်း အနီးရှိ ရေတွင်းများ၊ တူးမြောင်းများအား ဆောက်လုပ်ရေး စွန့်ပစ်ပစ္စည်းများကြောင့် ညစ်ညမ်းစေနိုင်သည်။

#### ခ) လျော့ချခြင်းများ

ဆောက်လုပ်ရေး လုပ်ငန်းများ လုပ်ဆောင်ပြီးပါက ဆောက်လုပ်ရေး စွန့်ပစ်ပစ္စည်းများအား ချက်ချင်းဖယ်ရှားရန်နှင့် လုပ်ငန်းခွင်အား မူလအခြေအနေအတိုင်း ထားရှိရမည်ဖြစ်သည်။ ဆောက်လုပ်ရေး ဝန်ထမ်းများအား စွန့်ပစ်ပစ္စည်းများ စနစ်တကျစွန့်ပစ်တတ်စေရန် သင်ကြားပေးထားရမည်။ လုပ်ငန်းခွင်အတွင်း ဝန်ထမ်းများအား အမှိုက် စုဆောင်းခြင်းနှင့် စွန့်ပစ်ခြင်းအား စနစ်တကျမှုရှိစေရန်နှင့် အလွယ်တကူစွန့်ပစ်ခြင်းများမပြုလုပ်စေရန် သဘောတူညီမှုများထားရှိရမည်။

#### မြေယာရှုခင်းအမြင်ပသာဒ သက်ရောက်မှု

##### က) ဖြစ်လာနိုင်ဖွယ်ရှိသော သက်ရောက်မှုများ

ဆောက်လုပ်ရေး လုပ်ငန်းစဉ်များကြောင့် ၁၅ရက်မှ ၃၀ရက်အတွင်း အမြင်ပသာဒ သက်ရောက်မှုနှင့် မြေယာရှုခင်းပြောင်းလဲမှုများ ဖြစ်ပေါ်လာနိုင်သည်။

ထို့အပြင် တာဝါတိုင်များနှင့် လျှပ်စစ်ဓာတ်အားလိုင်း လမ်းကြောင်းသည် အဝေးပြေးလမ်းများနှင့် အမြင်သာယာမှု ပျောက်ဆုံးခြင်းနှင့် မြေယာရှုခင်းပြောင်းလဲမှုတို့ဖြစ်ပေါ်လာနိုင်သော လူဖန်တီးသည့် အမြင်ကျူးကျော်မှုများအရ အမြင်ပသာဒကို ပြောင်းလဲမှုဖြစ်စေသည့် အခြား ဓာတ်အားလိုင်းများအား

ဖြတ်သန်းသွားနိုင်သည်။ မူလ တာဝါတိုင်များမှ ထပ်တိုးလာသော ထိခိုက်မှုများသည် ယင်းဧရိယာ၏ အမြင်တန်ဖိုးအား မလွတ်မလပ်ဖြစ်စေသည်။

**ခ) လျှော့ချခြင်းများ**

ကျက်စားရာနေရာများနှင့် သစ်တော ဧရိယာများအား ရှောင်ကြဉ်၍ စစ်တမ်းကောက်ယူအပြီးနောက် လမ်းကြောင်းအား အစီအစဉ်ဆွဲထားခြင်းဖြစ်သည်။ အပင်များ ရှင်းလင်းမှု အနည်းဆုံးဖြစ်ရန်နှင့် ဖြစ်နိုင်လျှင် စနစ်တကျ ခုတ်လှဲခြင်း နည်းအား (vis-à-vis felling of trees) အသုံးပြုသွားရန်ဖြစ်သည်။ အမြင်ဧရိယာ ထိခိုက်မှု နည်းပါးစေရန် တာဝါတိုင်တည်ဆောက်ခြင်းဖြင့် လုံလုံလောက်လောက် မြင်ရသော ရာဇမတ်ကာခြင်းဖြင့် လုပ်ဆောင်ရမည်ဖြစ်သည်။ မို့မောက်သော တောင်ကုန်းမြေမျက်နှာသွင်ပြင် အခြေအနေ ဧရိယာတွင် တာဝါတိုင်များ၏ အမြင်ပုံစံအား တစ်ခုတည်းမြင်နေရစေရန် ကန့်သတ်ထားသည်။ ထို့အပြင် တာဝါတိုင်၏ အမြင့်သည် မြေပြင်အခြေအနေထက် သိသာထင်ရှားစွာ ဖြစ်ပေါ်မနေစေရပါ။

**မြေပေါ်ရေပမာဏနှင့် အရည်အသွေး**

**က) ဖြစ်လာနိုင်ဖွယ်ရှိသော သက်ရောက်မှုများ**

ရေရရှိမှုသည် လုံလောက်သည်ထက် ပိုနေသောကြောင့် ရေသုံးစွဲမှုသည် ဒေသ၏ ရေလိုအပ်ချက်ကို သက်ရောက်မှုမရှိပါ။ သို့သော်လည်း လုပ်ငန်းခွင်နေရာများတွင် စွန့်ပစ်ရေများရှိလာနိုင်သည်။ ဆောက်လုပ်ရေး လုပ်ငန်းခွင်များအနီးရှိ ရေစီးဆင်းမှုများကြောင့် ရေထုညစ်ညမ်းလာနိုင်သည်။ တောင်စောင်းတစ်လျှောက် ဆောက်လုပ်ရေးလုပ်ငန်းကြောင့် ရေစီးဆင်းမှု ပုံစံ အနည်းငယ်ပြောင်းလဲမှု ဖြစ်လာနိုင်သည်။

တိုက်စားခြင်းနှင့် ရေစီးဆင်းမှု အနည်ထိုင်ခြင်း၊ လုံလောက်သော သန့်စင်ခြင်း ပြုလုပ်ထားခြင်း မရှိသော အညစ်အကြေးရည်များ စွန့်ပစ်ခြင်း၊ လုပ်ငန်းခွင် စွန့်ပစ်ပစ္စည်းနှင့် အဆိပ်ရှိ ပစ္စည်းများမှ ထုတ်လွှတ်ခြင်းများမှ ရေအရည်အသွေး ထိခိုက်မှုများ ဖြစ်ပေါ်လာနိုင်သည်။ ညစ်ညမ်းမှု အရင်းအမြစ်များမှာ အောက်ပါအတိုင်းဖြစ်သည်-

**တိုက်စားခြင်းနှင့် အနည်ကျခြင်း**

တိုက်စားခြင်းနှင့် အနည်ကျစီးဆင်းမှု အရင်းအမြစ်များတွင် အောက်ဖော်ပြတို့ပါဝင်ပါသည်။

- မြေဆွဲခြင်းနှင့် မြေသားရွေ့ခြင်းစသည့် တည်ဆောက်ရေးလုပ်ငန်းများမှ တိုက်စားခြင်းနှင့် အနည်ကျစီးဆင်းမှု ( အပင်ပေါက်ရောက်မှုအားရှင်းလင်းခြင်းနှင့် မြေသားလုပ်ငန်းများ)
- တည်ဆောက်နေစဉ်အတွင်း အနည်အများအပြားပါဝင်သည့် အရည်စွန့်ထုတ်ခြင်း ဥပမာ- မြေတူးဖော်ခြင်းလုပ်ငန်းများမှ မြေစိုင်းမြေခဲများ
- တိုက်စားခြင်းနှင့် စမ်းချောင်းကြမ်းပြင်မှ အနည်အနှစ်ထုတ်လွှတ်ခြင်းနှင့် မြစ်ကြောင်းဖြတ်သန်းရာတွင် မြစ်ကမ်းပါးအနှောင့်အယှက်ဖြစ်မှု

တိုက်စားမှုတွင် အနည်အနှစ်ပိုချခြင်းနှင့် အစာချက်လုပ်ခြင်းကို ကန့်သတ်နိုင်သော မြစ်ကြမ်းပြင်တွင် နေထိုင်ကျက်စားသည့် အကောင်ငယ်လေးများအား အသက်ရှူကြပ်စေနိုင်သောနှင့် မြစ်အတွင်း နေထိုင်ကျက်စားမှုကို ကျယ်ပြန့်စွာ အရည်အသွေးကျဆင်းစေသည့် ရေတွင်တိုးမြှင့်လာသောအနည်ပါဝင်မှုကို ဖြစ်ပေါ်စေနိုင်သည့် ဖြစ်နိုင်ခြေရှိပါသည်။

**အန္တရာယ်ရှိ ပစ္စည်းများ**

တည်ဆောက်ရေးလုပ်ငန်းတွက် အသုံးပြုနိုင်ကောင်းပြုနိုင်သည့် အန္တရာယ်ရှိ ပစ္စည်းများမှာ -

- သုတ်ဆေးနှင့် ရောနှောဆီ (solvents)
- ဆီ၊ ဓာတ်ဆီနှင့် စက်ဆီကဲ့သို့ ရေနံထုတ်ကုန်များ
- ဘီလပ်မြေသိုလှောင်ခြင်းနှင့် ပြင်ဆင်သည့်အဆောက်အအုံ
- စွန်းထင်းနိုင်သည့် စွန့်ပစ်ပစ္စည်း

အထူးသဖြင့် သိုလှောင်စဉ်နှင့် ကိုင်တွယ်အသုံးပြုစဉ်သာမက ကိရိယာ/ စက်များ ပြုပြင်ထိန်းသိမ်းရာတွင် ပတ်ဝန်းကျင်သို့ အန္တရာယ်ရှိ ပစ္စည်းများ ထုတ်လွှတ်နိုင်ခြေရှိပါသည်။

#### ခ) လျော့ချခြင်းများ

တည်ဆောက်ရေးလုပ်ငန်းခွင်တွင် အသင့်တော်ဆုံးရေအသုံးပြုမှုအား စီစဉ်ဆောက်ရွက် လိုက်နာမည်ဖြစ်ပါသည်။ တည်ဆောက်ရေးလုပ်ငန်းများတွင် ခန့်မှန်းရေလွှမ်းပမာဏသည် ရေစီးဆင်းမှုကာကွယ်ခြင်းအား သေချာစေမည်ဖြစ်ပါသည်။ မြစ်ဖြတ်ကူးသည့်နေရာတွင် ဒေါင်လိုက်ရှင်းလင်းမှုသည် အမြင့်ဆုံးသော ရေကြီးမှုအဆင့်တွင် မြစ်အကျယ်၏အကျယ်ဆုံးအပိုင်းထက်ပို၍ကြီးမားပြီး အလျားလိုက်ရှင်းလင်းမှုသည် ဥပဒေလိုအပ်ချက်များအတိုင်းဆောင်ရွက်မည်ဖြစ်ပါသည်။

လမ်းကြောင်းတစ်လျှောက် မြစ်ဖြတ်သန်းခြင်းများသည် သေးငယ်ပြီး တာဝါများ၏အကွာအဝေးအား ပြောင်းလဲမှု တစ်စုံတစ်ရာသက်ရောက်စေမည်မဟုတ်ပေ။

မြေတူးနေစဉ်အတွင်းတွေ့ရှိရသော မြေအောက်ရေအား စုပ်ထုတ်မည်မဟုတ်သည့်အပြင် ရေအရင်းအမြစ်အား ဆက်စပ်နေသည့် ဧရိယာများမှ မည်သည့်စီးဆင်းရေမျိုးမှ မဆို ကာကွယ်ထားမည်ဖြစ်ပါသည်။

ရေအရည်အသွေးအပေါ်သက်ရောက်မှုအတွက် အောက်ဖော်ပြပါ ယေဘုယျ ရေအရည်အသွေးထိန်းသိမ်းမှုနည်းလမ်းများအား အကောင်အထည်ဖော်ဆောင်သွားမည်ဖြစ်ပါသည်။

#### တိုက်စားခြင်းနှင့် အနည်တိုင်ခြင်း

- ရှင်းလင်းခြင်းနှင့် မြေသားလုပ်ငန်းများအား တိုက်စားမှုနှင့် နောက်ဆက်တွဲ အနည်ကျမှုကို အနည်းဆုံးဖြစ်စေရန်အတွက် ခြောက်သွေ့ရာသီတွင် ဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။
- မြေသားလုပ်ထားသည့်ကာလအား ရှင်းလင်းခြင်းနှင့် တည်ဆောက်ခြင်းလုပ်ငန်းများ ဟူ၍အဆင့်ခွဲခြားခြင်း နှင့် မြေသားလုပ်ထားသည့်ဧရိယာအားကင်းပတ်စများဖြင့် ဖုံးအုပ်ထားခြင်းဖြင့် အနည်းဆုံးလျော့နည်းစေမည်ဖြစ်ပါသည်။ မြစ်ကမ်းပါးများ၏မြေလှန်ထားသည့် ဧရိယာများသည် ချက်ခြင်းဖုံးအုပ်စေမည်ဖြစ်ပြီး ဒေသမျိုးစိတ်များဖြစ်သည့် ထင်းထုတ်လုပ်နိုင်သည့် အပင်စိုက်ပျိုးခြင်းဖြင့် သင့်တော်စွာ ပြန်လည်စိုက်ပျိုးမည်ဖြစ်ပါသည်။
- မြစ်ကမ်းပါးတွင် စိုက်ခင်းများအား ရှင်းလင်းရန်လိုအပ်ပါက စိုက်ခင်းများအား မြေသားတွင် အမြစ်အုံများကျန်ရစ်စေရန် အရင်းနှားမှဖြစ်စေ/အရင်းမှဖြစ်စေ ဖြတ်တောက်စေမည်ဖြစ်ပါသည်။
- အသုံးပြုမည့် ပစ္စည်းများအား မတ်စောက်သော ကုန်းစောင်းများ၊ ရေကြောင်းလမ်းများ(သို့) ရေဆင်းသည့် လမ်းကြောင်းများမှ အနည်းဆုံး၃၀ မီတာအကွာတွင် ထားရှိမည်ဖြစ်ပါသည်။
- ရေအရည်အသွေးအား ပုံမှန်စောင့်ကြည့်မည်ဖြစ်ပါသည်။

#### အန္တရာယ်ရှိ ပစ္စည်းများ

လောင်စာနှင့် အန္တရာယ်ရှိ ပစ္စည်းများ သိုလှောင်မှုအား ဖိတ်စင်မှုပြသနာများအား ကာကွယ်ရန် လုံလောက်စွာ ကန့်သတ်မည်ဖြစ်ပါသည်။



- ပမာဏအနည်းဆုံးဖြစ်သော ဓာတုပစ္စည်းများ၊ အန္တရာယ်ရှိပစ္စည်းများနှင့် လောင်စာများသာလျှင် လုပ်ငန်းခွင်တွင်သိုလှောင်မည်ဖြစ်ပါသည်။
- ပတ်ဝန်းကျင်သို့ ဆီစွန်းထင်းနေသည့် ရေစွန့်ထုတ်ခြင်းအား တားမြစ်ထားပါသည်။

#### ဇလဗေဒ

##### က) ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှုများ

ဇလဗေဒအပေါ် ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှုများတွင် အောက်ဖော်ပြပါတို့ပါဝင်ပါသည်။

- စိုက်ခင်းများရှင်းလင်းခြင်းသည် မြေသားမျက်နှာပြင်တွင် စီးဆင်းရေ ရွေ့လျားမှုအား အရှိန်များစေပါသည်။
- တာဝါတိုင်တည်နေရာ၊ စီမံကိန်းသွားလမ်းများ၊ ကုန်ကြမ်းသိုလှောင်သည့် ဧရိယာများနှင့် အခြားသော အခြေခံဆောက်အုံများအတွက် လိုအပ်သည့် မြေသားလုပ်ငန်းများသည် မြေပေါ်ရေစီးဆင်းမှုလမ်းကြောင်းအား ပြောင်းလဲနိုင်ပါသည်။
- စီမံကိန်းသွားလမ်းများတည်ဆောက်ရေးသည် ရေစီးဆင်းမှုကို ပြောင်းလဲစေနိုင်သည့် စမ်းချောင်းတွင်း အလုပ်များနှင့် ပတ်သတ်နေပါသည်။
- စမ်းချောင်းတွင်းအလုပ်များအတွက် ဇလဗေဒ၊ ရေနေဇီဝမျိုးစုံမျိုးကွဲနှင့် ကျေးရွာနေပြည်သူတို့၏ ရေအရင်းအမြစ်ရှိရာသို့ သွားလာနိုင်သည့်လမ်း တို့အားသက်ရောက်နိုင်သည့် ယာယီမြစ်ကြောင်းပြောင်းလဲမှု ( စီမံကိန်းသွားလမ်းများအတွက် လိုအပ်နိုင်ခြေရှိသည့်)

##### ခ) သက်ရောက်မှုများအား လျော့ချခြင်း

- ဖြစ်နိုင်လျှင် တည်ဆောက်ရေးအား ခြောက်သွေ့ရာသီတွင် ဆောက်ရွက်မည်ဖြစ်ပါသည်။
- မြေသားလုပ်ငန်းများအား မြေပေါ်ရေစီးဆင်းမှုအား ပြောင်းလဲမှုများ အနည်းဆုံးဖြစ်အောင်နှင့် တည်ရှိနေသောရေအားစုဆောင်းရန် ဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။
- မြစ်ကြောင်းပြောင်းလဲခြင်းသည်မြစ်အောက်ပိုင်းရေအမှတ်အောက်နည်းနိုင်သည့်အတိုင်းအတာကို စီးဆင်းမှု ပြောင်းလဲမည်ဟုမျှော်မှန်းထားပြီး ဒေသနေပြည်သူများအား မျှော်မှန်းထားသည့် အတိုင်းအတာနှင့် ပြောင်းလဲမှု ကြာချိန်တို့အပါအဝင် ရေအမှတ်အပြောင်းအလဲများအား အကြောင်းကြားမည်ဖြစ်ပါသည်။

#### ဇီဝမျိုးစုံမျိုးကွဲ (အပင်နှင့် သတ္တဝါ)

##### က) ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှုများ

စိုက်ပျိုးမြေအတွက်ကန့်သတ်မြေ ၃မီတာ အပါအဝင် မြေအသုံးချမှုအပြောင်းအလဲအတိုင်းအတာ (ခန့်မှန်းခြေ ၅၅၆ ဟက်တာ(၁၃၇၀ ဧက)အာ ရှင်းလင်းမည်ဖြစ်ပါသည်။ ယင်းတို့မှ ၆၄.၄ ဟက်တာ (၁၅၉ဧက)သည် စိုက်ပျိုးမြေ ဖြစ်ပြီး ဇီဝမျိုးစုံမျိုးကွဲအပေါ်တွင် ကြီးမားသောသက်ရောက်မှုရှိမည်ဟု မမျှော်မှန်းထားပါ။ ဓာတ်အားဖြန့်ဖြူးသည့်ဓာတ်အားလိုင်းဖြတ်လမ်းသည် တစ်ခါတစ်ရံ သစ်တောများအား သွယ်ဝိုက်၍ လျော့ကျစေပြီး အပိုင်းကွဲပြားစေပါသည်။ ၎င်းတို့သည် ရံဖန်ရံခါ သစ်တောပြုန်းတီးမှုအား ရုပ်ပိုင်းဆိုင်ရာ အခွင့်အလမ်းများတိုးတတ်စေခြင်းဖြင့် လျော့ပါးစေပါသည်။

တည်ဆောက်ရေးလုပ်ငန်းများကြောင့် ဇီဝမျိုးစုံမျိုးကွဲအပေါ် မျှော်မှန်းထားသည့် သက်ရောက်မှုများအတွက် အောက်ပါတို့ပါဝင်ပါသည်။

- ဧရိယာအတွင်း ယာယီ ပေါက်ရောက်ရှင်သန်မှုအားအနှောင့်အယှက်ဖြစ်မှုသည် တည်ဆောက်ရေးအား ချောမွေ့စေရန်လိုအပ်ပါသည်။ ယာယီနှောင့်ယှက်မှုသည် တာဝါတိုင်များ၊ တာဝါတိုင်တည်နေရာများ ဆီသို့သွားရောက်သည့်လမ်းများနှင့် ယာယီတိရိစ္ဆာန်မွေးမြူရေးခြံ၊ အလုပ်သမားတန်းလျားနှင့် တယ်လီဖုန်းရုံးတို့ပါသည်။
- နှောင့်ယှက်မှုနှင့် တည်ဆောက်ရေးလုပ်ငန်းများ၏ ရလဒ်အဖြစ် အလင်းရောင်နှင့်/ တုန်ခါမှုကြောင့် ဒေသခံတိရိစ္ဆာန်များ အစားထိုးမှု (မြေကော်ခြင်း၊ မြေတူးခြင်း၊ ရှင်းလင်းခြင်းနှင့် ယာဉ်များသွားလာမှု)
- ယာဉ်/ ယန္တရား နှင့်တိုက်မိမှု၊ အမဲလိုက်ခြင်း၊ ခိုးဖမ်းခြင်း ကြောင့်ဖြစ်ပေါ်လာသည့် တိရိစ္ဆာန်သေနှုန်း နှင့် ဖြတ်လမ်း၏အတွင်းဘက်နှင့် အပြင်ဘက်နှင့် စီမံကိန်းသွားလမ်းများ ဖန်တီးခြင်းကြောင့် ဖြစ်ပေါ်လာသည့် ကုန်သွယ်ရေးအတွက် စုဆောင်းခြင်း

အထက်ဖော်ပြပါကိစ္စရပ်များ၏ ဇီဝမျိုးစုံမျိုးကွဲအပေါ်သက်ရောက်မှုများအား ဆန်းစစ်သော ဇီဝမျိုးစုံမျိုး ကွဲလေ့လာရေးသည် သေးငယ်သော (သို့) လျစ်လျူရှုနိုင်သောလက္ခဏာများရှိသော်လည်း IUCN စာရင်းဝင် ခြိမ်းခြောက်ခံမျိုးစိတ်များနှင့် အမျိုးသားအဆင့် ကန့်သတ်ထားသည့်မျိုးစိတ်များအား သင့်တော်သည့် လက္ခဏာဖြင့် ဆန်းစစ်လေ့လာတွေ့ရှိခဲ့ပါသည်။

**ခ) သက်ရောက်မှုလျော့ချသည့်နည်းလမ်းများ**

- ဇလဗေဒ၊ ရေအရည်အသွေး၊ လေအရည်အသွေးနှင့် ဆူညံသံနှင့် တုန်ခါမှု တို့နှင့် သက်ဆိုင်သည့် အဆိုပြုထားသော သက်ရောက်မှုလျော့ချသည့် နည်းလမ်းများအား အကောင်အထည် ဖော်ဆောင်ရပါမည်။
- အဆိုပြုထားသည့် တည်ဆောက်ရေး ဧရိယာများအပြင်ဘက်တွင် သစ်ခုတ်ခြင်းနှင့် သက်ဆိုင်သည့် / ပြဌာန်းထားသည့် ဥပဒေနှင့် နည်းဥပဒေများအား လိုက်နာရပါမည်။ စီမံကိန်းနှင့် ဆက်စပ်နေသည့် သို့မဟုတ် ပါဝင်လုပ်ဆောင်နေသည့်ဝန်ထမ်းများ၊ ကန်ထရိုက်တာများအားလုံးနှင့် စီမံကိန်းဝန်ထမ်းများ၊ အလုပ်သမားများအား အမဲလိုက်ခြင်းနှင့် ကျူးကျော်အမဲလိုက်ခြင်းအား မပြုလုပ်ရန် တားမြစ်ထားပါမည်။ သစ်တောဥပဒေ ၁၉၉၂ ခုနှစ်၊ တောရိုင်းတိရိစ္ဆာန်ကာကွယ်ခြင်းနှင့် သဘာဝဧရိယာများ၏ တောရိုင်းအပင်ကာကွယ်စောင့်ရှောက်ခြင်း ဥပဒေ ၁၉၉၄ခုနှစ် အရ သားကောင်ထောင်ချောက်နှင့် ကျော့ကွင်းများအသုံးပြုခြင်း၊ ဖမ်းဆီးရရှိသော သားကောင်များ သယ်ဆောင်ခြင်းအတွက် ပြစ်ဒဏ်များနှင့် အလုပ်ထုတ်ခြင်းနှင့် တရားစွဲဆိုခြင်းအပါအဝင် ပြစ်ဒဏ်များ ချမှတ်ပါမည်။
- စီမံကိန်းပိုင်ရှင်သည် စီမံကိန်းပိုင်ရှင်၏ဝန်ထမ်းများနှင့် အလုပ်သမားများအား နည်းဥပဒေများ၊ လိုက်နာရမည့်စည်းမျဉ်းများနှင့် အဆိုပါတားမြစ်ချက်များသာမက ထိုအလုပ်သမားများ(သို့) ဝန်ထမ်းများ(သို့) စီမံကိန်းနှင့် ဆက်စပ်သူများသည် နည်းဥပဒေများနှင့် လိုက်နာရမည့်စည်းမျဉ်းများအား ချိုးဖောက်ပါက အပြစ်ပေးမှုနှင့် သက်ဆိုင်သည့် သတင်းအချက်အလက်များကို ဖြန့်ဝေပေးရန် တိုက်ရိုက်တာဝန်ရှိပါသည်။
- တည်ဆောက်ရေးအလုပ်များအတွက် စီစဉ်ထားသည့် ရှင်းလင်းရေး လုပ်ငန်းများသည် ရှင်းလင်းစွာသတ်မှတ်ပြီး မတော်တဆမှားယွင်း ရှင်းလင်းမှုများကို ရှောင်ရှားနိုင်စေရန် အမှတ်အသား ပြုလုပ်ထားရပါမည်။
- အနှောင့်အယှက်ဖြစ်စေသည့် ဧရိယာများအား တည်ဆောက်ရေးလုပ်ငန်းများ ပြီးလျှင်ပြီးခြင်း ပြန်လည်ရှင်သန်စေမည်ဖြစ်ပါသည်။

- တည်ဆောက်ရေးကန်ထရိုက်တာသည် ကုန်းနေအပင်နှင့် သတ္တဝါ၊ အပင်ပေါက်ရောက်မှုနှင့် တောရိုင်းသတ္တဝါတို့အား ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှုများအား ကာကွယ်ရန် ဇီဝဗေဒဆိုင်ရာအရင်းအမြစ် စီမံမှုအစီအစဉ်အား တည်ထောင်၍ ဆောင်ရွက်ရမည့် တည်ဆောက်ရေးလုပ်ငန်းများအား စီမံရန် စီမံခန့်ခွဲမှုအစီအစဉ်အား သက်ဆိုင်ရာခွင့်ပြုချက်နှင့် ပတ်ဝန်းကျင်ဆိုင်ရာစည်းမျဉ်းများနှင့်အညီ စောင့်ကြပ်ကြည့်ရှုရပါမည်။
- တည်ဆောက်ရေးဧရိယာသို့ ဒေသရင်းနှင့် ထူးဆန်းသည့် မျိုးစိတ်များအား ရောက်ရှိလာစေရန် ဆွဲဆောင်ခြင်းအား ရှောင်ရှားနိုင်စေရန် တည်ဆောက်ရေးနှင့် အိမ်သုံးစွန့်ပစ်ပစ္စည်းများအား သင့်တော်စွာ သိုလှောင်ပြီး စွန့်ပစ်ရပါမည်။
- ဆီ၊ ဓာတုနှင့် စွန့်ပစ်အမှိုက်များအား ဒေသဆိုင်ရာ မြို့တော်စည်ပင်သာယာရေး ဥပဒေနှင့် အညီ သိုလှောင်၊ ကိုင်တွယ် ၊ စွန့်ပစ်ရမည်ဖြစ်ပါသည်။
- တည်ဆောက်ရေးယာဉ်များနှင့် စက်ယန္တရားများအား မလိုလားအပ်သော ဆူညံသံထွက်ပေါ်မှုအား လျော့နည်းစေရန်အလို့ငှာ စက်မှုလုပ်ငန်းဆိုင်ရာ စံချိန်စံညွှန်းနှင့် အညီ ထိန်းသိမ်းရပါမည်။
- ကန့်သတ်အရှိန်နှုန်းပြသည့် လမ်းသင်္ကေတများအား တည်ဆောက်ရေးဧရိယာတစ်လျှောက်ရှိ လမ်းမအားလုံးတွင် တပ်ဆင်ထားမည်ဖြစ်ပါသည်။
- တည်ဆောက်ရေးလုပ်သားများအား သဘာဝအလျောက်ရှင်သန်ကျက်စားသည့် ဧရိယာများ၏ တန်ဖိုးအား သိမြင်နားလည်မှုကို မြှင့်တင်ရန် ကတိကဝတ်ထား ဆောင်ရွက်မည်ဖြစ်သည့်အပြင် ကျူးကျော်အမဲလိုက်ခြင်းအား တားမြစ်ခြင်းအတွက် အစီအမံများ ပြုလုပ်ဆောင်ရွက်မည်ဖြစ်ပါသည်။
- တိရိစ္ဆာန်များအား လုပ်ငန်းသုံးယာဉ်များမှ တိုက်မိမှုအတွက် ဖြစ်ပွားနိုင်ခြေ အနိမ့်ဆုံးလျော့ချရန် တည်ဆောက်ရေး ယာဉ်များအတွက် အရှိန်နှုန်းကန့်သတ်ချက် တစ်နာရီအများဆုံး မိုင် ၄၀နှုန်းအား သတ်မှတ်ထားပါသည်။
- တာဝါတိုင်နယ်နိမိတ်လမ်း၏ အပင်ပေါက်ရောက်မှုရှင်းလင်းခြင်းအား တတ်နိုင်သမျှ အနည်းဆုံးဖြစ်စေခြင်းနှင့် သတ်မှတ်ဒီဇိုင်းထက်ကျော်လွန်၍ ပိုမိုရှင်းလင်းမှုမဖြစ်စေရန် သေချာစေခြင်းတို့ ဆောင်ရွက်ပါမည်။
- တည်ဆောက်ရေးလုပ်သားများအား သဘာဝအလျောက် ရှင်သန်ကျက်စားသည့် ဧရိယာများ၏ တန်ဖိုးအား သိမြင်နားလည်မှုကို မြှင့်တင်ရန် ကတိကဝတ်ထား ဆောင်ရွက်မည်ဖြစ်သည့်အပြင် ကျူးကျော်အမဲလိုက်ခြင်းအား တားမြစ်ခြင်းအတွက် အစီအမံများ ပြုလုပ်ဆောင်ရွက်မည်ဖြစ်ပါသည်။
- ဖြတ်လမ်းများအတွင်း အပင်ပေါက်ရောက်မှုနှင့် ခြုံပင်ပေါက်ရောက်မှုအား လမ်းအသွားအလာ အနှောင့်အယှက်မဖြစ်လျှင် ချန်လှပ်ထားပါမည်။
- အပင်ပေါက်ရောက်မှုရှင်းလင်းဆောင်ရွက်မှုအားလုံးအား သစ်တောဌာန၏ အကြံပေးချက်နှင့် အတူ ဆောင်ရွက်မည်ဖြစ်ပါသည်။
- သစ်တောဌာန၏ လမ်းညွှန်ချက်အတိုင်း ခုတ်ထွင်ထားသည့် အပင်များအား စွန့်ပစ်မည်ဖြစ်ပါသည်။
- တည်ဆောက်ရေးပြီးစီးပါက အသုံးပြုထားသည့် တွင်းနှင့် သိုလှောင်ပစ္စည်းထားသည့် ဧရိယာများအား ပြန်လည်ပျိုးထောင်ပေးခြင်း ပြုလုပ်မည်ဖြစ်ပါသည်။
- ကန်ထရိုက်တာအလုပ်သမားများမှ သစ်ထုတ်လုပ်မှုအား တားမြစ်ထားပါသည်။
- အပင်များရှင်းလင်းရာတွင် ပေါင်းသတ်ဆေးအသုံးပြုမှုအား တားမြစ်ထားပါသည်။
- တောရိုင်းတိရိစ္ဆာန်များအား အမဲလိုက်ခြင်းအား တင်းကြပ်စွာ တားမြစ်ထားပြီး ယင်းတားမြစ်ချက်အား ဝန်ထမ်းအားလုံးလိုက်နာရပါမည်။

- ရှားပါး ငှက်မျိုးစိတ်များပါဝင်သည့် ဧရိယာများတွင် အပေါ်ပိုင်းဝါယာကြိုးအား ပိုမိုမြင်သာစေရန် ပလက်စတစ်ကိရိယာများဖြင့် ပြုလုပ်သင့်ပါသည်။ ဓာတ်လိုက်ခြင်း (အဓိကအားဖြင့် ငှက်ကြီးများ) အား ငှက်များနှင့် သဟဇာတဖြစ်စေမည့် တာဝါဒီဒိုင်းအသုံးပြုခြင်းဖြင့် ရှောင်ကျဉ်ရပါမည်။
- စီမံကိန်းဧရိယာအတွင်း နေထိုင်ပေါက်ရောက်သည်ဟု သိရှိထားပြီးဖြစ်သော ရှားပါးအပင်နှင့် တိရိစ္ဆာန်တို့၏ တည်နေရာအတိအကျအား သတ်မှတ်နိုင်ရန် ကွင်းဆင်းဆောင်ရွက်ခြင်း ပြုလုပ်မည်ဖြစ်ပါသည်။
- လမ်းကြောင်းအဆင့်မြှင့်တင်ခြင်း၊ သီးသန့်တည်ဆောက်ရေးနည်းပညာ(သို့) တည်ဆောက်ရေး အချိန်အား ကန့်သတ်ထားခြင်း သီးခြားအကြောင်းပြချက်များအတွက် လုပ်ဆောင်မည်ဖြစ်ပါသည်။
- ဓာတ်အားဖြန့်ဖြူးသည့်တိုင်၏ ထိပ်တွင်တည်ဆောက်ထားသည့် ဥဥသည့်နေရာအပါအဝင် မျိုးတုန်းအန္တရာယ်နှင့် ရင်ဆိုင်နေရသော မျိုးစိတ်အရင်းအမြစ်များနှင့် မျိုးတုန်းလှ မျိုးစိတ်အရင်း အမြစ်များအတွက် နေထိုင်ကျက်စားသည့်နေရာများဖန်တီးပေးရန် ဖြတ်လမ်းသို့ ဓာတ်အား သယ်ယူဖြန့်ဖြူးသည့်ဓာတ်အားလိုင်းအား စီမံခန့်ခွဲခြင်း ဆောင်ရွက်မည်ဖြစ်ပါသည်။

#### လေထုတွင်းသို့ ထုတ်လွှတ်ခြင်း/ ဖုန်များ

##### က) ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှု

ဓာတ်အားဖြန့်ဖြူးသည့် ဓာတ်အားလိုင်းများတည်ဆောက်ရာတွင် အကန့်အသတ်ရှိသော မြေပြင်အလုပ်များနှင့် ပတ်သတ်နေပါသည်။ ဖုန်မှုန့်ထွက်ရှိမှုအတွက် ဖြစ်နိုင်ခြေမှာ နည်းပါးပြီး ကြာချိန်တိုတောင်းပါသည်။ ဓာတ်အားဖြန့်ဖြူးသည့် ဓာတ်အားလိုင်းများတည်ဆောက်နေစဉ် ယာဉ်အသွားအလာထူထပ်လာမှုသည် ရံဖန်ရံခါနှင့် လျစ်လျူရှုနိုင်သည့် အနေအထားတွင် ဖြစ်မည်ဟု မျှော်မှန်းထားပါသည်။ ထို့ကြောင့် ညစ်ညမ်းမှုပါဝင်မှုအား အထောက်အပံ့သည် တည်ဆောက်ရေး လုပ်ငန်းများမှ ထွက်ပေါ်လာပြီး ယာဉ်အသွားအလာနှုန်းသည် သေးငယ်၍ ပြဌာန်းထားသည့် လေအရည်အသွေး စံချိန်စံညွှန်းများ (သို့) လက်ရှိပါဝင်မှုတွင် တိုးမြှင့်မှုတစ်စုံတစ်ရာ ဖြစ်စေနိုင်ရန်အတွက် မလုံလောက်ပေ။

##### ခ) သက်ရောက်မှုလျော့ချသည့်နည်းလမ်းများ

တည်ဆောက်ရေးလုပ်ငန်းနှင့် ၎င်းနှင့်ဆက်စပ်နေသည့် လုပ်ငန်းများမှ လေထုတွင်းသို့ထုတ်လွှတ်မှု ဖြစ်နိုင်ခြေရှိသည့် ကြားမှ စီမံကိန်း၏ပတ်ဝန်းကျင်ပေါ်အကျိုးသက်ရောက်မှုသည် နည်းပါးပါသည်။ အောက်ဖော်ပြပါ သက်ရောက်မှုလျော့ချသည့် နည်းလမ်းများသည် မသိသာထင်ရှားသည့် သက်ရောက်မှုများ ဖြစ်စေနိုင်သည့် ထုတ်လွှတ်မှု သက်ရောက်ခြင်းအား လျော့ကျစေမည်ဖြစ်ပါသည်။

- ဖုန်မှုန့် ထုတ်လွှတ်နိုင်သည့် ဧရိယာများတွင် ရေဖြန်းခြင်း
- ကတ္တရာမခင်းထားသည့် လမ်းများပေါ်တွင် သွားလာသည့် ယာဉ်များ၏အရှိန်နှုန်းသတ်မှတ်ချက်ကို ကန့်သတ်ထားခြင်း
- မြေစာ/ဆောက်လုပ်ရေးပစ္စည်းတင်ဆောင်လာသည့် ယာဉ်အား ဖုံးအုပ်စေခြင်း
- ထိန်းသိမ်းကာကွယ်သည့် စနစ်အား အသုံးပြုခြင်း
- ယာဉ်များအားစစ်ဆေးခြင်းနှင့် ကိရိယာများအား ရှောင်တခင် စစ်ဆေးခြင်းအား နေ့စဉ်ပြုလုပ်ခြင်း
- လေတိုက်နှုန်းမြင့်သည့်အခါတွင် ဖုန်ထစေသည့် လုပ်ငန်းများအား ရပ်ဆိုင်းစေခြင်း
- စီမံကိန်းလုပ်ငန်းခွင် အလေ့အကျင့်ကောင်း နှင့် ကောင်းမွန်သော လုပ်ငန်းခွင် ထိန်းသိမ်းမှုအား အသုံးပြုခြင်း

- အသုံးမပြုသည့်အခါတွင် စက်များအား ပိတ်ထားခြင်း
- ယာဉ်အသုံးပြုသွားလာမှုအချိန်အား လျော့နည်းစေရန် ဆောက်လုပ်ရေးအချိန်ဇယားအား ကောင်းမွန်အောင်ရေးဆွဲခြင်း
- မြေနုင့် သဲသယ်ယူရာတွင် သယ်ဆောင်လာသည့်ယာဉ်ပေါ်တွင် သေချာစွာ ဖုံးအုပ်ထားခြင်း

### ဆူညံသံနှင့် တုန်ခါခြင်း

#### က) ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှုများ

တာဝါတိုင်အနီးတဝိုက်တွင် တည်ဆောက်ရေးနှင့် ၎င်းနှင့် ဆက်စပ်နေသည့် လုပ်ငန်းများကြောင့် အပင်နှင့် သတ္တဝါများ နေထိုင်ကျက်စားမှု၊ ကျောင်းများ၊ ဘုရားကျောင်းများတို့အပေါ်တွင် အနှောင့်အယှက် ဖြစ်စေမှု အတွက် ဖြစ်နိုင်ခြေ ရှိပါသည်။

တာဝါတိုင်တည်ဆောက်နေစဉ်အတွင်း အလုပ်သမားများမှ ဆူညံသံ အနှောင့်အယှက်ဖြစ်စေမှု ရှိနိုင်ပါသည်။ တာဝါတိုင်များ တပ်ဆင်နေရာချထားစဉ်အတွင်း ထွန်စက်များ စဉ်ဆက်မပြတ် လည်ပတ်ဆောင်ရွက်ခြင်းမှ အနှောင့်အယှက်ဖြစ်ပေါ်စေနိုင်ပါသည်။

#### ခ) သက်ရောက်မှုလျော့ချသည့် နည်းလမ်းများ

တည်ဆောက်ရေးလုပ်ငန်းများသည် နောက်ဆက်တွဲ ပေါင်းစပ်ပါဝင်ပြီး ပြုလုပ်ဆောင်ရွက်ထားသဖြင့် ဆူညံသံသက်ရောက်မှု၏ ကြာချိန်တိုးမြှင့်ခြင်းအား မည်သည့်ဧရိယာမှ ခံစားရခြင်းမရှိနိုင်ပေ။ ဥပမာ- တာဝါတိုင်တည်ဆောက်ခြင်းနှင့် နေရာချထားခြင်းသည် ၃လမှ ၆လအတွင်း ကြာမြင့်နိုင်သော်လည်း လက်တွေ့တည်ဆောက်ရေးသည် ၁၅ရက်မှ ၃၀ရက်သာ ကြာရှည်ပါသည်။

တည်ဆောက်ရေးလုပ်ငန်းအား နေ့အချိန်အတွင်းတွင်သာ ဆောင်ရွက်မည်ဖြစ်သည်။ ပစ္စည်းများပို့ဆောင်ပေးသည့် နောက်တွဲယာဉ်များနှင့် ကိရိယာများထွန်စက်များ၏ ရွေ့လျားမှုမှထွက်ပေါ်လာသည့် ဆူညံသံအချို့ဖြစ်ပေါ်လာနိုင်သော်လည်း ယဉ်အသွားအလာ သိပ်သည်းမှု မဟာဏ္ဍာ ရံဖန်ရံခါသာ ဖြစ်နိုင်ပြီး သိသာထင်ရှားမှုမရှိလှပေ။ အောက်ဖော်ပြပါတို့သည် ထပ်ပေါင်းပါဝင်သည့် သက်ရောက်မှု လျော့ချနိုင်သည့် နည်းလမ်းများ ဖြစ်ပါသည်။

- ဆူညံသံထွက်ပေါ်လာသောလုပ်ငန်းရပ် အလုံးစုံအား လူနေဧရိယာမှ ကွာဝေးသော နေရာတွင်သာ ထားရှိကြောင်းသေချာစေခြင်း
- ဆူညံသံထွက်ပေါ်လာသောကိရိယာများအား အခြေခံအားဖြင့်နေ့စဉ်စစ်ဆေးခြင်း
- စက်များအားလုံးကို အသုံးမပြုသည့်အချိန်တွင်ပိတ်ထားခြင်း
- ပစ္စည်းပို့ဆောင်ခြင်းအပါအဝင် ညအချိန်အလုပ်များအား ကန့်သတ်ထားခြင်း
- ထိတွေ့ဝန်းကျင်ဆူညံသံအဆင့်အား 55dBA အောက်ရှိစေရန် ထိန်းသိမ်းထားခြင်း
- လုပ်ငန်းခွင်လုပ်ငန်းရပ်များ၏ အချိန်ဇယားအား အထူးသဖြင့် ဆူညံသံလုပ်ငန်းရပ်များ၏ ထပ်ခါဖြစ်ပေါ်ခြင်း / တစ်ပြိုင်နက်ဖြစ်ပေါ်ခြင်းအား လျော့ချရန်အတွက် ဖြစ်နိုင်ခြေများလျော့ချရန် စဉ်းစားထားခြင်း

ကေဘယ်ကြိုးများ တပ်ဆင်ခြင်းလုပ်ငန်းစဉ်သည် လုပ်ငန်းဆောင်ရွက်နေသည့် ပတ်ဝန်းကျင် အနီးတဝိုက်တွင် နီးကပ်စွာ နေထိုင်သည့် ပြည်သူများသာကြားနိုင်သော လူတို့၏အသံသာ ထွက်ပေါ်နိုင်ပါသည်။ သို့သော်လည်း အဆိုပါသက်ရောက်မှုများသည် နေရာအလိုက်ဖြစ်ပေါ်နိုင်၍ ကာလမှာ တိုတောင်းမည် ဖြစ်ပါသည်။

## လူမှုရေးကိစ္စများနှင့်စီမံခန့်ခွဲမှု

### ဆန္ဒမပါသောနေရာပြောင်းရွှေ့ချထားမှု (တည်ဆောက်ရေး)

ဓာတ်အားဖြန့်ဖြူးသည့် ဓာတ်အားလိုင်း ဖြတ်သန်းရာ ဧရိယာကို အတတ်နိုင်ဆုံး ပြန်လည် နေရာချထားခြင်းအား ရှောင်ရှားခြင်းဟူသည့် စည်းမျဉ်းဖြင့် သေချာစွာရွေးချယ်ထားပါသည်။ ရလဒ်အနေဖြင့် အဆိုပြုလက်ရှိ ဓာတ်အားလိုင်းဒီဇိုင်းကြောင့် ဓာတ်အားဖြန့်ဖြူးသည့် ဓာတ်အားလိုင်းအကြားအလပ် နေရာတွင် ကျရောက်နေသောအိမ်ထောင်စုမရှိပေ။

### မြေယူခြင်း/ မြေအသုံးချခွင့်

#### သက်ရောက်မှု ၁

မြေအားအမြဲတမ်းအဆောက်အအုံဖြစ်သည့် အုတ်မြစ်၊ ဓာတ်တိုင်များစသည့် တို့အတွက် အသုံးပြုပါမည်။ (လက်ရှိတွင်မြေ အသုံးချမှုကြောင့် ဖြစ်ပေါ်သော အနှောင့်အယှက်များ ဖြစ်မှုများအား လျော်ကြေး ပေးသင့်ပါသည်။ မြေယာများအတွက် နှုန်းထားများအား ညှိနှိုင်းမှုအခြေခံ၍ သဘောတူညီထားပါသည်။) စီမံကိန်းသည် မြေယာအသုံးချမှုအား အောက်ပါတို့ဖြင့် ပြောင်းလဲမည်ဖြစ်ပါသည်။

- လမ်းများနှင့် အခြားသော ယာယီအခြေခံအဆောက်အအုံများအတွက်လိုအပ်သည့် ဧရိယာမှ ယာယီ မြေအသုံးချမှုအား ဖယ်ရှားခြင်း
- စိန်ပုံသဏ္ဌာန်တာဝါ (Lattice tower) များအတွက် မြေဧရိယာကျဉ်းများသာ အမြဲအသုံးပြုရန်
- ဓာတ်အားဖြန့်ဖြူးသည့် လိုင်းနှင့်အတူတကွ ယှဉ်တွဲ၍ တာဝါတိုင်နယ်နိမိတ်လမ်းအတွင်း ခွင့်ပြုနိုင်သော မြေအသုံးချမှု အမျိုးအစားများအား အမြဲတမ်းခွင့်ပြုခြင်းပြုလုပ်၍ အောက်ပါတို့ပါဝင်ပါမည်။
  - မြေသားတူးခြင်းအား တားမြစ်ခြင်း
  - ၄.၅ မီတာထက်ကျော်လွန်၍အပင်စိုက်ခြင်းအား တားမြစ်ခြင်း
  - ယခင်သဘာဝစားကျက်မြေပါဝင်သည့် ဧရိယာမှ လွဲ၍ အပင်နိမ့် သီးနှံများ စိုက်ပျိုးခြင်း အားခွင့်ပြုခြင်း
  - လမ်းသစ်များဖန်တီးခြင်းမှတစ်ဆင့် ထပ်တိုးမြေအားသွားရောက်သည့် လမ်းဖွင့်ပေးခြင်း

မြေအသုံးချမှုတွင် အပြောင်းအလဲများနှင့် ၎င်းပြောင်းလဲမှုများ၏ သက်ရောက်မှုသည် လူထုသို့ စီမံကိန်း ဧရိယာတစ်လျှောက်တွင် ပြောင်းလဲနေမည် ဖြစ်ပါသည်။ သက်ရောက်မှုအဆင့်သည် လက်ရှိ အသုံးပြုမှု အဆင့်၊ အခြားသောအရင်းအမြစ် ရရှိနိုင်မှုနှင့် ဒေသတွင်းစီးပွားရေး ကွဲပြားမှုပေါ်တွင်မူတည် ပါသည်။

မြေများ၏ မြေအသုံးချမှုအပြောင်းအလဲများ ပမာဏ (ခန့်မှန်း ၅၅၆ဟက်တာ (၁၃၇၀ ဧက) ၃ မီတာအောက် အပင်စိုက်ပျိုးခြင်းအားကန့်သတ်ထားသည့် မြေအပါအဝင်)သည် ရှင်းလင်းပစ်မည်ဖြစ်ပါသည်။ ထိုထဲမှ ၆၄.၄ ဟက်တာ (၁၅၉ဧက)သည် စိုက်ပျိုးမြေဖြစ်ပြီး ၎င်းတို့သည် ပတ်ဝန်းကျင် လူထုအဖွဲ့အစည်းများ၏ လူမှုရေးအခြေအနေများကို သိသာထင်ရှားသည့်သက်ရောက်မှုများ ရှိစေမည်မဟုတ်ပေ။

### အကြံပြုထားသည့် သက်ရောက်မှုလျော့ချခြင်း

- လျော်ကြေးအတွက် ညှိနှိုင်းခြင်းသည် အခမဲ့ဖြစ်၍ တရားမျှတသည်ကို သေချာစေရပါမည်။ လျော်ကြေးသည် ဈေးကွက်နှုန်းထားနှင့် တူညီသည်ကိုလည်း သေချာစေရပါမည်။
- လျော်ကြေးပမာဏအား ဆုံးဖြတ်ရာတွင် ထိုမြေယာများ၏ အခွင့်အလမ်းဈေးနှုန်းကိုလည်း ထည့်သွင်းစဉ်းစားရန်လိုအပ်ပါသည်။



## သက်ရောက်မှု ၂

ဓါတ်အားလိုင်းလမ်းကြောင်းတလျှောက် အချို့နေရာများတွင် လမ်းကြောင်းပြောင်းလဲမှုအချို့သည် မူရင်းလမ်းကြောင်းမှ သွေဖည်မှုအချို့ဖြစ်စေနိုင်သည့် သီးခြားလိုအပ်ချက်များအား ထည့်သွင်းစဉ်းစားရန် ရှိနိုင်ပါသည်။

### အကြံပြုထားသည့် သက်ရောက်မှုလျော့ချခြင်း

- ဓါတ်အားလိုင်းလမ်းကြောင်းတွင် ပြောင်းလဲမှုများအကြောင်းကို မြေပိုင်ရှင်များအား အကြောင်းကြား ရပါမည်။ လမ်းကြောင်းပြောင်းလဲ ရေးဆွဲပြီးနောက် မလိုအပ်သည့် မြေများအား မြေပိုင်ရှင်များသို့ ပြန်လည် ပေးအပ်ရပါမည်။

## သက်ရောက်မှု ၃

တည်ဆောက်ရေးလုပ်ငန်းများ ဆောင်ရွက်နေစဉ်အတွင်း လူထု နှင့် ပုဂ္ဂလိက ပိုင်ဆိုင်မှုနှင့် တစ်ဦးခြင်းပိုင်ဆိုင်မှုအား ထိခိုက်မှုများရှိနိုင်ပါသည်။ အခြားရွေးချယ်စရာနည်းလမ်းများ ခွဲခြမ်းစိတ်ဖြာမှုသည် စီမံကိန်းအကောင်အထည်ဖော်ဆောင်သူမှ ပြုလုပ်ဆောင်ရွက်ရမည်ဖြစ်ပြီး ဓာတ်အားလိုင်းတစ်လျှောက်တွင် လူထုပိုင်ဆိုင်မှု (သို့) ပုဂ္ဂလိကပိုင်ဆိုင်မှု အရင်းအမြစ်များအား အကောင်းဆုံးရှောင်ရှားရမည် ဖြစ်ပါသည်။ မည်သည့်နေရာတွင်မဆို ပုဂ္ဂလိကအရင်းအမြစ်များအား သက်ရောက်ပါက လျော်ကြေးအား ညှိနှိုင်းရမည်ဖြစ်ပြီး လျော်ကြေးပမာဏအတွက် ထည့်သွင်းရပါမည်။

### အကြံပြုထားသည့် သက်ရောက်မှုလျော့ချခြင်း

- တည်ဆောက်ရေးလုပ်ငန်းရပ်များအားစီစဉ်ထားမှသာ လူထုနှင့် တစ်ဦးခြင်းပိုင်ဆိုင်မှုအား ရှောင်ရှားနိုင်မည် (သို့) အသုံးပြုမှုတွင် ကြိုတင်ခွင့်တောင်းနိုင်မည် ဖြစ်ပါသည်။
- ပိုင်ဆိုင်မှု(သို့) အဆောက်အအုံများအား မခန့်မှန်းနိုင်သော အသုံးပြုမှုနှင့်/သို့ မဟုတ် ထိခိုက်မှုများသည် ချက်ချင်း လျော်ကြေးပေးဆောင်ရန် လိုအပ်ပါသည်။

## သက်ရောက်မှု ၄

### စီးပွားရေးနှင့် အသက်မွေးမှုလုပ်ငန်းများ

ဓာတ်အားလိုင်း တည်ဆောက်ရေးနှင့် ဆက်စပ်အဆောက်အအုံ တည်ဆောက်ရေးသည်ဒေသနေ ပြည်သူ များအား အလုပ်အကိုင် အခွင့်အလမ်းများ ပေးနိုင်မည် ဖြစ်သည့်အပြင် ဒေသတွင်း စီးပွားရေးနှင့် အသက်မွေးမှု လုပ်ငန်းများအား ကောင်းသော သက်ရောက်မှုများ ရှိစေမည်ဖြစ်ပါသည်။ ထို့အပြင် စီမံကိန်းတွင် အလုပ်ခန့်အပ်ခြင်းနှင့် ဆက်စပ်သင်တန်းသည် ဒေသနေပြည်သူများ၏ ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံရေး အလေ့အကျင့်ဆိုင်ရာ တိုးတက်လာသော အလုပ်ဗဟုသုတ အပါအဝင် တည်ဆောက်ရေး စီမံကိန်းများတွင် အတွေ့အကြုံနှင့် အရည်အချင်းကို တိုးတက်စေမည် ဟုမျှော်မှန်းထားပါသည်။

### သက်ရောက်မှုလျော့ချသည့်နည်းလမ်းများ

အောက်ဖော်ပြပါ နည်းလမ်းများအား စီးပွားရေးနှင့် အသက်မွေးမှုအတွက် စီမံကိန်း၏အကျိုးကျေးဇူးကို များသထက်များစေရန် အကောင်အထည်ဖော်ဆောင်သင့်ပါသည်။

- UREC ကုမ္ပဏီ သည် အလုပ်သမားအခြေအနေများအား သေချာစွာ စီမံခန့်ခွဲရပါမည်။
- တည်ဆောက်နေစဉ်အတွင်း ဆောက်လုပ်ရေးကန်ထရိုက်တာသည် ဒေသနေပြည်သူများ လိုအပ်သော အရည်အသွေးနှင့် အတွေ့အကြုံရှိသည့် နေရာများတွင် ၎င်းတို့အား ဌာနရမ်း အသုံးပြုရပါမည်။ သို့သော်လည်း စီမံကိန်းပြင်ပမှ အလုပ်သမားအများအပြား အထူးသဖြင့် အရည်အချင်းရှိသော အလုပ်သမားများ လာရောက်သည်ကိုလည်း အသိအမှတ်ပြုပါသည်။

- ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံရေးနှင့် နည်းပညာနယ်ပယ်ဆိုင်ရာ သင်တန်းအား ဝန်ထမ်းအားလုံးကို တက်ရောက်စေမည်ဖြစ်ပါသည်။

### ဖြစ်နိုင်ခြေရှိသော ကျန်းမာရေးသက်ရောက်မှုနှင့် အဆိုပြုစီမံခန့်ခွဲမှု

#### လူထုကျန်းမာရေးသက်ရောက်မှုများ

အချိန်တိုတောင်းသော်လည်း ဧရိယာအတွင်းရှိ အလုပ်သမားတည်ရှိမှုသည် ဒေသတွင်းပဋိကုမ္ပဏီများ (လူထုအတွင်း လိင်မှတဆင့် ရောဂါကူးစက်မှု အန္တရာယ်အပါအဝင် ကျန်းမာရေးသက်ရောက်မှု) ကို ဖန်တီးပေးနိုင်ပါသည်။

#### အကြံပြုထားသည့် သက်ရောက်မှုလျော့ချခြင်း

လူထုကျန်းမာရေးပညာပေးလှုပ်ရှားမှု အားထောက်ပံ့ပြုလုပ်ပေးပြီး တစ်ကိုယ်ရည်သန့်ရှင်းရေး၊ ရောဂါ ကာကွယ်ရေး (ကူးစက်နိုင်သည့်လမ်းကြောင်းများနှင့် သက်ဆိုင်ရာရောဂါ လက္ခဏာများအပါအဝင်) နှင့် အခြေခံကျန်းမာရေးမြှင့်တင်မှုများကို ဟောပြောပေးပါသည်။ ထိုအစီအစဉ်အား ခရိုင်နှင့် ဒေသတွင်း ကျန်းမာရေး တာဝန်ခံများနှင့် တိုင်ပင်ဆွေးနွေးကာ ရေးဆွဲ အကောင်အထည် ဖော်ဆောင်ခဲ့ပါသည်။

လျှပ်စစ်ဥပဒေနှင့် အခြားသော မြန်မာနိုင်ငံဥပဒေလိုအပ်ချက်များနှင့် ကိုက်ညီစေရန် ကတိကဝတ် ပေးအပ်ထား သကဲ့သို့ အထူးသဖြင့် ကလေးလုပ်သားနှင့် အမွေခိုင်းစေမှု၊ လုပ်ငန်းအခြေနေ၊ လူကုန်ကူးမှု၊ ခွဲခြားမှုမရှိမှုနှင့် သာတူညီမျှအခွင့်အရေးပေးမှု၊ တိုင်ကြားမှုနှင့် လျော်ကြေးပေးအပ်သည့် စနစ်သာမက လုပ်ငန်းခွင်ဆိုင်ရာကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံရေးစသည့် အလုပ်သမားများနှင့် သက်ဆိုင်သည့် အပြည်ပြည်ဆိုင်ရာညီလာခံနှင့် အညီ ဆောင်ရွက်မည်ဟု ကတိပြုပါသည်။

#### ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံရေး

တည်ဆောက်ရေးလုပ်ငန်းများသည် ဝန်ထမ်းများအား ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံရေး အန္တရာယ် ဖြစ်စေ နိုင်ပါသည်။ ထိုအန္တရာယ်များတွင် အောက်ပါတို့ပါဝင်ပါသည်။

- အလုပ်လုပ်နေစဉ် မတော်တဆထိခိုက်မိခြင်းနှင့် ဒဏ်ရာရခြင်း
- အလုပ်သမားများအကြားရောဂါကူးစက်ပြန့်ပွားခြင်းနှင့်
- သန့်ရှင်းမှုအားနည်းသည့် ရေဆိုးစနစ်နှင့် အလုပ်နှင့် နေထိုင်သည့် ဧရိယာပတ်ဝန်းကျင် အခြေအနေ တို့ကြောင့် ရောဂါဖြစ်ပွားခြင်း

#### သက်ရောက်မှုလျော့ချနိုင်သည့်နည်းလမ်းများ

အောက်ဖော်ပြပါ နည်းလမ်းများအား အကောင်အထည်ဖော်ဆောင်မည်ဖြစ်ပါသည်။

- ကျန်းမာရေးအသိပညာပေးသင်တန်းအား ဝန်ထမ်းများအားလုံး မဖြစ်မနေပါဝင်ရမည်ဖြစ်ပြီး လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံရေး အသိပညာပေးမှုကို ပြောကြားမည်ဖြစ်ပါသည်။
- သန့်ရှင်းသည့် သောက်ရေအား တန်းလျားများနှင့် အလုပ်ဧရိယာများတွင် ထားရှိထားမည်ဖြစ်ပါသည်။
- လုံလောက်သည့် မိလ္လာသန့်စင်မှုအား ထားရှိထားမည်ဖြစ်ပါသည်။
- အရေးပေါ်ရှေးဦးသူနာပြုစွဲလမ်းများအား အလုပ်သမားများ အရံသင့်အသုံးပြုနိုင်စေရန် ထားရှိထားမည် ဖြစ်ပြီး ရှေးဦးသူနာပြုအသင်းများအား သီးခြား သင်တန်းပေးမည်ဖြစ်သည့်အပြင် ကွဲပြားခြားနားသည့် လုပ်ငန်းခွင်နေရာများတွင် နှစ်ယောက်၊သုံးယောက်တွဲ၍ တာဝန်ပေးအပ်ထားမည်ဖြစ်ပါသည်။
- ခြင်ထောင်များနှင့် အခြားသော အရံအတားများအား ထောက်ပံ့ပေးခြင်းနှင့် ခြင်ပေါက်ပွားနိုင်သည့် နေရာများအား လျော့နည်းအောင် ပြုလုပ်ခြင်းအပါအဝင် ခြင်နှင့်အခြားပိုးမွှားများအား စီမံသည့် ပိုးမွှားထိန်းချုပ်မှု ပြုလုပ်မည်ဖြစ်ပါသည်။

## ရှေးဟောင်း၊ သမိုင်းဝင်နှင့် ယဉ်ကျေးမှုဆိုင်ရာ အကျိုးသက်ရောက်မှုများ

### ဖြစ်နိုင်ခြေ သက်ရောက်မှုများ

လုပ်သားများ ယာယီရွှေ့ပြောင်း နေထိုင်မှုကြောင့် ဒေသ ယဉ်ကျေးမှုဆိုင်ရာ သက်ရောက်မှုနှင့် လူမှုရေးဆိုင်ရာ စိုးရိမ်မှု တို့ကို ဖြစ်ပေါ်စေနိုင်ပါသည်။

အမျိုးမျိုးသော ကွဲပြားသည့် ဘာသာစကားနှင့် ဒေသခံ လူမျိုးစုများ၏ ရိုးရာ ယဉ်ကျေးမှုများ အပေါ် အခြေခံပြီး လျှပ်စစ် ဓာတ်အားပေးလိုင်း တစ်လျှောက်တွင် သမိုင်းဝင် ဒေသများ ရှိပါသည်။ ဆောက်လုပ်ရေး လုပ်ငန်း သဘော သဘာဝနှင့် အတိုင်းအတာ အရ ယင်း သမိုင်းဝင် ဒေသများကို နှောင့်ယှက်မှု၊ သက်ရောက်မှုများ ရှိမည် မဟုတ်ပါ။ ဒေသခံ လူများမှ ဆောက်လုပ်ရေး လုပ်ငန်းနှင့် လျှပ်စစ် ဓာတ်အားပေးလိုင်း တည်ရှိနေခြင်းသည် သူတို့၏ ဘဝ နေထိုင်မှုကို အနှောင့်အယှက် မဖြစ်နိုင်ကြောင်းကို ဖော်ပြခဲ့ပြီး တည်ဆောက်ရေး လုပ်ငန်းကိုလည်း ကန့်ကွက်မှုများ မရှိခဲ့ပါ။

အဓိက အခြေခံ အချက်အလက်များ ကောက်ယူမှု အရ လျှပ်စစ်နှင့် စွမ်းအင် ဝန်ကြီးဌာန၏ အဆိုပြု လျှပ်စစ် ဓာတ်အားပေးလိုင်း တည်ဆောက်ခြင်း လုပ်ငန်းသည် ဆောက်လုပ်ရေး လုပ်ငန်း လမ်းကြောင်း တစ်လျှောက် ယဉ်ကျေးမှုဆိုင်ရာ အမွေအနှစ်များ အပေါ် ဆိုးကျိုးသက်ရောက်မှု အလွန် နည်းပါးပါသည်။ သို့သော်လည်း ကချင်ပြည်နယ်နှင့် စစ်ကိုင်းတိုင်းသည် ၁၅ ရာစု ရှမ်းသမိုင်းကြောင်း ဖြစ်သည့် အတိုင်း စီမံကိန်း အဆိုပြုသူနှင့် တစ်ဆင့်ခံ ကန်ထရိုက်တာများသည် ဓာတ်အားပေးလိုင်း အဆောက်အဦးများ တည်ဆောက်သည့် ကာလ တူးဖော်ခြင်း လုပ်ငန်း ဆောင်ရွက်နေစဉ်တွင် ယဉ်ကျေးမှုဆိုင်ရာ ပစ္စည်းများ တွေ့ရှိပါက အစီရင်ခံရန် အကြံပြုထားပါသည်။

### သက်ရောက်မှုလျော့ချနိုင်သည့်နည်းလမ်းများ

- ကန်ထရိုက်တာမှ လိုက်နာရန် လိုအပ်သည့် ရိုးရာ အလေ့အထများနှင့် စည်းကမ်းများကို လေ့လာရန်နှင့် အတည်ပြု ထားသည့် ဥပဒေနှင့် စည်းမျဉ်းများဖြင့် ညှိနှိုင်း ဆောင်ရွက်ရန် ဒေသခံ အာဏာပိုင်များနှင့် အကြံဉာဏ် ရယူ ဆောင်ရွက်မည် ဖြစ်ပါသည်။
- ဒေသခံ နေထိုင်သူများနှင့် ရွှေ့ပြောင်း အလုပ်သမားများ အကြား ပဋိပက္ခများ အတွက် ဖြစ်နိုင်ခြေများကို လျော့ချရန် ကျင့်ဝတ် စည်းမျဉ်းများ စတင် ဖော်ဆောင်ခြင်းနှင့် လိုက်နာစေခြင်းကို ဆောင်ရွက်မည် ဖြစ်ပါသည်။
- စီမံကိန်း အနီးဝန်းကျင်အတွင်း မည်သည့် ဖျော်ဖြေမှု ကျင်းပခြင်းများ သို့မဟုတ် အပန်းဖြေ အဆောက်အဦးများကို ဒေသခံရွာ၏ တန်ဖိုးထားမှုနှင့် ရိုးရာဓလေ့များအရ တင်းကျပ်စွာ ဆောင်ရွက် သွားမည်ဖြစ်ပြီး
- အလုပ်သမား ခေါ်ယူမှုတွင် ဒေသခံများအား ဦးစားပေး ခန့်အပ်ဆောင်ရွက်သွားမည် ဖြစ်သည်။

### ယာဉ်သွားလာမှုနှင့် သယ်ယူပို့ဆောင်ရေး

#### (က) ဖြစ်နိုင်ခြေရှိသည့် သက်ရောက်မှုများ

ဗန်းမော်နှင့် နဘား လျှပ်စစ် ဓာတ်အားပေးလိုင်းသည် ဧရာဝတီမြစ်နှင့် တောင်တန်းနိမ့်များကို ဖြတ်သွားပြီး ယင်း နေရာတွင် လူနေထိုင်မှု မရှိသည့် အတွက် စီမံကိန်း ယာဉ်သွားလာမှု စနစ်ကြောင့် သက်ရောက်မှုများမှာ နည်းပါးပါသည်။ ထို့အပြင် ဆောက်လုပ်လုပ်ရေး လုပ်ငန်း ဆောင်ရွက်စဉ် ယာဉ်များ ဒေသတွင်း လမ်းများတွင် သွားလာမှုကြောင့် ယာဉ်သွားလာမှု ဆိုင်ရာ ပြဿနာများ ရှိနိုင်ပါသည်။

ဆောက်လုပ်ရေး ကာလအတွင်း သယ်ယူပို့ဆောင်ရေး၊ ဆောက်လုပ်ရေးနှင့် ဆက်စပ်သည့် လုပ်ငန်းများ အတွက် သီးသန့် မြေပိုင်ဆိုင်မှု အဆင့်၊ အများပြည်သူဆိုင်ရာ အဆင့်တွင် ရွာ/ ဆက်သွယ်ရေး လမ်းများကို

ပမာဏ ကျော်လွန်၍ ပျက်စီးခြင်း/ အသုံးပြုခြင်း စသည်တို့ကြောင့် ဝင်ထွက်လမ်းများကို အနှောက်ယှက် ဖြစ်စေနိုင်ပါသည်။

(စီမံကိန်း အဆိုပြုသူ သို့မဟုတ် တစ်ဆင့်ခံ ကန်ထရိုက်တာမှ သီးခြား/ အများပြည်သူဆိုင်ရာ အနှောက်ယှက်ဖြစ်မှု သို့မဟုတ် အဆင်မပြေမှု တို့ကို မဖြစ်စေရန် ဝင်ထွက်လမ်းများကို ရှောင်ရှားနိုင်သည့် ကြိုးပမ်းမှုများ ဆောင်ရွက်မည် ဖြစ်ပါသည်။ ဆောက်လုပ်ရေး ကန်ထရိုက်တာမှ မည်သည့် နေရာမဆို ထိုကဲ့သို့ ဝင်ထွက်လမ်းများ အတွက် သက်ရောက် ခံရသည့် မြေပိုင်ဆိုင်သူများနှင့် ညှိနှိုင်းမှုများကို မဖြစ်မနေ ဆောင်ရွက်ထားပြီး ဖြစ်ပါသည်။)

**(ခ) အကြံပြု လျှော့ချရေး နည်းလမ်းများ**

- စီမံကိန်းလုပ်ငန်းအတွက် အများပြည်သူဆိုင်ရာ/ ရွာ လမ်းများ အသုံးပြုမှု ရှောင်ရှားခြင်း။ အခြား လမ်းများ ဖောက်လုပ်ခြင်းနှင့် အသုံးပြုခြင်း ဆောင်ရွက်သင့်ပါသည်။ ချဉ်းကပ်လမ်းများ အားလုံး အသုံးပြုပြီးနောက် အပြည့်အဝ ပြန်လည် ထိန်းသိမ်းရန် ရှိပါသည်။
- သယ်ယူပို့ဆောင်ရေး အချိန်ဇယားတွင် လမ်း အသုံးများသည့် အချိန်များကို ရှောင်ရှားရန် စီစဉ်ဆောင်ရွက် သွားမည် ဖြစ်ပါသည်။
- ဆောက်လုပ်ရေး ဧရိယာ တစ်လျှောက် ယာဉ်သွားလာမှုဆိုင်ရာ သင်္ကေတများကို စိုက်ထူသွားမည် ဖြစ်ပါသည်။
- ဆောက်လုပ်ရေး ဧရိယာ တစ်လျှောက် သက်ဆိုင်ရာ ယာဉ်သွားလာမှု စည်းကမ်းများကို အကောင်အထည် ဖော်ဆောင်မည် ဖြစ်ပါသည်။
- ကြီးမားသည့် ဝန်များ သယ်ယူပို့ဆောင်ရန် လိုအပ်သည့် ကိစ္စများတွင် အချို့ လမ်းပိုင်းများနှင့် တံတားများကို အလေးချိန်ခံနိုင်ရန် အားဖြည့် တည်ဆောက်သွား မည်ဖြစ်ပါသည်။
- လိုင်းကြိုးဆွဲသည့် လုပ်ငန်းတွင် ယာဉ်သွားလာမှုဆိုင်ရာ အန္တရာယ် ရှိနိုင်သည့် အတွက် အများပြည်သူနှင့် အိမ်ရာ အဆောက်အအုံများကို ကာကွယ်ရန် လမ်းများနှင့် မြစ် တစ်လျှောက် ယာယီ အကာကွယ်များကို (ဝါးငြိမ်းများ ကဲ့သို့) တည်ဆောက်သွားမည် ဖြစ်ပါသည်။

**ဖြစ်နိုင်သည့် အန္တရာယ်များ**

ဘေးအန္တရာယ်ကင်းပြီး ကျန်းမာရေးနှင့် ညီသည့် ပတ်ဝန်းကျင် အတွက် သီးခြား ကဏ္ဍများတွင် ရှိသည့် ဘေးအန္တရာယ်များကို ထည့်သွင်း စဉ်းစားခြင်းနှင့် ရုပ်ပိုင်းဆိုင်ရာ၊ ဓာတုဗေဒဆိုင်ရာ၊ ဇီဝဆိုင်ရာနှင့် ဓာတ်ရောင်ခြည်ဆိုင်ရာ ဘေးအန္တရာယ်များ အပါအဝင် စီမံကိန်းနှင့် သက်ဆိုင်သော ဘေးအန္တရာယ် အတန်းအစား သတ်မှတ်ခြင်း စသည်တို့ အတွက် လိုအပ်ချက်ကို ကမ္ဘာ့ငွေကြေး ရန်ပုံငွေ အဖွဲ့၏ ဆောင်ရွက်မှု စံသတ်မှတ်ချက် ၂ တွင် ဖော်ပြထားပါသည်။ မတော်တဆဖြစ်ပွားမှု၊ ဒဏ်ရာ အနာတရ ဖြစ်ပွားမှုနှင့် ရောဂါ ဖြစ်ပေါ်လာမှု၊ ဆက်စပ်မှု သို့မဟုတ် လုပ်ငန်းခွင် သင်တန်းပေး နည်းပါးမှုကြောင့် ဖြစ်ပွားခြင်း စသည်တို့ကို ကာကွယ်ရန် လိုအပ်ချက်များ၊ သင့်လျော်သည့် လက်တွေ့လုပ်ဆောင်မှုများ၊ ဘေးအန္တရာယ် ဖြစ်ပွားစေသည့် အကြောင်းရင်းများကို ဆောင်ရွက်မှု စံသတ်မှတ်ချက် တွင် ဖော်ပြထားပါသည်။

**(က) လုပ်ငန်းဆောင်ရွက်မှု**

စီမံကိန်းနှင့် ဆက်စပ်သည့် လုပ်ငန်းများအားလုံး

**(ခ) ဖြစ်နိုင်ခြေ သက်ရောက်မှုများ**

ဆောက်လုပ်ရေး ကာလအတွင်း ကုန်းစောင်းများ တစ်လျှောက် အလုပ်သမားများ ချော်ကျဲခြင်း၊ လမ်းမတော်

တဆ ဖြစ်ပွားမှုများ၊ တာဝါတိုင်များ ထောင်စဉ်အတွင်း အလုပ်သမားများ မတော်တဆ ဖြစ်ပွားခြင်းနှင့် အခြား လုပ်ငန်းခွင် ဘေးအန္တရာယ်များ မှ ရှုပ်ပိုင်းဆိုင်ရာ ထိခိုက် ဒဏ်ရာရမှုများ ဖြစ်ပွားနိုင်ပါသည်။

သင့်လျော်သည့် အစီအစဉ်ကို လိုက်နာခြင်း မရှိလျှင် တင်းအား နည်း/များ ဖြင့် လိုင်းကြိုးဆွဲခြင်း လုပ်ငန်းနှင့် အခြား လျှပ်စစ်ပိုင်းဆိုင်ရာ ယူနစ်များမှ ဘေးအန္တရာယ် ဖြစ်နိုင်ခြေ ရှိပါသည်။ အလုပ်သမားများ တစ်ကိုယ်ရည် ကာကွယ်ရေးသုံး ပစ္စည်းများ အသုံးပြုရန် အသားမကျခြင်း၊ အသုံးပြုရန် ရှောင်ရှား ခြင်းကြောင့် မတော်တဆမှု/ ဘေးအန္တရာယ် ဖြစ်ခြင်းများ ဖြစ်စေနိုင်ပါသည်။

လမ်း/လမ်းကြောင်း တစ်လျှောက် နေထိုင်ရာ နေရာများနှင့် အနီးနားတွင် ကျင်များ တူးခြင်းသည် အနီးအပါးရှိ လူနှင့် အိမ်မွေး တိရစ္ဆာန်များ အတွက် မတော်တဆ ဖြစ်ပွားမှုများ ဖြစ်စေနိုင်ပါသည်။

#### (ဂ) လျှော့ချခြင်းများ

ဆောက်လုပ်ရေး လုပ်ငန်းများတွင် ပါဝင်သည့် ဝန်ထမ်းများ မဖြစ်မနေ လိုက်နာရမည့် ကြိုတင် ကာကွယ်မှုနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး အလေ့အထများကို ဆောက်လုပ်ရေး လုပ်ငန်းများ စတင်သည်နှင့် ဦးစားပေး သင်တန်းပေး သွားမည် ဖြစ်ပါသည်။

လုပ်ငန်းခွင်တွင် အလုပ်သမားများ လိုအပ်သည့် တစ်ကိုယ်ရည် ကာကွယ်ရေးသုံး ပစ္စည်းများ အသုံးပြုခြင်းနှင့် ၎င်းတို့၏ အသုံးပြုမှုကို ကြီးကြပ်သွားမည် ဖြစ်သည်။ တာဝါတိုင် ထောင်နေစဉ်တွင်း အလုပ်သမားများ အတွက် ဘေးအန္တရာယ်ကင်း သိုင်းကြိုးများကို သေချာစွာ ဆောင်ရွက်မည် ဖြစ်သည်။ ယာဉ်သွားလာမှုဆိုင်ရာ သတ်မှတ်ချက်များကို ယာဉ်များ သွားလာရာတွင် လိုက်နာစေရန်နှင့် တောင်ကြောလမ်း တစ်လျှောက် သွားလာရာတွင် ဘေးအန္တရာယ်ကင်းသည့် အရှိန်ဖြင့်သာ ထိန်းသိမ်း သွားလာ စေမည် ဖြစ်သည်။

ကြိုတင် သတင်းပေးချက်နှင့် ခွင့်ပြုချက်ဖြင့် လိုင်း/အသုံးပြုသည့် ပစ္စည်းများ သင့်လျော်စွာ ပိတ်ချပြီးနောက် တင်းအားနည်း ဝါယာ/ တင်းအားများ ဝါယာနှင့် အခြား လျှပ်စစ်ပိုင်းဆိုင်ရာ အသုံးပြုသည့် ပစ္စည်းများ အနီး လိုင်းဆွဲခြင်း လုပ်ငန်းများ ဆောင်ရွက်မည် ဖြစ်သည်။

မြေတူးခြင်း လုပ်ငန်းများ အားလုံးကို အနီးနားတွင် နေထိုင်သူများကို ကြိုတင် သတင်းပေးခြင်းဖြင့် လုပ်ငန်း ကန်ထရိုက်တာ၏ ကြီးကြပ်မှုဖြင့် ဆောင်ရွက်မည် ဖြစ်သည်။ လမ်း သို့မဟုတ် တောင်ပေါ်လမ်းနှင့် နီးသည့် တူးထားသော ကျင်းများ နေရာတွင် သင့်လျော်သည့် ဆိုင်းဘုတ်များ စိုက်ထူထားမည် ဖြစ်သည်။

တာဝါများ၏ ဒီဇိုင်းသည် သင့်လျော်သည့် စံနှုန်းများကို (ကမ္ဘာ့ငွေကြေး ရန်ပုံငွေ အဖွဲ့ စံနှုန်းနှင့် အိန္ဒိယ စံနှုန်း) လိုက်နာ ဆောင်ရွက်မည် ဖြစ်ပြီး ယင်း စံနှုန်းတို့မှာ လေတိုက်ခတ်မှုနှင့် မြေငလျင် တို့ကြောင့် ဖြစ်သည့် အန္တရာယ်ကို လျှော့ချရန် ပြည့်ဝသည့် ဘေးအန္တရာယ် ကင်းရှင်းစေမှု မဟာဏ ရှိပါသည်။ လေပြင်း တိုက်ခတ်မှုကဲ့သို့ ရာသီဥတု ပြင်းထန်သည့် အခြေအနေများကြောင့် ဓာတ်အားပေးလိုင်းကို သက်ရောက်နိုင်မှုမှာ ဖြစ်ပါသည်။ ထို့ကြောင့် သဘာဝ ဘေးအန္တရာယ်ကြောင့် သက်ရောက်မှုမှာ နည်းပါးပါသည်။

### ၆.၂။ လုပ်ငန်းလည်ပတ်စဉ်ကာလ သက်ရောက်မှုများ

#### မြေဆီလွှာ

ဓာတ်အားပေးလိုင်း လုပ်ငန်း လည်ပတ်မှုကြောင့် သဘာဝ ပေါက်ပင်နှင့် မြေဆီလွှာ အပေါ် မည်သည့် သိသာ ထင်ရှားသည့် သက်ရောက်မှုများ မရှိနိုင်ဟု ခန့်မှန်းရပါသည်။ ဓာတ်အားပေးလိုင်း တာဝါတိုင်များ လုပ်ငန်းလည်ပတ်စဉ်နှင့် ထိန်းသိမ်းပြုပြင်ခြင်း လုပ်ငန်း ဆောင်ရွက်စဉ် ကာလ အတွင်း အလူမီနီယံ အောက်ဆိုဒ် ဖိတ်စင်မှုကြောင့် မြေဆီလွှာ အပေါ် သက်ရောက်နိုင်မှု ရှိပါသည်။ ဆေးသုတ်နေစဉ် အတွင်း



တာဝါတိုင် အောက်ခြေတွင် အခင်းများ ဖြန့်ခင်းခြင်းကဲ့သို့ လျှော့ပါးရေး နည်းလမ်းများနှင့် အတူ အတွေ့ကြုံရှိ ဝန်ထမ်းများဖြင့် အကြိမ်ရေး အနည်းငယ်သာ ဆေးသုတ်မည် ဖြစ်ပါသည်။

### စွန့်ပစ်ပစ္စည်း

ဓာတ်အားပေးလိုင်း လုပ်ငန်း လည်ပတ်စဉ် ကာလအတွင်း သိသာသည့် စွန့်ပစ်ပစ္စည်း ထုတ်လုပ်မှု မရှိနိုင်ဟု မျှော်မှန်းရပါသည်။

### မြေယာရှင်းအမြင်ပသာအနုနှင့် မြင်ကွင်း အပေါ် သက်ရောက်မှု

ဓာတ်အားပေးလိုင်း လုပ်ငန်း လည်ပတ်စဉ်တွင် တည်ဆောက်ထားသည့် ကွန်ယက်တွင် လျှပ်စစ်ဓာတ်အား ပေးပို့မည့် လုပ်ငန်းသာ ပါဝင်သဖြင့် မြင်ကွင်းပေါ် ထပ်မံ သက်ရောက်မှုများ မရှိနိုင်ပါ။

### မြေပေါ်ရေနှင့် မြေအောက်ရေ

ဓာတ်အားပေးလိုင်း အခြေခံအဆောက်အဦများမှ လုပ်ငန်းလည်ပတ်စဉ် ကာလအတွင်း ရေ အရည်အသွေး အပေါ် အောက်ပါ သက်ရောက်မှုများ ရှိနိုင်ပါသည်။

- ကြမ်းခင်း ဧရိယာများ (တာဝါတိုင် အောက်ခြေများ) ရှိခြင်းကြောင့် လုပ်ငန်းလည်ပတ်စဉ် ကာလ တစ်လျှောက် စိမ့်ဝင်မှု လျော့ကျစေသဖြင့် မြစ်ချောင်းများ ဆီသို့ ညစ်ညမ်းစေသည့် အရာများကို မြေပေါ် စီဆင်းရေမှ သယ်ဆောင်မှု များပြားလာသည့် အတွက် ရေ အရည်အသွေးကို သက်ရောက်နိုင်ခြေ ရှိပါသည်။ တာဝါတိုင် အောက်ခြေများကို ဧရိယာ အနည်းငယ်သာ ပေးထားဖြင့် (၁၀၀ စတုရန်းမီတာခန့်) ယင်းကြောင့် သက်ရောက်မှုမှာ နည်းပါသည်ဟု ခန့်မှန်းရပါသည်။

### လျှော့ပါးရေး အစီအမံများ

- အကြို ဆောက်လုပ်ရေး စီးဆင်းမှု အတိုင်း မျက်နှာပြင် စီဆင်းမှု ထိန်းသိမ်းရန်နှင့် စိမ့်ဝင်မှု ချောမွေ့စေရန် ကြမ်းခင်း ဧရိယာရှိ ရေနုတ်မြောင်းများကို ပုံစံထုတ် ဆောက်လုပ်မည် ဖြစ်ပါသည်။

### ဖိစီးမှုများကဲ့သို့

လုပ်ငန်းလည်ပတ်စဉ် ကာလအတွင်း မျှော်မှန်းရသည့် သက်ရောက်မှုများမှာ

- ဓါတ်အားလိုင်းစကြိုန် တလျှောက် အတွင်း စားကျက်မြေ ၂၉၆ ဟတ်တာ (၇၃ ဧက)နှင့် ပြုပြင် မွမ်းမံမှုကြောင့် စားကျက်မြေ ၅၅၆ ဟတ်တာ အမြဲတမ်း ဆုံးရှုံးမှု၊
- ဓါတ်အားလိုင်းနယ်နိမိတ်လမ်းကြောင်းကြောင့် သစ်တောများတွင် အပင်အမြင့် ၃ မီတာ သတ်မှတ်ထားခြင်း ကဲ့သို့ သစ်တော စားကျက်နေရာ၏ ဆက်စပ်မှု (အထူးသဖြင့် ရွက်ပြက်တောနိမ့်များ) ကို အနှောင့်အယှက် ဖြစ်စေနိုင်ပါသည်။ သို့သော်လည်း အမြင့်အမျိုးမျိုးရှိသော သစ်ပင်များကို ထိန်းသိမ်းခြင်းဖြင့် အပင်များတွင်မှီတည်နေထိုင်သော မျိုးစိတ်များ၏ တောတောင် တလျှောက် သွားလာရန် အထောက်အကူ ပြုနိုင်ပါသည်။
- ပြုပြင်မွမ်းမံရေး လုပ်ငန်းများမှ အလင်းရောင်၊ ဆူညံသံနှင့် ဓာတ်အားပေးပို့မှုမှ ဆူညံသံတို့ကြောင့် နေထိုင် ကျက်စားသည့် သတ္တဝါများကို အနှောင့်အယှက်နှင့် ပြောင်းရွှေ့မှုများ ဖြစ်စေနိုင်ပါသည်။
- လုပ်ငန်းလည်ပတ်စဉ် ကာလတွင် လျှပ်စစ်လိုင်းများ သွယ်တန်းမှုကြောင့် ငှက်မျိုးစိတ်များ ဓါတ်လိုက် သေဆုံးမှုများ ဖြစ်စေနိုင်ပါသည်။ ငှက်မျိုးစိတ် သေဆုံးမှုများမှာ ၎င်းတို့ နေထိုင် ပျံသန်းသည့် နေရာတွင် ဓါတ်အားလိုင်း တည်ရှိနေခဲ့လျှင် သို့မဟုတ် အလင်း အားနည်းသည့် အခြေအနေတွင် သွားလာမှု ရှိခဲ့လျှင် ပိုမိုများပြားနိုင်ပါသည်။

### လျှော့ချရေးနည်းလမ်းများ



- လမ်းကြောင်း အတွင်း ဓါတ်အားလိုင်း လုပ်ငန်းဆောင်ရွက်မှု လုံခြုံစေရန် အပင်ခုတ်ခြင်းများကို တားမြစ်ထားပါမည်။ အပင်ပေါက်များ နှင့်အပင်လတ်များကိုလည်း ထိန်းသိမ်းရန် ဆောင်ရွက်ပါမည်။
- တည်ဆောက်ခြင်း လုပ်ငန်းများ ဆောင်ရွက်ပြီးစီးပါက အပင်များ ပြန်လည်စိုက်ပျိုးခြင်း လုပ်ငန်းများကို သင့်လျော်သော နေရာများတွင် ဆောင်ရွက်ပါမည်။
- ဝန်ထမ်းများအား သဘာဝ သစ်တောသစ်ပင်များ၏ တန်ဖိုးကို နားလည် သဘောပေါက်မှု မြှင့်တင်ရန် သဘာဝ ပေါက်ပင်များ စီမံခန့်ခွဲမှုကို ဆောင်ရွက်မည် ဖြစ်ပြီး အမဲလိုက်ခြင်းများ၊ သစ်တောထွက်ပစ္စည်းများ ထုတ်ယူသုံးစွဲမှုကို တားဆီးခြင်းစသော အစီအစဉ်များကိုလည်း ဆောင်ရွက်မည် ဖြစ်ပါသည်။
- ဝန်ထမ်းများအား သဘာဝ သစ်တောသစ်ပင်များ၏ တန်ဖိုးကို နားလည် သဘောပေါက်မှု မြှင့်တင်ရန် ကတိကဝတ်ကို ဆောင်ရွက်မည် ဖြစ်ပြီး အမဲလိုက်ခြင်းများ၊ သစ်တောထွက်ပစ္စည်းများ ထုတ်ယူသုံးစွဲမှုကို တားဆီးခြင်းစသော အစီအစဉ်များကိုလည်း ဆောင်ရွက်မည် ဖြစ်ပါသည်။
- သားရဲတိရစ္ဆာန်များကို သက်ဖြတ်ခြင်း၊ အမဲလိုက်ခြင်းများကို ပြင်းထန်စွာ တားမြစ်ထားမည် ဖြစ်ပြီး
- ဓာတ်အားပေးလိုင်းအား ဓာတ်လိုက်သည့် အန္တရာယ်မှ လျော့နည်းစေရန် လျှပ်စစ်စီးသည့် အစိတ်အပိုင်းနှင့် မြေစိုက် ပစ္စည်းများ အကြား ၁.၅ မီတာ ခြားထားခြင်းနှင့် လျှပ်စစ်စီးသည့် အစိတ်အပိုင်းများအား ဖုံးအုပ်ထားခြင်းများ ပါဝင်သည့် ပုံစံဖြင့် ဆောက်လုပ်မည် ဖြစ်သည်။

#### လေထု အရည်အသွေး

လုပ်ငန်းလည်ပတ်ခြင်းနှင့် ပြုပြင်ထိန်းသိမ်းခြင်းကြောင့် လေထု အရည်အသွေးကို သက်ရောက်နိုင်ပါသည်။

- ရေဒီယို သတ္တိကြွမှုကြောင့် ဓာတ်အားပေးလိုင်းမှ အိုဇုန်း ထုတ်လွှင့်မှု ရှိသော်လည်း ကျန်းမာရေး ဘေးအန္တရာယ် ရှိနိုင်မှုကို မသိနိုင်ပါ။
- လမ်းကြောင်း စီမံခန့်ခွဲမှု အတွက် သဘာဝပေါက်ပင်များ မီးရှို့ခြင်းကြောင့် လေထု ညစ်ညမ်းခြင်း။
- ဓာတ်အားပေးလိုင်း လုပ်ငန်းလည်ပတ်မှုကြောင့် မည်သည့် လေထုညစ်ညမ်းမှုများကို တိုက်ရိုက် ထုတ်လွှတ်မှု မရှိသဖြင့် မျှော်မှန်း သက်ရောက်မှုများကို လျစ်လျူရှုနိုင်ပါသည်။ ဓာတ်အားပေးလိုင်း လုပ်ငန်းလည်ပတ်မှုမှ ဖန်လုံအိမ် အာနိသင်ရှိသည့် ဓာတ်ငွေ့ထုတ်လွှတ်မှုမှာ ထိန်းသိမ်း ပြုပြင်သည့် လုပ်ငန်းများမှ ယာဉ်များ၏ လောင်စာ အသုံးပြုမှုမှသာ ရှိပါသည်။ တစ်နည်းအားဖြင့် တူညီသောလျှပ်စစ်ပမာဏ ထုတ်လုပ်မှုအတွက် ဖန်လုံအိမ် အာနိသင်ရှိ ဓာတ်ငွေ့ ထွက်ရှိနိုင်သော်လည်း ရေအားလျှပ်စစ် စီမံကိန်း တစ်ခုလုံးတွင် ယင်းစီမံကိန်းမှာ အဆိုပါ ဓာတ်ငွေ့ ထုတ်လွှတ်မှုမှ ကာကွယ်နိုင်ခြေ ရှိပါသည်။ စီမံကိန်းမှ ဖန်လုံအိမ် အာနိသင်ရှိ ဓာတ်ငွေ့ ထုတ်လွှတ်မှုမှာ လျစ်လျူရှုနိုင်ပါသည်။

#### လျော့ပါးရေး အစီအမံများ

ပြုပြင်ထိန်းသိမ်းမှု အတွက် သဘာဝပေါက်ပင်များကို မီးရှို့မည် မဟုတ်ပါ။ ရှည်လျားပြီး ရှုပ်နေသည့် သဘာဝပေါက်ပင်များကို ရှင်းလင်းရန် စက်ယန္တရား အသုံးပြုမည် ဖြစ်သည်။

#### ဆူညံသံ

(က) အလားအလာရှိသည့် သက်ရောက်မှုများ

လုပ်ငန်း လည်ပတ်သည်နှင့် သဘာဝ ဖြစ်စဉ် အရ လျှပ်စစ် စက်ဝန်း ဖြစ်ပေါ်မှု (Corona Discharge) (လေထု၏ လျှပ်စစ်ပိုင်းဆိုင်ရာ အနည်းငယ် ပြိုကွဲမှု) အားဖြင့် လျှပ်စစ်စီးဝင်သည့် လိုင်းကြိုး (energized overhead lines) မှ ဆူညံသံ ထုတ်လွှတ်နိုင်ပါသည်။ လျှပ်ကူးပစ္စည်းများကို လျှပ်စစ် စက်ဝန်း

သက်ရောက်မှုများ လျော့ချရန် ပုံစံထုတ် တည်ဆောက် ထားသော်လည်း အချို့ အခြေအနေများတွင် အသံ (hissing sound) ကြားနိုင်ပြီး တစ်ခါတစ်ရံတွင် ကြိမ်နှုန်းနိမ့် အသံ (a low frequency hum) ကြားရနိုင်ပါသည်။ သို့သော်လည်း ဓာတ်အားပေးလိုင်း ၂၃၀ ကေဗီ အတွက် လျှပ်စစ် စက်ဝန်း ဖြစ်ပေါ်မှုကြောင့် ဆူညံသံ ဖြစ်ပေါ်မှုကို လျစ်လျူရှု နိုင်ပါသည်။

အခြား ဆူညံသံ အရင်းမြစ် အနေဖြင့် တာဝါတိုင်များ ထိန်းသိမ်း မွန်းမံခြင်းမှ ထုတ်လွှတ်နိုင်သော်လည်း ယင်းမှာ ဖြစ်ခဲ့ပြီး လွန်စွာမှ နည်းပါးပါသည်။

#### **(ခ) လျော့ပါးရေးနည်းလမ်းများ**

ဓာတ်အား ပို့လွှတ်ခြင်း အတွက် လျှပ်ကူးပစ္စည်းများ (Conductors) ကို လျှပ်စစ် စက်ဝန်း ဖြစ်ပေါ်မှု လျော့နည်းစေရန် ပုံစံထုတ် တည်ဆောက်မည် ဖြစ်သည်။ ယင်းမှာ ဧရိယာတွင်းရှိ နောက်ခံ ဆူညံသံ အဆင့်ထက် ကျော်လွန်သည့် ဆူညံသံ ထုတ်လွှတ်မှုကို မဖြစ်စေနိုင်သည့် အပြင် အချို့ ရာသီဥတု အခြေအနေတွင် ၎င်း ဆူညံသံများကို ကန့်သတ် ထားပါသည်။

#### **လူမှုဝန်းကျင်ဆိုင်ရာ ပြဿနာများနှင့် စီမံခန့်ခွဲမှု**

##### **စီးပွားရေးနှင့် သက်မွေးဝမ်းကျောင်း**

လမ်းကြောင်း ထိန်းသိမ်း မွန်းမံ နေစဉ်တွင် အထူးသဖြင့် သဘာဝပေါက်ပင်ဆိုင်ရာ စီမံခန့်ခွဲမှုတွင် ဒေသခံ နေထိုင်သူများကို အလုပ်ကိုင် ပေးအပ်နိုင်ပါသည်။

##### **လျော့ပါးရေး အစီအမံများ**

- ဒေသခံလူများကို ဖြစ်နိုင်ခြေ ရှိသည့် သင့်လျော်သော နေရာများ အတွက် အလုပ်ခေါ်ယူ သွားမည် ဖြစ်ပြီး
- စီမံကိန်း အလုပ်သမားများ အားလုံးကို ကာကွယ်ရန် သင့်လျော်သည့် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး အစီအမံများကို ဆောင်ရွက်သွားမည် ဖြစ်သည်။

##### **လူထု ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး**

လူထု အနေဖြင့် ယင်း၏ ဘေးအန္တရာယ် ကင်းရှင်းမှုနှင့် ဓာတ်လိုက်ခြင်း ကဲ့သို့ ဖြစ်နိုင်ခြေရှိသည့် မတော်တဆမှုများ၊ အရေပြား ရောဂါများ စသည် တို့ကို စိုးရိမ်မှု ရှိနိုင်ပါသည်။

စီမံကိန်း အဆိုပြုသူသည် ကျန်းမာရေးနှင့် ဆက်စပ်သည့် ကြောက်ရွံ့မှုများကို ဖြေရှင်းရန် သက်ဆိုင်ရာ ပတ်သက်သူများနှင့် အကြံပြု ဆွေးနွေး ကြိုးပမ်း သွားမည်ဖြစ်သည်။

ဓာတ်လိုက်ခြင်းမှာ ဗိုအားမြင့် လျှပ်စစ်ဖြင့် ထိမိသောကြောင့် သို့မဟုတ် ပစ္စည်းများနှင့် ဗိုအားမြင့် လျှပ်စစ်ဖြင့် ထိမိသောကြောင့် (ကိရိယာများ၊ ယာဉ်များ သို့မဟုတ် လှေကားများ ကဲ့သို့) ဖြစ်သည်။

##### **အကြံပြုထားသည့် လျော့ပါးရေးနည်းလမ်းများ**

- ဖြစ်နိုင်သည့် ဘေးအန္တရာယ်များ ဖော်ထုတ်ပြီး ယင်းတို့ကို ဖော်ပြခြင်းနှင့် လျော့နည်းစေခြင်း။
- ဓာတ်အားပေးလိုင်း ဆောက်လုပ်ရေးနှင့် လုပ်ငန်းလည်ပတ်ခြင်း၏ နည်းပညာ ကဏ္ဍများကို ဆက်သွယ် ဆောင်ရွက်ခြင်းနှင့် မတော်တဆမှုများ သို့မဟုတ် အခြား ကျန်းမာရေး စိုးရိမ်မှုများကို ဖြေရှင်းခြင်း။
- ယင်း ရည်ရွယ်ချက်အတွက် ရိုးရှင်းသည့် ပုံကားချပ်များနှင့် လက်ကမ်းစာစောင်များကို ဒေသ ဘာသာစကားဖြင့် အသုံးပြုခြင်း။
- ဘေးအန္တရာယ် ကင်းရှင်းရေး ကိစ္စများကို မြေပိုင်ရှင်များအား သင်တန်းပေးခြင်းနှင့် အန္တရာယ် ဖြစ်ပွားမှုများတွင် အရေးယူဆောင်ရွက်ခြင်း။

- အများပြည်သူ အပါအဝင် အလုပ်သမားများ၏ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေးကို လျှပ်စစ် နှင့် စွမ်းအင် ဝန်ကြီးဌာန နှင့် ၎င်း၏ ကန်ထရိုက်တာများမှ အလွန် သက်ဆိုင်သည်ကို ဖော်ပြခြင်း။
- ဗို့အားမြင့် ဧရိယာများသို့ ဝင်ထွက်သွားလာခြင်းကို တားဆီးရန် သင်္ကေတများနှင့် အကာအကွယ်များ တပ်ဆင်ခြင်း။
- ဓာတ်အားပေးလိုင်း အနီး မြေစိုက် လျှပ်စစ်စီးသည့် ပစ္စည်းများ (grounding conducting objects) တပ်ဆင်ခြင်း။

#### လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး

စီမံကိန်း ဝန်ထမ်းများနှင့် ဆက်စပ်သည့် အန္တရာယ်များမှာ အောက်ပါတို့ ပါဝင်ပါသည်။

- သာမန် ပြည်သူ အနေဖြင့် ကြုံတွေ့ဖူးခဲ့သည်ထက် မြင့်မားသည့် လျှပ်စစ်သံလိုက်စက်ကွင်းနှင့် ထိတွေ့မှု၊
- ဓာတ်လိုက်ခြင်းမှာ ဗို့အားမြင့် လျှပ်စစ်ဖြင့် ထိမိသောကြောင့် သို့မဟုတ် ပစ္စည်းများနှင့် ဗို့အားမြင့် လျှပ်စစ်ဖြင့် ထိမိသောကြောင့် (ကိရိယာများ၊ ယာဉ်များ သို့မဟုတ် လှေကားများ ကဲ့သို့) ဖြစ်သည်။
- တာဝါတိုင်များ၏ အမြင့်ပိုင်းတွင် အလုပ်လုပ်ခြင်း။

#### လျှော့ပါးရေး အစီအမံများ

##### လျှပ်စစ်သံလိုက် စက်ကွင်း

- ဖြစ်နိုင်ခြေရှိသည့် ထိတွေ့မှု အဆင့်များ ဖော်ထုတ်ခြင်း၊ အလုပ်သမားများ အားလုံးအတွက် သင်တန်းပေးခြင်း၊ အများပြည်သူ သွားလာခြင်း အတွက် သင့်လျော်သည့် ဇုန်များ အသေးစိတ် ဖော်ပြခြင်းနှင့် အလုပ်သမားများကို ယင်း ကန့်သတ်ချက်များ သင့်လျော်စွာ သင်တန်းပေးခြင်း၊ အလုပ် လည်ပတ်သည့် တစ်လျှောက် ထိတွေ့ချိန် သတ်မှတ်ရန် အတိုင်းအတာများ ပြဌာန်းခြင်း နှင့် အလုပ်သမားများ အတွက် တစ်ကိုယ်ရည် စောင့်ကြပ်ခြင်း ကိရိယာများ ဖြည့်ဆည်းပေးခြင်း စသည်တို့ကို လုပ်ငန်း လည်ပတ်ခြင်းတွင် လျှပ်စစ်သံလိုက် စက်ကွင်း ဘေးအန္တရာယ် ကင်းရှင်းရေး အစီအစဉ် ဦးစားပေး အကောင်အထည် ဖော်ဆောင်သွားမည် ဖြစ်သည်။
- ဘေးကင်းစေသည့် အလေ့အထများ လိုက်နာ ဆောင်ရွက်စေခြင်းနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး လက်ဆွဲ စာအုပ် အကောင်အထည်ဖော် ဆောင်ရွက်ခြင်း။
- ကာကွယ်ရေး မျက်မှန်များ၊ လက်အိတ်များ၊ လုံခြုံရေး သိုင်းကြိုးများ၊ ဦးထုပ်များ၊ ရာဘာဘွတ်ဖိနပ်ရှည်များ စသည့် တစ်ကိုယ်ရည်သုံး ကာကွယ်ရေး ပစ္စည်းများကို အသုံးပြုစေခြင်းနှင့် ဖြည့်စည်းပေးခြင်း။
- ပြုပြင်မွမ်းမံခြင်းလုပ်ငန်း ဆောင်ရွက်ရန် လိုင်းအားလုံး အရင်ဦးစွာ ပိတ်ခြင်း၊ တစ်ကိုယ်ရည် ကာကွယ်ရေးသုံး ပစ္စည်းများ အသုံးပြုခြင်း၊ အရေးပေါ်ကိစ္စများအတွက် လုပ်ထုံးလုပ်နည်းများနှင့် မတော်တဆ ဖြစ်မှုအတွက် လျော်ကြေး ပေးလျော်သည့် လုပ်ထုံးလုပ်နည်းများ စသည့် လုပ်ငန်းခွင် လုံခြုံစိတ်ချရမှု။
- အလုပ်သမားများကို ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး လုပ်ထုံးလုပ်နည်းနှင့် စပ်လျဉ်းသည့် သင်တန်းများ ပေးရန်မှာ မရှိမဖြစ် လိုအပ်ပါသည်။

##### ဓာတ်လိုက်ခြင်း

- ဓာတ်အားလိုင်း ပေါ် သို့မဟုတ် အနီးတွင် အလုပ်လုပ်ရန် ဓာတ်အားလိုင်းအား လျှပ်စစ်ဖြတ်တောက်ထားခြင်းနှင့် မြေစိုက်ထားခြင်း တို့ကို ဦးစွာ ဆောင်ရွက်မည် ဖြစ်သည်။
- ဓာတ်အား စီးဝင်နေသော အလုပ်များအား လေ့ကျင့်ထားသည့် အလုပ်သမားများ ဖြင့်သာ ဆောင်ရွက်မည် ဖြစ်သည်။

### အမြင့်နေရာများတွင် အလုပ်လုပ်ခြင်း

- သင့်လျော်သော ပြုတ်ကျမှု ကာကွယ်ရေး ကိရိယာများ၊ ကိရိယာများ အသုံးပြုနည်း သင်တန်းပေးခြင်း၊ အမြင့်တက်သည့် နည်းပညာများ သင်တန်းပေးခြင်းနှင့် ပြုတ်ကျခံရမည့် အလုပ်သမားများ ကယ်ဆယ်ခြင်း စသည့်တို့ ပါဝင်သည့် ပြုတ်ကျမှုမှ ကာကွယ်သည့် အစီအမံများ အကောင်အထည်ဖော် ဆောင်ရွက်မည် ဖြစ်သည်။
- ပစ္စည်းတင်ချ ကိရိယာများ၊ စွမ်းအင်သုံး ပစ္စည်းများနှင့် ကိရိယာ ထည့်သည့် အိတ်များ အပါအဝင် ကိရိယာများအားလုံးကို သင့်လျော်စွာ သတ်မှတ် ထိန်းသိမ်းထားမည် ဖြစ်သည်။

### ၇။ စီမံကိန်းအကြောင်းအရာ ဖော်ထုတ် ဆွေးနွေးခြင်း နှင့် ပူးပေါင်း ပါဝင်မှု ရလဒ်များ

လျှပ်စစ်ဓာတ်အားလိုင်း တစ်လျှောက်တွင်ရှိသော သက်ဆိုင်သူအမျိုးမျိုးနှင့် တွေ့ဆုံ၍ အများပြည်သူ တွေ့ဆုံဆွေးနွေးခြင်း နှင့် ပူးပေါင်းပါဝင်ဆောင်ရွက်မှုများကို ဆောင်ရွက်ခဲ့ပါသည်။ အောက်ပါ သက်ဆိုင်သူများနှင့် တွေ့ဆုံစည်းဝေးခြင်း၊ ကဏ္ဍအလိုက် အုပ်စုဖွဲ့စည်းဆွေးနွေးခြင်းများကို အမျိုးသား ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း၏ ခွင့်ပြုချက်ရယူခြင်း အစီအစဉ်အရ အများပြည်သူများနှင့် တွေ့ဆုံဆွေးနွေးခြင်း လိုအပ်ချက်များ၏ အခန်းကဏ္ဍတစ်ရပ်အနေဖြင့် စုစည်းတင်ပြထားပါသည်။

#### ဇယား ၇.၁။ ။ သက်ဆိုင်သူများနှင့် တွေ့ဆုံစည်းဝေးပွဲများ

သက်ဆိုင်သူများ အုပ်စု	နေ့ရက် နှင့် အချိန်	တွေ့ဆုံဆွေးနွေးခြင်း လှုပ်ရှားမှုများ
မြို့နယ်အုပ်ချုပ်ရေး ဌာန၊ အခြားဆက်စပ် နေသည့် ဌာနများ၊ သတင်းဌာန၊ အစိုးရမ ဟုတ်သော အဖွဲ့အစည်း၊ လွှတ်တော်အမတ်များ၊ UREC ၊ လျှပ်စစ်နှင့် စွမ်းအင်ဝန်ကြီးဌာန၊ REM စသည့်တို့ ပါဝင်သော သက်ဆိုင်သူများ	14-6-2017 (10:00 am-12:00pm)	အင်းတော်မြို့နယ်ခန်းမ၌ တွေ့ဆုံဆွေးနွေးခြင်း
	14-6-2017 (2:00 pm-4:00pm)	ကသာမြို့နယ်ခန်းမ၌ တွေ့ဆုံဆွေးနွေးခြင်း
	22-7-2017 (10:00am-12:00pm)	ရွှေဂူမြို့နယ်ခန်းမ၌ တွေ့ဆုံဆွေးနွေးခြင်း
	27-6-2017 (10:00am-12:00pm)	ဗန်းတော်မြို့နယ်ခန်းမ၌ တွေ့ဆုံဆွေးနွေးခြင်း

ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ထုံးလုပ်နည်းအရ ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း စူးစမ်းဆောင်ရွက်နေစဉ်အတွင်း ရွာပေါင်း (၄၂) ရွာမှ ဆက်စပ်ပတ်သက်နေသော သက်ဆိုင်သူများ (ရွာလူကြီးများ နှင့် နေထိုင်ကြသူများ) အား မိတ်ဆက်ရန် အုပ်စုဖွဲ့စည်းဝေးပွဲများကို ၂၀၁၇ ခုနှစ် ဇွန်လ ၁၄ ရက်နေ့မှ ၂၇ ရက်အတွင်း ဆောင်ရွက်ခဲ့ပါသည်။ အဆိုပြုစီမံကိန်းနှင့် ယင်း၏အတိုင်းအတာမှ ကြိုတင်ခန့်မှန်းထားသော သက်ရောက်မှုများကို ပြည်သူလူထုသို့ အသိပေးသည်။ ကြိုတင်ချမှတ်ထားသော ထိခိုက်မှုလျော့ချရေးနည်းလမ်းများ ထုတ်ဖော်ပြခဲ့သည်။ ပြည်သူလူထုမှ ပြန်လည်ပြောကြားချက်များကို ကောက်ယူခဲ့သည်။ တွေ့ဆုံဆွေးနွေးခြင်းမှ တွေ့ရှိချက်များကို ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း အစီရင်ခံစာ မွမ်းမံရာတွင် ထည့်သွင်းဖော်ပြပေးသွားမည်။

### ၈။ ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်နှင့် စောင့်ကြည့်လေ့လာမှု အစီအစဉ်

စီမံကိန်းအတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုသည် မဟာဓါတ်အားလိုင်း အကောင်အထည် ဖော်ခြင်းကြောင့် ဆိုးကျိုး သက်ရောက်မှုများကို လျော့ချ၍ ကောင်းကျိုး သက်ရောက်မှုများကို တိုးမြှင့်စေရန် ရည်ရွယ်ပါသည်။

ဆောက်လုပ်ရေးလုပ်ငန်းများ မဆောင်ရွက်မီ ၎င်းဆောက်လုပ်ရေးအဆင့် (ESMMP-CP) အတွက် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲမှုနှင့် စောင့်ကြည့်လေ့လာမှု အစီအစဉ်များကို ဆောင်ရွက်ပါမည်။ ESMMP-CP တွင် IEE တွင်ပါဝင်သော ပတ်ဝန်းကျင်ဆိုင်ရာ ဆောင်ရွက်ချက်များအတွက် အစီအစဉ်ခွဲများ ပါဝင်ပါသည်။ ဆောက်လုပ်ရေး ကန်ထရိုက်တာသည် လုပ်ငန်းခွင် ESMMP ၏ အစီအစဉ်များအတိုင်း ဆောင်ရွက်မည်ဖြစ်ပြီး ၎င်းသည် လုပ်ငန်းခွင်အခြေအနေအပေါ် မူတည်ပြီး RoW ၏ သတ်မှတ်ထားသော အပိုင်းများကို ဖြေရှင်းပေးနိုင်ပါသည်။ (ဥပမာ- ကျေးရွာ၊ ရေလမ်းနှင့် သက်ရှိနေထိုင်မှုနှင့် ဆက်စပ်နေမှုများ) ပတ်ဝန်းကျင် စောင့်ကြည့်လေ့လာမှုအစီအစဉ်ကို အောင်မြင်စွာ အကောင်အထည်ဖော်မှုသည် ပုံမှန် စောင့်ကြည့်လေ့လာခြင်း၊ စာရွက်စာတမ်းနှင့် သတင်းပေးပို့ခြင်းအပေါ်တွင် မူတည်နေပါသည်။ ဆောက်လုပ်ရေးကာလအတွင်း စောင့်ကြည့်လေ့လာမှုကို အောက်ပါအတိုင်း အမျိုးအစား ခွဲခြားထားပါသည်။

- ကန်ထရိုက်တာများအတွက်- ဆောက်လုပ်ရေး လုပ်ငန်းများတွင် လျော့ပါးစေရေး နည်းလမ်းများကို အပြည့်အဝအကောင်အထည်ဖော်ခြင်းရှိမရှိ နေ့စဉ် စောင့်ကြည့် လေ့လာခြင်းနှင့် ၎င်းရလဒ်များသည် စာချုပ်ပါအထောက်အထားများနှင့် ကိုက်ညီစေရန် လေ့လာခြင်း။
- စီမံကိန်းပိုင်ရှင်များအတွက်- ဆောက်လုပ်ရေး ကန်ထရိုက်တာများ၏ စောင့်ကြည့်လေ့လာမှု ရလဒ်များ မှန်ကန်စေရန်၊ လိုအပ်သော ပတ်ဝန်းကျင်ဆိုင်ရာ အခြေအနေများ ထောက်ပံ့ပေးရန်နှင့် ကန်ထရိုက်တာနှင့် တွေ့ဆုံရန်၊ နှင့် လက်ရှိပတ်ဝန်းကျင်ဆိုင်ရာ အခြေအနေ၏ သင့်လျော်သော ဓါတ်ပုံကို ပို့ပေးရန်နှင့် ၎င်းနေရာတွင် ဆောင်ရွက်နိုင်ရန်တို့အတွက် ပုံမှန် စစ်ဆေးမှုများကို ဆောင်ရွက်ရပါမည်။

ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်တွင် ၁) EMP အကောင်အထည်ဖော်ရန် အခန်းကဏ္ဍ နှင့် တာဝန် ဝတ္တရားများ ၂) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု ဆောင်ရွက်ချက်များ ၃) ပတ်ဝန်းကျင် စောင့်ကြည့်လေ့လာရေး အစီအစဉ် ၄) အသုံးစရိတ်လျာထားမှုများ ပါဝင်ပါသည်။ ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ် အသေးစိတ်ကို အခန်း (၈) တွင် ဖော်ပြပေးထားပါသည်။

## ၉။ နိဂုံးနှင့် အကြံပြုချက်

ဇီဝ မျိုးစုံမျိုးကွဲများကို သက်ရောက်မှုများ၊ ရေ အရည်အသွေး၊ ယာဉ်သွားလာမှုနှင့် အများပြည်သူ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး အပါအဝင် သဘာဝပတ်ဝန်းကျင်နှင့် ဒေသခံ လူထုကို သက်ရောက်နိုင်သည့် ဘေးအန္တရာယ်များကို ပတ်ဝန်းကျင် ထိခိုက်မှုဆိုင်ရာ ဆန်းစစ်ခြင်းဖြင့် ခွဲခြား ဖော်ထုတ် ထားပါသည်။ စီမံခန့်ခွဲမှု ဆောင်ရွက်ချက်များကို ယခု အစီရင်ခံစာတွင် သင့်လျော်သည့် ဆောက်လုပ်ရေးကာလ ပတ်ဝန်းကျင်၊ လူမှုဝန်းကျင် စီမံခန့်ခွဲမှု (ESMMP-CP) အနေဖြင့် မွမ်းမံ ကောင်းမွန်အောင် ဆောင်ရွက်မည် ဖြစ်ပြီး ယင်းမှ ခွဲခြား ဖော်ထုတ်ထားသည့် သက်ရောက်မှုများကို ရှောင်ရှားရန်နှင့် လျော့ချရန် အကောင်အထည် ဖော်ဆောင်ရွက် သွားမည်ဖြစ်ပါသည်။

အဆိုပြုထားသည့် ဓာတ်အားပေးလိုင်း စီမံကိန်းမှာ အတန်းအစား (ခ) စီမံကိန်း (ကမ္ဘာ့ငွေကြေး ရန်ပုံငွေ အဖွဲ့၏ သတ်မှတ်ချက် အရ အတန်းအစား (ခ) - အရေအတွက်အနည်းငယ်၊ ယျေဘုယျအားဖြင့် စီမံကိန်း အတွင်း၊ ဆုံးရှုံးမှုများခြင်း စသည့် ဖြစ်နိုင်ခြေ ရှိသည့် သတ်မှတ် ထားသော လူမှုဝန်းကျင်နှင့် သဘာဝ ပတ်ဝန်းကျင် ဆိုးကျိုး သက်ရောက်မှုများနှင့် အသင့်ဖော်ပြထားသည့် လျော့ပါးရေး အစီအမံများကို စီမံကိန်းများတွင် အသုံးပြုခြင်း) အဖြစ် အောက်ပါ အချက်များ အရ ခွဲခြားထားပါသည်။

- ဓာတ်အားပေးလိုင်း စီမံကိန်းသည် အလျားလိုက်ရှိသည့် စီမံကိန်းဖြစ်ပြီး ၁၂၁ ကီလိုမီတာခန့် ရှည်လျားကာ အဆိုပြု ဓာတ်အားလိုင်း အလယ်မှ ဘေးတစ်ဖက်တစ်ချက်လျှင် ၂၄.၈ မီတာခန့် ကျယ်သော ဓာတ်အားလိုင်းနယ်နိမိတ်လမ်းကြောင်း (right of way) အဖြစ် မြေနေရာ လိုအပ်ပါသည်။
- စီမံကိန်းလည်ပတ်သည့် ကာလအတွင်း ညစ်ညမ်းမှု အလားအလာ နည်းပါးသည့် စီမံကိန်းဖြစ်ပါသည်။
- စီမံကိန်းကြောင့် နေရာ ရွှေ့ပြောင်းရသည့် အိမ်ထောင်စုများလည်း မရှိပါ။
- စီမံကိန်းသည် အချို့ လူမှုဝန်းကျင်နှင့် ပတ်ဝန်းကျင်ဆိုင်ရာ ဆိုးကျိုး သက်ရောက်မှု အချို့ ရှိနိုင်သော်လည်း ယင်းတို့မှာ အနည်းငယ်သာ ရှိပြီး ဓာတ်အားလိုင်းနယ်နိမိတ်လမ်းကြောင်း အတွင်းသာ ထိခိုက်နိုင်မှု ရှိပါသည်။
- ဆောက်လုပ်ရေးလုပ်ငန်းအဆင့်တွင် ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများမှာ အပြန်အလှန် ရှိနိုင်ပါသည်။ ဥပမာအားဖြင့် နိုင်ငံတော်မှ ဝင်ငွေများ စီမံကိန်းတလျှောက်လုံးရရှိနေပြီး . ဓာတ်အားပေးလိုင်းနယ်နိမိတ် အတွင်းရှိ သစ်တောမြေများ ဆုံးရှုံးခြင်း စသည့် သက်ရောက်မှုများ ဖြစ်နိုင်ပါသည်။



# **1 PROJECT DESCRIPTION**

## **1.1 Project Background**

Myanmar has been suffering frequent electrical shortages and lengthy blackouts for many years due to insufficient electrical power supply. As a consequent, development of country's economic sector, living standards of citizens and other energy reliable sectors has been hardly hampered.

Since newly elected government has introduced a democracy reform in both political and economic processes, the demand of power supply has been dramatically increased by blooming of industrial sectors and increasing in urbanized population. Power shortage remains as a critical challenge and government has been trying to tackle on it in various ways.

Electrical power demand has become a pressing issue in Myanmar because of less number of sources for power generations which are aging and obsolete power generation capacity and low operating capacity in transmission and distribution system.

It is obvious that secure and sufficient electrical supply is an essential tool to boost the country's economic growth, to alleviate the poverty by bringing a better social security system including education, health and welfare and to stabilize and promote the living standards of citizens across the country.

In order to overcome the current power deficiency crisis, Ministry of Electricity & Energy (MOEE) has been planning to accelerate the development of power generation, transmission and distribution facilities including exploring additional hydropower sources, construction of new power grid and substation, upgrading existing systems, seeking sustainable and renewable energy and other available means of energy sources in consultation with overseas financial institutions and development partners.

As a result, this 230 kV power transmission line project was opted as an essential infrastructure with intention of boosting the capacity of country's power grid facility which will play vital role to meet the substantial needs of electrical power supply in Myanmar.

However, due to the potential impacts of this project which are mainly upon agricultural land use and clearance of trees along the transmission route, IEE study will be crucially needed to minimize the negative impacts. The goal of this IEE study is to promote environmentally sustainable livelihoods and development of the country.

The general objectives for long term are:

- Conservation and sustainable use of natural resources,
- Protection and enhancement of the quality of all forms of life,
- Promotion of public awareness on environmental issues,
- Strengthening and building capacities to carry out IEE,
- Integration of environmental considerations in development planning process,
- Generation, storage, and dissemination of environmental information, and
- Linking grassroots development strategies to global and international initiatives.
- The specific objectives for power transmission line are:
  - To assess the nature, intensity and duration of impacts, positive and / or negative, to proposed development projects,
  - To assist in decision-making with regard to costs and benefits of proposed development projects,
  - To promote local community and public participation in the IEE process, and

- To promote social and cultural considerations in project design

The following activities will be implemented to meet the completion of these objectives.

- Examining the existing baseline data that describe all relevant physical, biological, social, cultural and economic characteristics of the potential project affected area through secondary sources such as reviews and field investigation
- Evaluating the initial existing conditions before the Project started and significances of the positive and negative impacts which can affect to the proposed project area by project activities of transmission line construction and operation
- Understanding the past and current history of lands to be acquired and identify the loss of assets by projects activities
- Adopting and applying the effective mitigation measures that could avoid or mitigate the potential impacts to a level deemed as acceptable
- Defining the appropriate environmental and social management and monitoring plans to be implemented throughout the life of project cycle.

The present IEE report is prepared according to the reference letter, letter no. 1439/Da Pa Sa (Design)/2018 that dated on 17<sup>th</sup> September 2018, issued by Power Transmission Project Department, Department of Power Transmission and System Control, Ministry of Electricity and Energy. Based on the reference letter from MOEE, the following scope of work is prepared. The reference letter is attached in Appendix-1. This report intends to assess the Initial Environmental Examination (IEE) of the proposed power transmission line and two substations.

## 1.2 Project Size and Location

The 230kV power transmission line (121 km) is started from Bhamo (Bamaw) Sub-station to Nabar Sub-station. The 230kV Bamaw Sub-station located 3km south of Bamaw downtown, Kachin State. The extended 230kV Nabar Sub-station located near Nabar Village and 20km north-west of Katha, Sagaing Region. The locations of the 230 kV transmission systems and the power transmission line system package 1 are shown in Figure 1.2-1.

For connection of Northern Kachin State to 230kv National Grid, this project includes the construction of 230kv transmission line between Bamaw and Nabar with the length of about 121 km, two newly -built 230kV/66kV substations and one extended substation aiming at power supply for area along the Northern Mandalay to Kachin State. Situated in the northern region of Mandalay, the Project Area has the better natural condition with the average temperature of 20°C and 33.9° C in January and April respectively. The location of sub-stations and transmission line route are shown in Figure 1.2-2. Detailed transmission line route are shown in Appendix-3.

Main construction contents in Package 1 (230kV Transmission System Bamaw-Nabar) are as follows:

- a. 230kV double circuit line Bamaw-Nabar with estimated length of 75miles (121km);
- b. New Bamaw 230/110/66kV substation with 2×100MVA 230/110kV step-up transformers, 1×50MVA 110/66kV transformer, two 230kV line feeders, one 110kV line feeder and three 66kV line feeders.
- c. New Nabar 230/66kV substation with 2×50MVA transformers, 6×230kV line feeders and three 66kV line feeders.
- d. Replacement of conductor ACSR “IBIS” with ACCC “LATEDO” on single circuit existing 110kV line Tapein 1-Bamaw with length of 22 miles (35km).

This construction organization design describes installation and commissioning of substation projects.

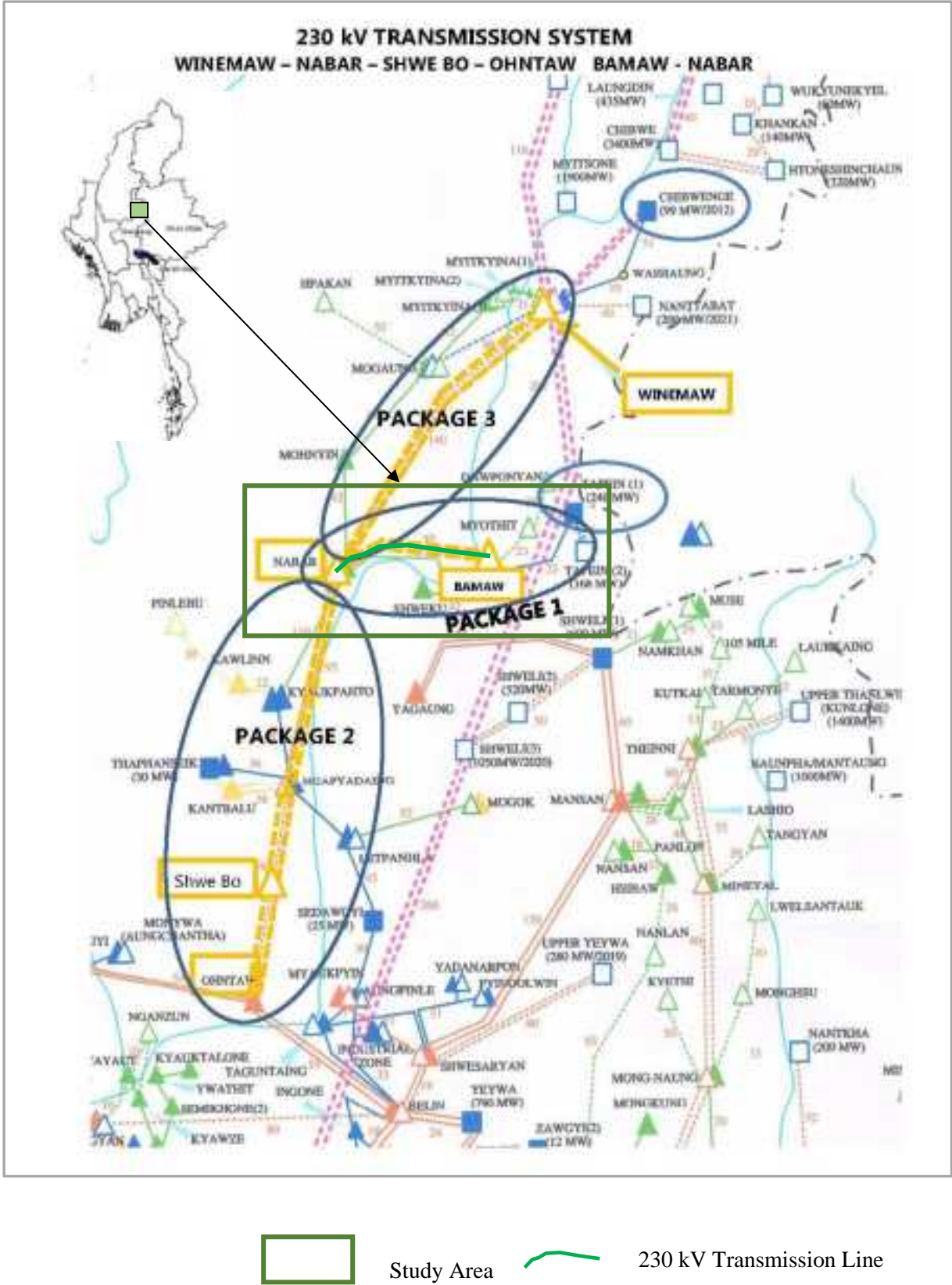
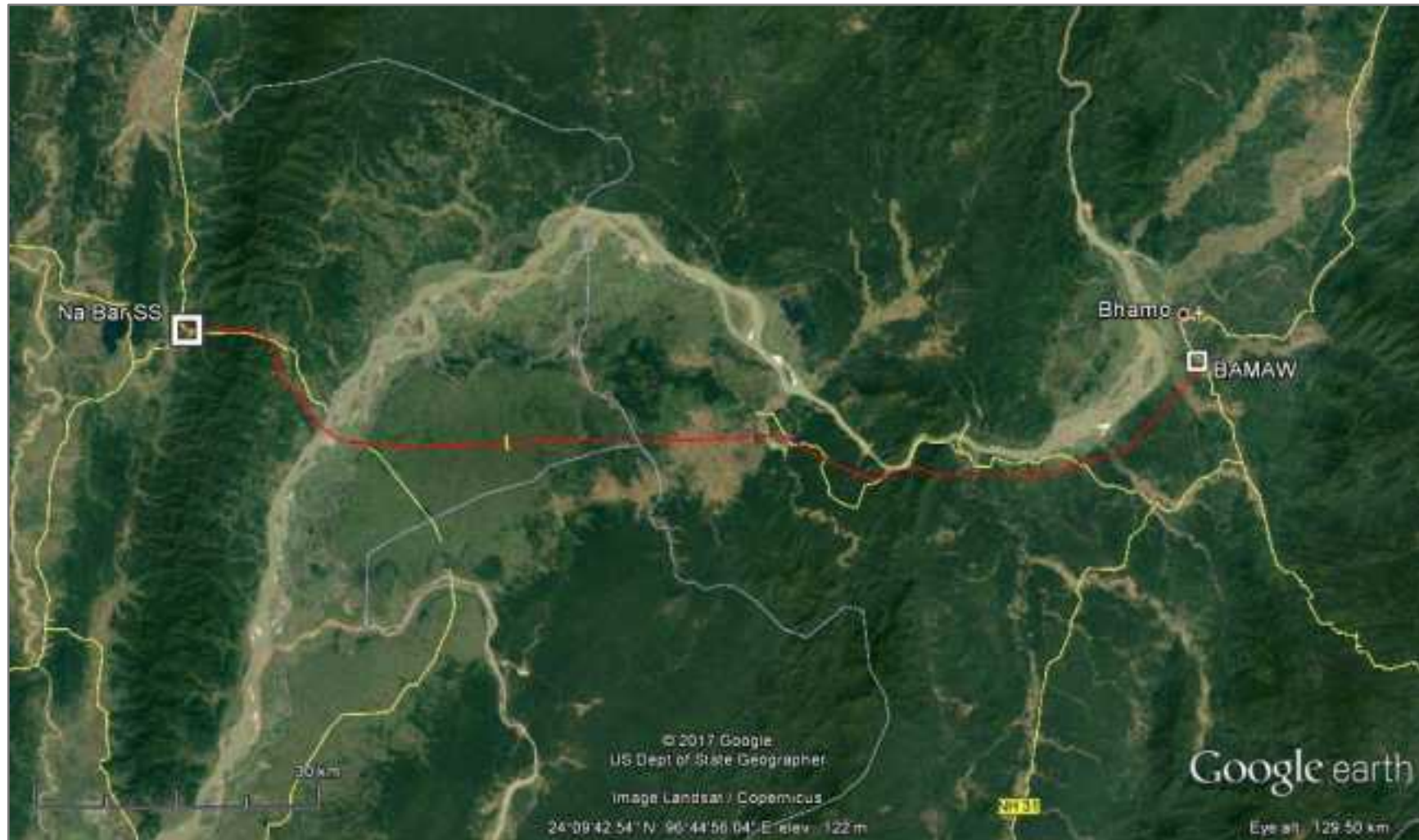


Figure 1.2-1: Location of the Proposed Power Transmission Line (Package 1)





**Figure 1.2-2: Location of Substations and transmission line route between Nabar and Bhamo (Bamaw)**

## 1.3 Project Infrastructure

### 1.3.1 Transmission Line Routes

The scope of transmission line component is stated below:

- (1) 230kV double circuit line Bamaw – Nabar with estimated length of 75 miles (121 km).
- (2) Replacement of conductor ACSR “IBIS” with ACCC “LAREDO” on single circuit existing 110 kV line Tapein 1 – Bamaw with length of 22 miles (35 km).

#### *(1) Bamaw-Nabar Transmission Line Route*

The 230kV power transmission line route is started from Bhamo (Bamaw) Sub-station to Nabar Sub-station. The length of the route is 121 km. The areas along the whole lines are mainly farmlands and hills, with a few forests and woodlands scattered. The forests, generally up to 15-25 meters tall, are mostly teak woods. Geologically, most of these areas are sandstones, strong-weathered rocks and pan soil, with a few shales and mires.

### 1.3.2 230kV Bamaw Sub-station (New-built)

The Scope of 230kV Bamaw Sub-station and 230kV Nabar Sub-station are described as follows.

230kV Bamaw substation located 3km south of Bamaw downtown, land acquisition work is completed, and the control building had been finished. The substation include 2 sets of 230kV main transformers, 2 feeders of 230kV, 4 feeders for 66kV, the site condition of Bamaw sub-station is shown in Figure 1.3-1. Layout drawing of new-built Bamaw Sub-station is attached in Appendix-4.



**Figure 1.3-1: Site condition of Bamaw Sub-station.**

### 1.3.3 230kV Nabar Sub-station (Extended)

Extended 230kV Nabar Substation located near Nabar Village and 20km north-west of Katha, land acquisition work is completed, and the control building had been finished. The substation includes 2 sets of 230kV main transformers, 6 feeders of 230kV, 66kV



connection with existing 66KV substation, the condition of Nabar sub-station is shown in Figure 1.3-2. Layout Drawing is attached in Appendix-5.



**Figure 1.3-2: Site condition of Nabar Sub-station.**

#### **1.3.4 Construction Organization**

Union Resources & Engineering Co., Ltd. is responsible for construction of proposed project. Decision-making level of Project Dept. consists of Project Manager, Chief Engineer and Deputy Project Manager. According to the characteristics of different construction periods, a number of construction teams are specifically formed to meet engineering construction needs, with organization and staff composition allocated in the principle of dynamic, efficient and capable per different construction periods.

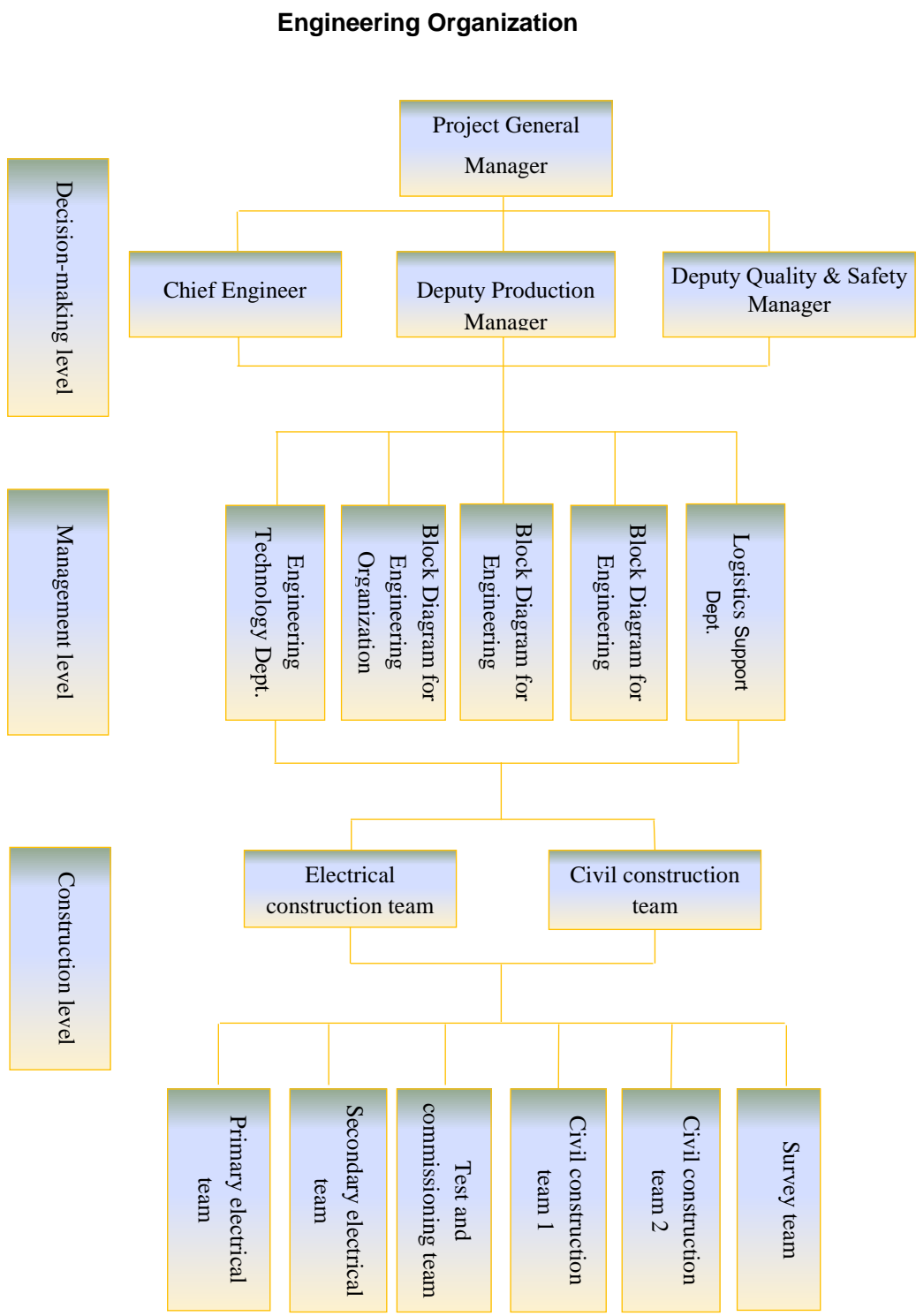


Figure 1.3-3: Block Diagram for Engineering Organization

### 1.3.5 Resources Allocation and Scheduling

#### 1. Allocation of Construction Resources

Civil construction and electric equipment installation project of Bamaw and Nabar substations will last for 34 months as specified in the contract, for which we will reasonably arrange staff and equipment mobilization based on the schedule and construction intensity, in order to meet construction needs.

## 2. HR Staffing

Staffing of all construction work types will be under dynamic management for optimization according to the construction tasks during different periods when considering construction organization design.

## 3. Equipment Allocation

Mobilization of construction equipment shall be mobilized on the basis of construction schedule. Main construction machinery and equipment to be used in this bid section refer to Table 2.4-1 and tests and detecting equipment to be provided for this bid section refer to Table 2.4-2.

**Table 1.3-1: Main Construction Machinery and Equipment to Be Used in This Bid Section**

SN	Equipment Name	Model & Specs	Qty.	Country of Origin	Year of Manufacture	Production Capacity	Where to be Used	Remarks
(1)	<b>Earthwork construction equipment</b>							
1	Loader	2.2m <sup>3</sup>	1	China	2005	Good	Civil engineering	
2	Hand drill	YT28	20	China	2007	Good	Civil engineering	
3	Backhoe	CAT320C	2	Joint-ventured	2005	Good	Civil engineering	
4	Bulldozer	120 kW	1	China	2004	Good	Civil engineering	
5	Axial flow fan	11kW	5	China	2006	Good	Civil engineering	
6	Vibration roller	SLYL30/40	1	China	2011	Good	Civil engineering	
(2)	<b>Gravel aggregate processing equipment</b>							
1	Jaw crusher	250×400	3	China	2006	Good	Civil engineering	
2	Impact crusher		3	China	2006	Good	Civil engineering	
(3)	<b>Concrete construction equipment</b>							
1	Concrete mixer	JZL250	6	China	2006	Good	Civil engineering	
2	Concrete mixer	JL250	2	China	2006	Good	Civil engineering	
3	Vibrator	Plug-in type 2.2 kW	20	China	2005	Good	Civil engineering	
4	Vibrator	Flat plate type 2.2kW	2	China	2005	Good	Civil engineering	
5	Steel cutting machine	10 kW	2	China	2006	Good	Civil engineering	
6	Steel bar bender	Φ6-40	2	China	2006	Good	Civil engineering	
7	AC welder	AX7-500	5	China	2006	Good	Civil engineering	
8	DC welder	BX1-500	2	China	2006	Good	Civil engineering	
9	Winch	5t+10t	4	China	2003	Good	Civil engineering	
(4)	<b>Transportation Equipment</b>						Civil engineering	
1	Dump truck	EQ140 5t	4	China	2010	Good	Civil engineering	

2	Diesel dumper	1t+2t	4	China	2010	Good	Civil engineering	
(5)	Other necessary construction equipment for electric equipment installation							
1	Dual-use heat retaining electrode oven	Y2H2-150	1	China	2009	Good	Substation	
2	Inverter DC welder	ZX7-500S	2	China	2010	Good	Substation	
3	Inverter DC welder	ZX7-400	4	China	2009	Good	Substation	
4	Argon arc welding machine	AX7-500	1	China	2008	Good	Substation	
5	Pneumatic grinding equipment	/	1	China	2006	Good	Substation	
6	Hydraulic pipe bender	4''	2	China	2004	Good	Substation	
7	Cutting machine	G1-30	2	China	Newly purchased	Good	Substation	Newly purchased
8	Pickup truck	0.5 ton	1	China	2012	Good	Substation	
9	Passenger and goods double-service truck	1.5t	2	China	2010	Good	Substation	
10	Truck crane	25t	2	China	/	Good	Substation	Rented
11	Jack	20t	4	China	2012	Good	Substation	
12	Manual forklift	5t	1	China	2012	Good	Substation	
13	Air compressor	2.5m <sup>3</sup>	2	China	2010	Good	Substation	
14	Dust collector	FV29WS	4	Japan	2009	Good	Substation	
15	Vacuum pump	JZJ2X600-4.2	1	China	2006	Good	Substation	
16	Vacuum oil filter	ZLY	1	China	2013	Good	Substation	
17	Sign plate printer	NTC M-300	1	Japan	2004	Good	Substation	
18	Cable tester	FC200	4	China	2009	Good	Substation	
19	Microcomputer based cable marker	LM-350AII	1	China	2002	Good	Substation	
20	Dehumidifier	CH948B	2	China	2012	Good	Substation	
21	Polisher		6	China	Newly purchased	Good	Substation	Newly purchased
22	Magnetic drill	32mm	2	China	2010	Good	Substation	
23	Various kinds of torque wrenches		2	/	Newly purchased	Good	Substation	Newly purchased
24	Air heater		2	/	Newly purchased	Good	Substation	Newly purchased
25	Various kinds of wrenches		A complete set	/	Newly purchased	Good	Substation	Newly purchased
26	Various kinds of files		Set	/	Newly purchased	Good	Substation	Newly purchased
27	Various kinds of electric tools		A complete	/	Newly purchased	Good	Substation	Newly purchased

			set					
28	Interphone	kenwood	10	China	Newly purchased	Good	Substation	Newly purchased

**Table 1.3-2: List of Test and Detecting Instruments**

SN	Equipment Name	Model Specifications	Quantity	Country Country of Origin	Year of Manufacture	Equipment status	Where to be Used	Remarks
1	Partial discharge test device	DST-4	1 set	China	2002	Good	Substation	
2	Flowmeter	LG15	1 pce	China	1998	Good	Substation	
3	Total station	GTS-332N	1 pce	China	2013	Good	Substation	
4	Automatic dielectric loss tester	AI-6000F	1 pce	China	2010	Good	Substation	
5	Transformer DC resistance tester	JD2550	1 pce	China	2009	Good	Substation	
6	Battery charging and discharging tester	YDC-220/50A	1 set	China	2013	Good	Substation	
7	Single-arm electric bridge	QJ23	1 pce	China	2009	Good	Substation	
8	Fully automatic oil tester	N981	1 pce	China	2010	Good	Substation	
9	Level gauge	DS3	2 units	China	2014	Good	Substation	
10	Microcomputer-based relay test system	PW4661E	2 units	China	2010	Good	Substation	
11	Trace moisture analyzer	CMS-III	2 sets	China	2008	Good	Substation	
12	Loop resistance tester	JD2201A	2 units	China	2010	Good	Substation	
13	High voltage DC generator	ZGS-200kV /2	2 units	China	2010	Good	Substation	
14	High voltage DC generator	ZGS-300kV /3	1 pce	China	2010	Good	Substation	
15	Intelligent transformation ratio & group tester	ZBC-III	2 units	China	2002	Good	Substation	
16	Power analyzer	WFLC-E	1 pce	China	2012	Good	Substation	
17	High-voltage test transformer	YDQ-50kV /100	1 set	China	2004	Good	Substation	
18	High-voltage test transformer	YD-100kV/25	1 set	China	2004	Good	Substation	
19	High-voltage test transformer	YDQ-200kV /50	1 set	China	2004	Good	Substation	
20	Single-phase voltage regulator	TDGC-2kVA	3 units	China	2004	Good	Substation	
21	Single-phase voltage regulator	TDG-1kVA	3 units	China	2003	Good	Substation	
22	Three-phase voltage regulator	TSGC-3kVA	3 units	China	2004	Good	Substation	
23	Grounding resistance	AI-6301	2 sets	China	2012	Good	Substation	
24	Electric test pump	4D-SY 61/16	2 units	China	2004	Good	Substation	
25	High-voltage switch characteristic tester	GKHD410	2 units	China	2008	Good	Substation	
26	Triple frequency power generator	GYSBF	2 units	China	2008	Good	Substation	
27	SF6 leak detector		2 units	Xi'an	2013	Good	Substation	
28	Current transformer	TAC750	2 units	China	2010	Good	Substation	

SN	Equipment Name	Model Specifications	Quantity	Country Country of Origin	Year of Manufacture	Equipment status	Where to be Used	Remarks
29	Insulation resistance tester	CA6505	2 units	China	2011	Good	Substation	
30	Ammeter	1, 2, 5, 10A	4 Pcs	China	2010	Good	Substation	
31	Voltmeter	75, 500, 600V	3 Pcs	China	2008	Good	Substation	
32	Multimeter	Fluke 17B	20 Pcs	U.S.A	2010	Good	Substation	
33	Digital phase-sequence meter	KEW-ETD	2 Pcs	Japan	2010	Good	Substation	
34	Infrared thermometer	HCIJET	5 Pcs	China	2010	Good	Substation	
35	Infrared imager	DL700E/E+	1 Pcs	China	Newly purchased	Good	Substation	
36	Portable FM series resonance HV test equipment	HDSR-F500-500 type (500KV)	1 set	China	Newly purchased	Good	Substation	
37	Portable FM series resonance HV test equipment	Model HDSR-F260-260 (260KV)	1 set	China	2012	Good	Substation	
38	Transformer winding deformation tester	GBR — 1000	1 set	China	2013	Good	Substation	
39	Electroscope	33kV, 66kV, 110kV, 132kV, 230kV	2 for each	China	Newly purchased	Good	Substation	
40	Noise meter	HCIJET	2 units	China	Newly purchased	Good	Substation	
41	Laser range finder	UT392-100	2 units	China	2013	Good	Substation	
42	Illuminometer	TASI=631	2 units	China	Newly purchased	Good	Substation	

#### 4. Construction Schedule

According to tendering documents:

##### a. Preparation basis

- (1) Tendering documents, drawings, technical documents and on-site survey data provided by the Employer;
- (2) Clarifications in the tendering documents of the Project;
- (3) Controlled target in construction periods of Project stipulated in the bidding documents;
- (4) Implementation conditions and basic requirements stipulated in the tendering documents;
- (5) Technical regulations, specifications and standards related to the Project;
- (6) Our current construction capacity, manpower, material resources and construction experience of similar projects;

##### b. Preparation principles

- (1) Arrange construction procedure and schedule in strict accordance with contract progress control requirements specified in the tendering documents, to ensure that the target in total contract duration is fulfilled on schedule.
- (2) Optimize resources allocation to fully embody the principle of balanced construction.
- (3) Apply moderate construction intensity and sufficiently consider unpredictable factors, which are beneficial to improve the assurance rate of construction schedule and construction quality and save construction costs.

##### c. Schedule

- (1) Schedule Diagram of Bamaw and Nabar Substations (refer to construction progress schedule)



- (2) Bamaw and Nabar Substations Schedule Gantt Chart and Network Diagram (see attached drawings).

### **1.3.6 Construction Measures and Methods**

Before constructors enter into the site for construction, technical drawings shall be jointly checked up, job skills training and safety education provided for all constructors and technical details disclosed.

Before constructors enter into the construction site, the personnel who arrived early shall be arranged for earlier admission to prepare production and living facilities and power sources, which shall be designed to meet construction needs. Offices, equipment rooms, material warehouses and residences for Project Department personnel and constructors shall be built on the construction site based on the actual construction situation. In addition, the Project Dept. shall be equipped with direct-dial telephone and fax machine, and relevant personnel shall be provided with mobile phones and interphones.

Upon field investigation, appropriate living resident shall be selected according to the requirements of construction layout, in which water, electricity and communication shall be available and temporary warehouse space allowed. With regard to the selection of large material station, the ability to resist natural disasters shall be considered besides qualified living conditions. Meanwhile, project logo shall be provided at the Project Department, temporary facilities be constructed and installation and commissioning of construction equipment be completed. Fire-fighting equipment and security facilities shall be established as well. In addition, material processing, ordered goods transportation and storage shall be accomplished and commencement application be submitted.

### **1.3.7 Construction Machinery Preparation**

The company shall comprehensively check, inspect, maintain and repair all tools, instruments and test equipment that may be used during construction to ensure their normal use and check their performance. The instrument and equipment that are in normal condition for use shall be labeled with appropriate certificate (it shall be verified and issued by units qualified for verification) upon checking.

Equipment and Materials Dept. of the Project Dept. is the administrative department of construction machinery and tools and instruments, who shall be responsible for their usage, configuration, maintenance, storage and identification, and the establishment of measures for construction equipment management and machinery and equipment use program. Necessary maintenance shall be provided the machinery and equipment entering into the site by the Equipment and Materials Dept. Meanwhile, to meet the requirements of construction intensity and line production of all working surfaces, enough construction machinery and equipment shall be equipped.

### **1.3.8 Construction Manpower Resources Preparation**

A professional construction team shall be organized. At the same time, the proportion of technicians to general workers shall be properly selected when considering duration, work amount, discipline, type of work and other factors, and labor personnel demand plan shall be made according to the determined flow-process construction organization mode.

#### **1. Organization of construction manpower**

An appropriate number of professional construction team shall be dispatched, which shall include construction management personnel and professionals. Before mobilization, all

operators shall have physical examination and pre-operation training and workers involved in special type of work shall possess required work permits to ensure the Project will be completed on schedule.

## **2. Organization of technical force**

A technology, quality and safety management system shall be constituted by the Engineering Technology Dept., Quality Dept. and Safety Dept. under the leadership of chief engineer of the Project, to be responsible for the design of construction scheme, preparation of construction measures, technical disclosure and technology management, operation of quality management and quality assurance system, operation of safety management and safety assurance system, etc. Besides management engineers, civil engineers and electrical engineers as well as test and survey engineers, technical professionals involved in some special types of work shall be allocated.

The labour schedule is attached in Appendix-13.

## **1.4 Material Supply**

As regards the materials to be applied in the Project, market survey shall be conducted per technical requirements and then procurement be started when approved by the Employer.

### **1. Cement procurement**

- (1) Select qualified professional manufacturer with production license that is approved for production.
- (2) Collect delivery inspection reports of the same batch of products produced in the factory and submit the data such as production license and product inspection report to the Employer and consulting engineer for approval.
- (3) All batches of cement shall be provided with product certificate and test report and the test results shall meet the standards.

### **2. Aggregate procurement**

- (1) Aggregate procurement shall adopt the principle of proximity.
- (2) When sample test report of cement, sand and stone is reviewed and approved by the consulting engineer, concrete mix shall be designed for trial and test and the final mix proportion shall be determined based on the test result.

### **3. Steel and steel products processing**

- (1) Steel shall be purchased from qualified manufacturers with license and good reputation. A sample shall be randomly sampled from each specification that is required in the material list for laboratory test. Later, the test report and relevant information shall be submitted to the Employer and consulting engineer for approval.
- (2) Received steel shall be attached with an original copy of product certificate or product quality certificate issued by the manufacturer. Materials shall be managed and material management system shall be standardized in order to prevent nonconforming materials from entering into the construction site.

## **1.5 Technical Disclosure**

Engineering technical disclosure is intended to enable construction workers to understand the engineering characteristics, construction tasks, design requirements, process, operation method of special projects, quality standards, safety measures, etc. Technical disclosure

adopts step-by-step approach. Specifically, technical disclosure of the Project Dept. shall be organized by the chief engineer of the Project and that of operation level be organized by the construction technology principal. Construction shall not be started until disclosure is completed.

In order to ensure the smooth development of construction upon commencement as well as construction quality and progress, the technical backbone arranged in previous projects of same scale to be independently responsible for technical work at the project site shall be employed as the on-site technical principal of the Project.

### **1. Joint checkup of construction drawings**

The chief engineer of the Project shall organize technicians, quality personnel and safety personnel to jointly checkup the construction drawings when the contract is signed, in order to fully master the requirements of design drawings and understand the design philosophy. If any problem or doubt is found during review, please contact with the Designer for solutions in a timely manner.

### **2. Construction technology training**

The chief engineer of the Project shall organize all construction teams for construction technology, quality and safety disclosure before commencement.

### **3. Preparation of quality plans, construction organization design and operating instructions**

Overall quality plan shall be prepared for the Project based on the requirement of the Project.

According to engineering characteristics, appropriate operating instructions shall be selected for each construction stage as specifications and guidance for construction operations.

Preparation plan for construction instructions of the Project refers to Table 2.4-3 and Table 2.4-4.

**Table 1.3-3: Civil Engineering Construction Instructions**

SN	Name of Operating Instructions
1	Earthwork Construction Instructions
2	Scaffolding Works Instructions
3	Concrete Construction Instructions
4	Roofing Project Construction Instructions
5	Doors, Windows and Decorative Works Instructions

**Table 1.3-4: Electric Equipment Installation Construction Instructions**

SN	Name of Operating Instructions
1	Main Transformer Unloading and Positioning Instructions
2	Transformer Oil Treatment Instructions
3	Transformer Suspended Core Inspection Instructions
4	Transformer Installation Instructions
5	HV Switch Installation Instructions

6	Grounding System Construction Instructions
7	Cable Tray Installation Instructions
8	Cable Laying Instructions
9	LV Cabinet Installation and Wiring Instructions
10	Electric Equipment Handover Test Instructions
11	Relay Protective Device Inspection Instructions
12	Computer and Comprehensive Automatic System Commissioning Instructions
13	DC System and Battery Construction Instructions
14	Communication Equipment Handover Test Instructions
15	Substation Start-up Commissioning Program

#### **4. Engineering technology management methods**

Three-level technical management system shall be applied. To be specific, the Project Dept., as the first level, shall be in charge of review, approval and inspection and supervision of technical proposals, operational guidance for the technician at lower level, preparation and review of major construction program and development of detailed construction organization design; the Technical Dept. shall be responsible for the preparation of construction scheme and safety technology measures, implementation and inspection of various construction schemes, support for all technology-related work and technical disclosure and participate in the joint drawing checkup organized by the Project Dept.; and work teams shall primarily take charge of the implementation of specific measures and information feedback, and specific technical and technological operations, actual practice guidance for staff and participation in other technical management work organized by the Project Dept. or construction team. In addition, three-level technical disclosure system, system for joint checkup and signing of drawings and technical proposal approval system shall be executed. Responsibilities, rights, interests and division of technicians at all levels shall be clearly defined to optimize the construction scheme and make efforts to reduce engineering costs.

#### **5. Details of procedures**

All personnel of the Project Dept. shall be familiar with the construction drawings and relevant design information, in order to fully understand and master the design drawings, design intent, structural characteristics and technical requirements. Meanwhile, such personnel shall keep joint checkup records, participate in the joint checkup organized by the Employer and the Designer, put forward questions and suggestions on the design drawings, try to obtain the first-hand information through field survey, investigate and analyze natural conditions and technical and economic conditions, prepare construction organization design for unit projects on such basis and utilize the technical preparations that are applied as the core of construction preparation in the whole process.

##### **1.5.1 Construction Management**

Technical management system shall be strictly implemented and technicians of each department shall clarify their respective responsibilities to ensure completion of work on

time with good quality. Design change notice and the Employer's work contact management system shall be faithfully implemented.

### **1. Site Planning and Layout Principle for Production and Living Facilities**

- (1) Upon receiving notice of award, our project department will send personnel to the construction site in advance to select a reasonable position to set up the project management department. According to the project scale and construction period, the Project department is planned to construct production management buildings including office, canteen, dormitory, material warehouse, and bathroom. Project shall be constructed with its specific location and layout complying with standards approved by the Employer, to ensure the entering of construction personnel and equipment to site at time stipulated by the Contract.
- (2) Living facilities and equipment for project department and construction team shall be prepared in advance.
- (3) According to the scale, characteristics, construction environment and construction conditions of this Project, the general layout principle of the Project is proposed as follows:

All temporary living and production building facilities, construction roads shall be arranged within the scope designated by the Employer and locations of main buildings shall be reserved.

Arrangement of construction site and camp shall be reasonable, compact, convenient and practical, with a streamlined scale in order to reduce construction cost.

The camp shall be provided with sufficient and reliable environmental protection facilities and fire-fighting equipment as per relevant requirements.

Arrangement of all living and production facilities shall embody the principle of work safety and civilized construction, to prevent construction disturbance and impact as much as possible.

### **2. Construction Detour**

According to the actual situation and characteristics of the Project, construction detour is intended to be built directly from the highway, and service road within the construction area shall be modified timely with the change of construction site.

### **3. Layout of Construction Water, Electricity and Communication System**

#### **a. Living and construction water supply**

Living and construction water demand for the Project is pretty small which can be solved near the site. Water is introduced from the nearest water point

#### **b. Living and construction power supply**

According to the actual site situation, living and construction power supply is either provided by diesel generators equipped or from the power supply access point offered by the employer.

#### **c. Construction communication**

According to the local actual communication network conditions, appropriate communication tools shall be provided.

### **4. Layout of Aggregate Supply and Concrete Mixing System, and Concrete Precast Yard**

#### **a. Aggregate supply**

Aggregate required for the Project is purchased locally.

**b. Production of semi-finished concrete**

All concrete required for the Project is produced by a 1.0m<sup>3</sup> concrete mixer at site with manual batching.

**c. Concrete precast**

Precast concrete components are to be produced by ourselves at site.

**5. Steel Products and Steel Structure Fabrication**

Steel processing and equipment repair are conducted at local repair site. Galvanized components shall be outsourcing finished products.

**1.5.2 Material Management**

Stocking area and warehouse for material, equipment and supplies are to be provided at Project Dept. camp, and the Material Dept. shall be responsible for the management.

**1. Other Sporadic Facilities**

**a. Fire-fighting Equipment**

Corresponding fire-fighting equipment and sufficient foam extinguisher and dry powder fire extinguishers shall be provided at storehouse, construction site and living space.

**b. Setup of Signals**

Necessary signals shall be provided at construction site, including standard road signal, alarm signal, danger signal, control signal, safety signal, knowledge signal, etc. All signal markings shall be clear and accurate. See attached drawings for arrangement of temporary building and facilities.

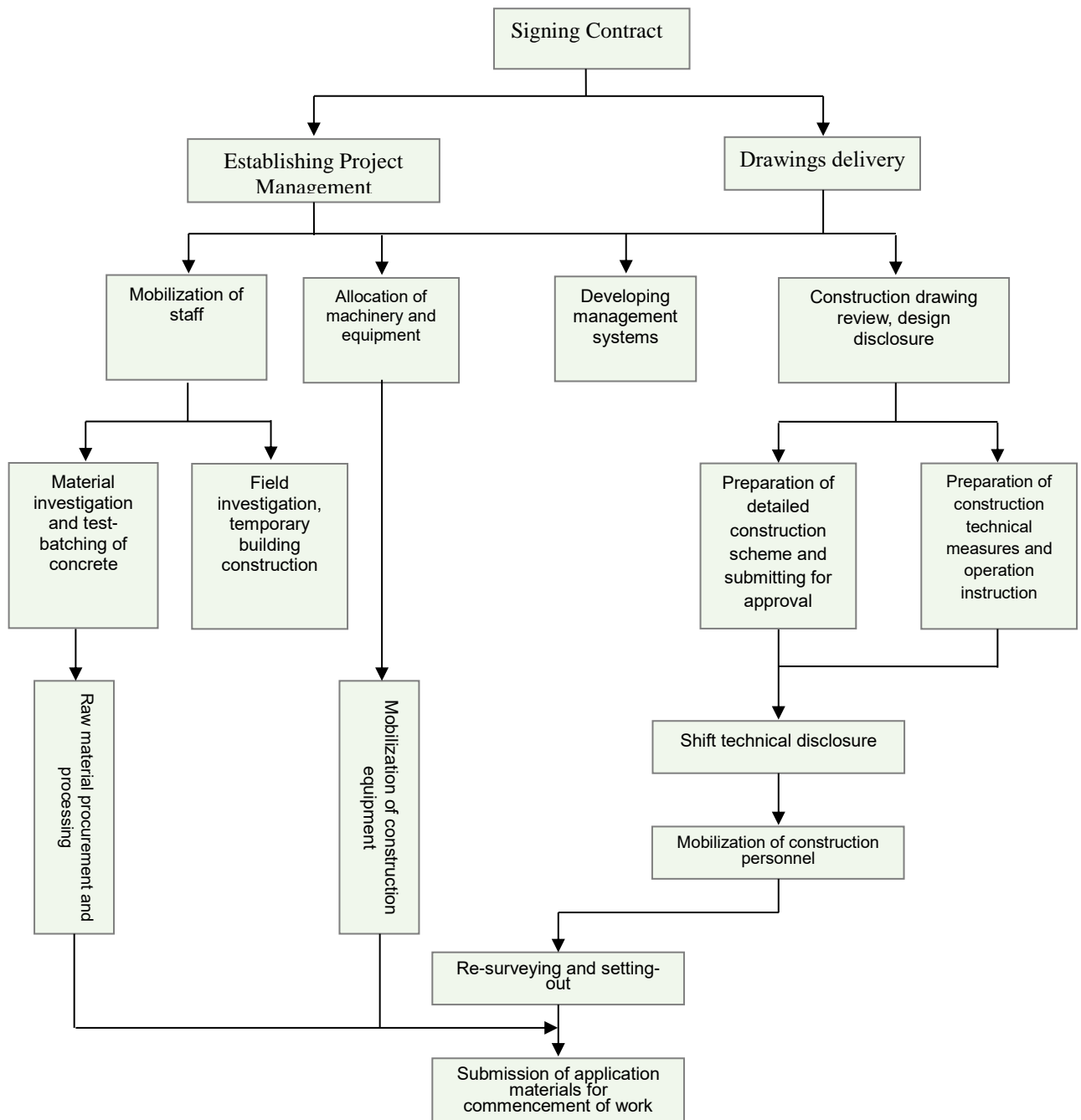
According to the requirements of general construction progress and general layout of the Project, necessary technology and material conditions shall be provided and the construction manpower and construction site shall be planned as a whole for the smooth commencement and completion of the Project.

**1.5.3 Preparation for Internal and External Coordination**

Once the Contract is signed, all kinds of personnel of the Project Dept. shall be well arranged as per requirements and begin to perform their duties. Personnel engaged in early works will be first arranged for mobilization to create a good external environment for formal commencement of Project. Personnel from the Project Dept. shall, in cooperation with the Employer and related parties, attend the construction coordination meetings to ensure that construction progresses smoothly. In the process of preparation, the Project Dept. shall, in cooperation with the employer and Party A, participate in coordination and contact, check the route on site and determine the pile location.

The Process of construction preparation is shown in Figure 1.5-1.





**Figure 1.5-1: Block Diagram for Construction Preparation**

## 1.6 Design Description for Transmission Line

### 1.6.1 Normative References

All relevant technical specifications and standards such as IEC, ISO, ANSI ASTM < BS and/or EN are to be read in conjunction with this specification. In cases of conflict, the provisions of bid document shall take precedence. Unless otherwise stated, the latest revision, edition and amendments shall apply.

### 1.6.2 Weather Conditions

The weather conditions used in the project are conformed in the guaranteed data sheets.

Description	Unit	Value
Maximum ambient temperature	°C	+40
Minimum conductor temperature	°C	+10
Maximum conductor temperature	°C	+75
Every day temperature	°C	+25
Temperature with maximum wind	°C	+10
Reference wind speed VRatIOM above ground	m/s	35

### 1.6.3 Insulation Coordination and Lightning Protection and Grounding

Insulation coordination and lightning protection and grounding are conformed in the guaranteed data sheets and bid document.

Minimum vertical clearances from the line conductors at maximum sag to ground or for various crossings as follows:

Description	Unit	Value
Normal ground	m	7.5
Ground in populated areas	m	8.0
Roads and streets	m	9.0
Grown trees	m	4.7
Residential or other buildings	m	7.2
Power lines (above)	m	3.9
Telecommunication lines	m	3.9
Railways	m	10.0

## 1. Conductors and Ground Wires

Conductor using ACSR TERN, Ground wires using one OPGW and one regular steel wire Ground wire.

### a. Conductors

Parameters for conductors are as follows:

Conductor type	ACSR "TERN" IEC Code 403.77-A1/S1A-45/3.38+7/2.25
Conductor overall diameter (mm)	27.00
Area aluminium (mm <sup>2</sup> )	403.77
Area Total (mm <sup>2</sup> )	431.60
Aluminium wires (mm)	45/3.88
Steel wires (mm)	7/2.25
Conductor linear mass (kg/km)	1340
Ultimate Tensile Strength (kN)	98.7
Resistance dc @ 20 °C (Ohms/km)	0.0718
Modulus elasticity final (N/mm <sup>2</sup> )	66,600
Coefficient of Linear expansion (°C <sup>-1</sup> )	21.12*10 <sup>-6</sup>
Greased conductor requirements	Nil

**b. Overhead Ground Wire**

(1) Parameters for Ground wire are as follows:

Conductor type (16-S1A-19/2,7)	Regular steel wire (not greased)
Conductor overall diameter (mm)	13.48
Steel wires (number off)/(strand diameter mm)	19/2.7
Area Total (mm <sup>2</sup> )	108.80
Linear mass (kg/km)	857.0
Minimum ultimate tensile strength (MPa)	1.310
Ultimate strength (kN)	142.1
Modulus elasticity final (N/mm <sup>2</sup> )	190,000
Resistance (ohms/km)	1.794
Coefficient of linear expansion, $B$ , ( $^{\circ}\text{C}^{-1}$ )	$11.5 \times 10^{-6}$

(2) OPGW Characteristics

OPGW shall have the following main characteristics:

OPGW type	SFPOC/SFSJ-J-9534 24 SM Fibers (or equivalent)
Nominal overall diameter (mm)	14.25
Nominal cross section area mm <sup>2</sup>	115
Aluminium Clad Steel wire - No./Dia.	6/2.85
Stainless Steel Tube – No./Dia.	1/2.80
Aluminium Alloy wires – No./Dia.	12/2.85
Ultimate Tensile Strength (kN)	71.2
Modulus of Elasticity (N/mm <sup>2</sup> )	95,333
Coefficient of Linear expansion ( $^{\circ}\text{C}^{-1}$ )	$17.3 \times 10^{-6}$

**c. Conductor and OPGW Anti-vibration Measures**

The vibration strength of conductor and overhead ground wire has much to do with the average operation stress. To void the unfavorable effect on the conductor vibration caused by gentle breeze it is generally considered that when the everyday operation stress of conductor is to be 17%-24% of its breaking strength, installation of dampers is necessary (under general span condition), especially for the single conductor transmission line. Meanwhile in order to reduce damage to the conductor and overhead ground wire possibly caused by their vibration due to gentle breeze that may endanger the safety of grid, during the design of transmission line dampers are considered to be erected no matter how big the span is, but the number of damper to be erected will depend on the span length (for details, please see the table given below).

Dampers with several response frequencies will be adopted for this project, the types are as follows:

The type of damper used for conductor will be FR-3.

The type of damper used for Overhead Ground wire will be FR-2.

## 2. Insulators

### a. Characteristics and Guaranteed Values

#### U120B (IEC 383)

Diameter of insulating part	mm	255
Spacing	mm	146
Coupling size and standard	mm	16A, IEC60120
Minimum weight of zinc coating	g/mm <sup>2</sup>	500
Minimum electromechanical failing load	kN	120
Maximum working load	kN	60
Wet power-frequency (1 min, 50Hz) withstand voltage	kV	40
Dry lightning impulse (1.2/50 us) withstand voltage	kV	110
Minimum puncture voltage	kV	110
Creepage distance	mm	320
Weight	kg	5.5

#### U160BL (IEC 383)

Diameter of insulating part	mm	280
Spacing	mm	170
Coupling size and standard	mm	20, IEC60120
Minimum weight of zinc coating	g/mm <sup>2</sup>	500
Minimum electromechanical failing load	kN	160
Maximum working load	kN	80
Wet power-frequency (1 min, 50Hz) withstand voltage	kV	45
Dry lightning impulse (1.2/50 us) withstand voltage	kV	115
Minimum puncture voltage	kV	110
Creepage distance	mm	405
Weight	kg	7.5

### b. Characteristics of Insulator String

Characteristics and guaranteed values of insulator string shall be as follows:

#### (1) Suspension insulator string

Applicable voltage	kV	230
No. of insulator units (U120B)		
Single suspension set	no.	16
Double suspension set	no.	2×16
Breaking strength of complete set		
Single suspension set	kN	120
Double suspension set	kN	240
Single suspension Insulator set Design Drawing No		TL--01
Double suspension Insulator set Design Drawing No		TL- 02

#### (2) Tension insulator string

Applicable voltage	kV	230
No. of insulator units (U160BL)		
Double tension set	no.	2×14
Breaking strength of complete set		
Double tension set	kN	320
Double Tension Insulator set Design Drawing No		TL- 03

## 1.6.4 Towers

### 1. Types of Towers

All towers shall be self-supporting galvanized steel lattice type with body and leg extensions. The design of tower shall be accord with BS and ASCE 10-1997 and Bidding Documents. According to the Bidding Documents the tower of double circuit shall be that of the conductor vertical arrangement. The types of towers shall be as follows:

No.	Type of tower	Applicable for	Insulator string set type	Range of horizontal angle deviation (degrees)
1	DS	Tangential positions or points of very light angle deviation	Suspension	0-2
2	DHS	Tangential positions or very light angle deviation, for use in large span and across river.	Suspension	0-2
3	DLA	Positions of light or medium angle deviation	Tension	0-30
4	DHA	Positions of heavy angle deviation, for use terminal tower	Tension	30-70 (as angle tower) 0-45(as terminal tower)
5	DHP	Positions of transposition	Tension	0-2

*Remark:* There are two purpose for the type of DHS, one use for large span, another use for across river, when it is used for large span the height of tower is normal, when it is used for across over the height of tower is very high, the height of lowest cross-arm above ground level is about 99m.

### 2. Design Spans of Towers

The design spans (m) to be applied for every tower type will be as follows:

No.	Type of tower	Wind span (m)	Weight span (m)
1	DS	450	700
2	DHS	800	1100
3	DLA	450	1050
4	DHA	450	1050
5	DHP	450	1050

The tower types refer to outline drawing for tower type.

### 3. Body and Leg Extensions of Towers

Towers shall be provided with body extensions in a 3m step to a standard height. In addition to the body extensions, each leg will have hillside extensions in a 1m step to suit for the original ground slope and ensure that cutting ground to level setting will not be used.

### 4. Design Loads of Towers

For the design purpose of towers, the maximum operating temperature of conductor ACSR TERN shall be set at 75 °C for this particular project.

The towers shall be designed to meet with the following loading criteria.

- i) Wind speed: 35 m/s
- ii) Wind pressures on:
  - On conductors and earth wires:  $700 \text{ N/m}^2$
  - On towers:  $1700 \text{ N/m}^2$

## **5. Materials of Towers**

The materials of towers and their anti-corrosion measures

- (1) All the tower members shall be hot dipped galvanized for anti-corrosion purpose
- (2) The steel used for the towers shall be of Q420B, Q345B and Q235B.
- (3) The connection bolts of the towers shall be grade 6.8 and grade 8.8.

Otherwise such as the length of tower members and dimension of bolts nuts and washers accord with Bidding Documents.

## **6. Accessories of Tower**

One leg of each tower shall be equipped with step bolts at approximately 400mm centres, starting immediately above the anti-climbing devices and extending to the highest cross-arm of the tower.

Anti-climbing devices shall be designed for each tower. These are to be attach at a height of approximately 3m, but not less than 2.5m above ground level. Each tower must be fitted with tower number plate, phase plate and danger sign.

Otherwise accessories of tower accord with Bidding Documents.

### **1.6.5 Foundations**

#### **1. Foundation Types**

Pad and pier Foundation, Drilled Foundations such as single cast-in-situ piles and multiple cast-in-situ piles shall be selected respectively according to the terrain and geography conditions.

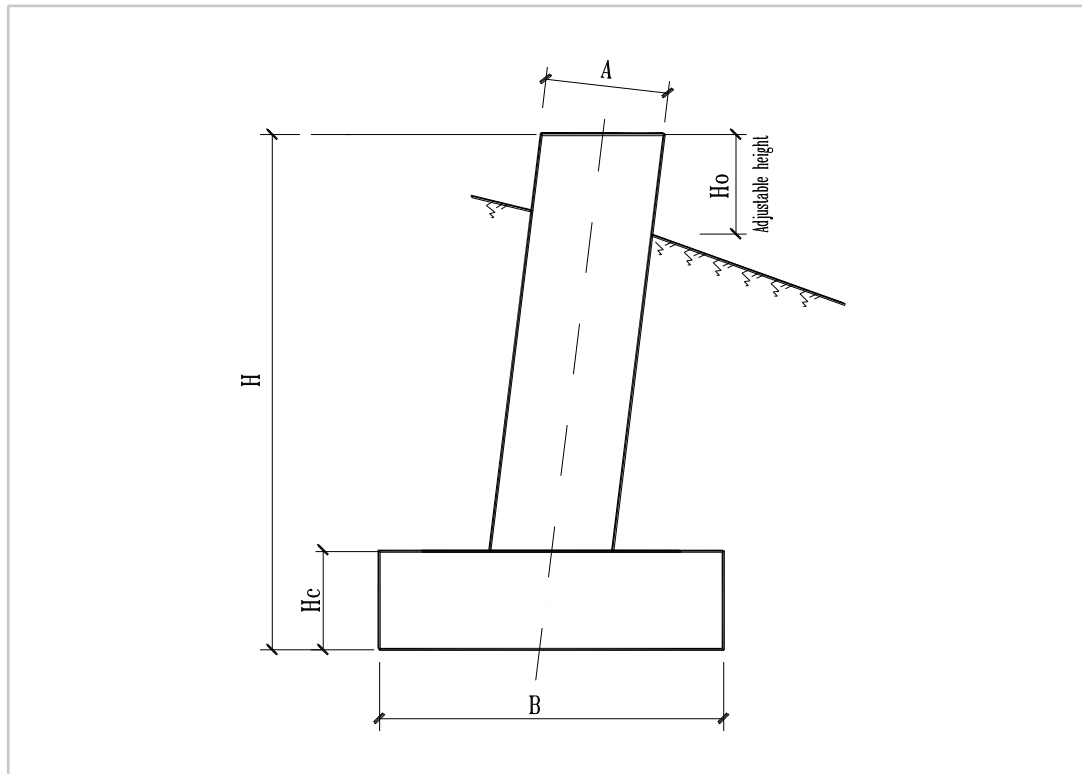
##### **a. Pad and Pier Foundation**

Pad and pier Foundation shall be used for all types of suspension towers and angle towers.

The geography conditions accord with type 1 soil and type 2 soil of Bidding Documents.

The schematic diagram of the foundation is as follow (Figure 1.6-1).



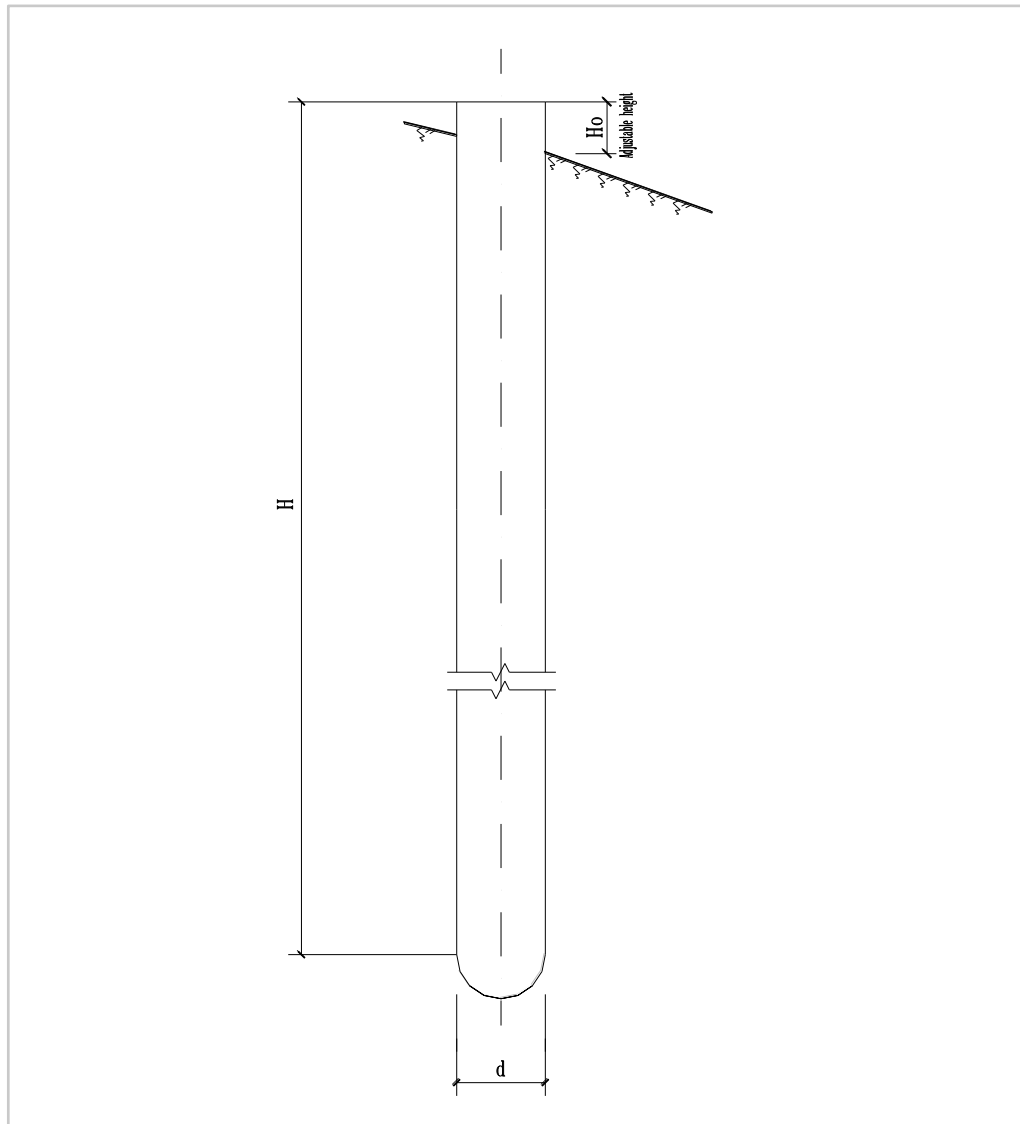


**Figure 1.6-1: Pad and pier foundation**

**b. Drilled Foundations such as single cast-in-situ piles**

Single cast-in-situ piles foundations are used for tower location in inferior geography conditions which accord with type 3 soil and type 4 soil of Bidding Documents , and the load of foundation is light or tower locate steep slopes. This foundation will be less to use owing to its higher cost.

The schematic diagram of the foundation as follow (Figure 1.6-2):

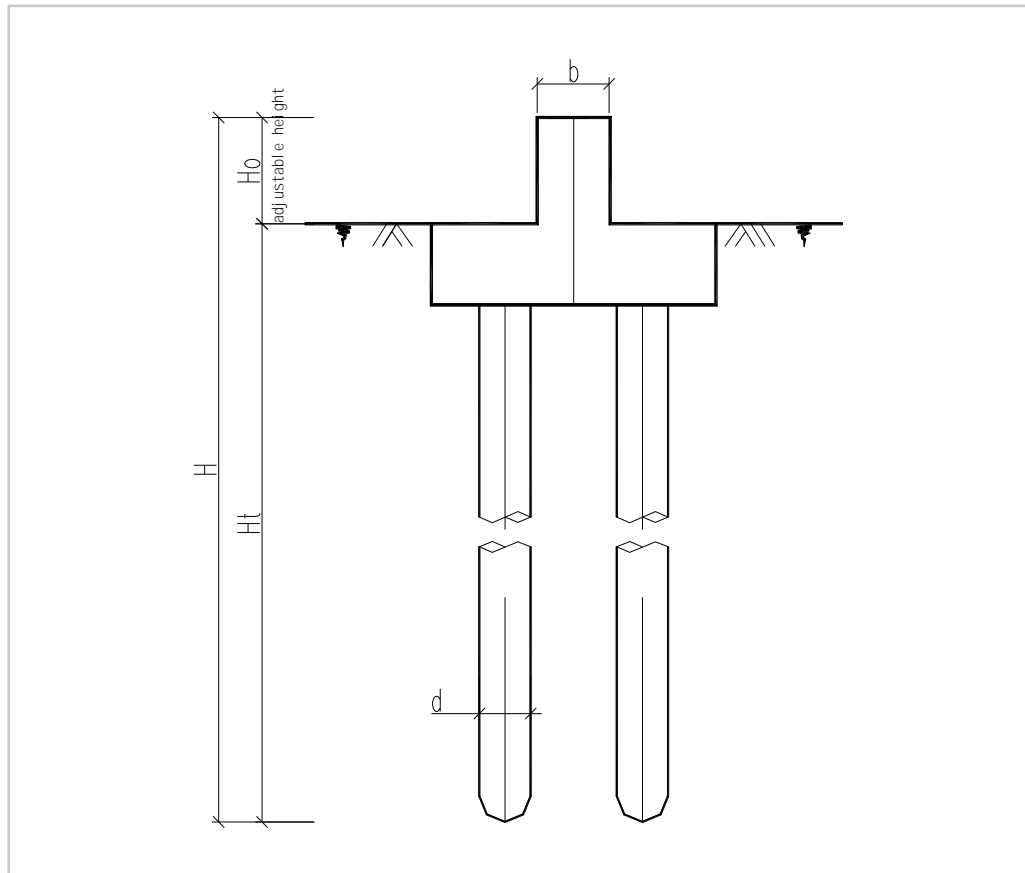


**Figure 1.6-2: Single cast-in-situ piles**

**c. Drilled Foundations such as multiple cast-in-situ piles**

Multiple cast-in-situ piles foundations are used for tower location in inferior geography conditions which accord with type 3 soil and type 4 soil of Bidding Documents, and the load of foundation is heavy or tower is used for across river. This foundation will be less to use owing to its higher cost.

The schematic diagram of the foundation as follow (Figure 1.6-3):



**Figure 1.6-3: Multiple cast-in-situ piles cast-in-situ piles**

*Remark:* The number of piles in Figure 1.6-3 does not indicate the actual number of piles, the actual number of piles shall be determined by the actual calculation of foundation.

All of these foundations design accord with Bidding Documents.

The foundation types refer to OUTLINE DRAWING FOR FOUNDATION TYPE.

## 2. Foundation Materials

### a. Concrete

Concrete of foundation: grade C30

### b. Steel

Foundation reinforced bar: HPB300 and HRB400

Angle steel and steel plates: Q235B, Q345B and Q420B

Sill anchor: Q345B

The foundation stub angle steel and the tower-leg steel shall be of the same material and specifications.

## 1.6.6 Connection of Tower and Foundation

Tower and foundation are connected by stub angle and sill anchor.

## 1.7 Construction Procedures for Sub-station

Corresponding specialized construction teams are to be established for the substation Project, these include civil works construction team, electrical installation and commissioning team, and a flow construction method is to be adopted as per discipline for the construction of substation Project.

### 1.7.1 Construction Procedures of Civil Works

Construction procedures for substation and construction process flow chart of site preparation are shown in Figure 1.7-1 and 1.7-2.

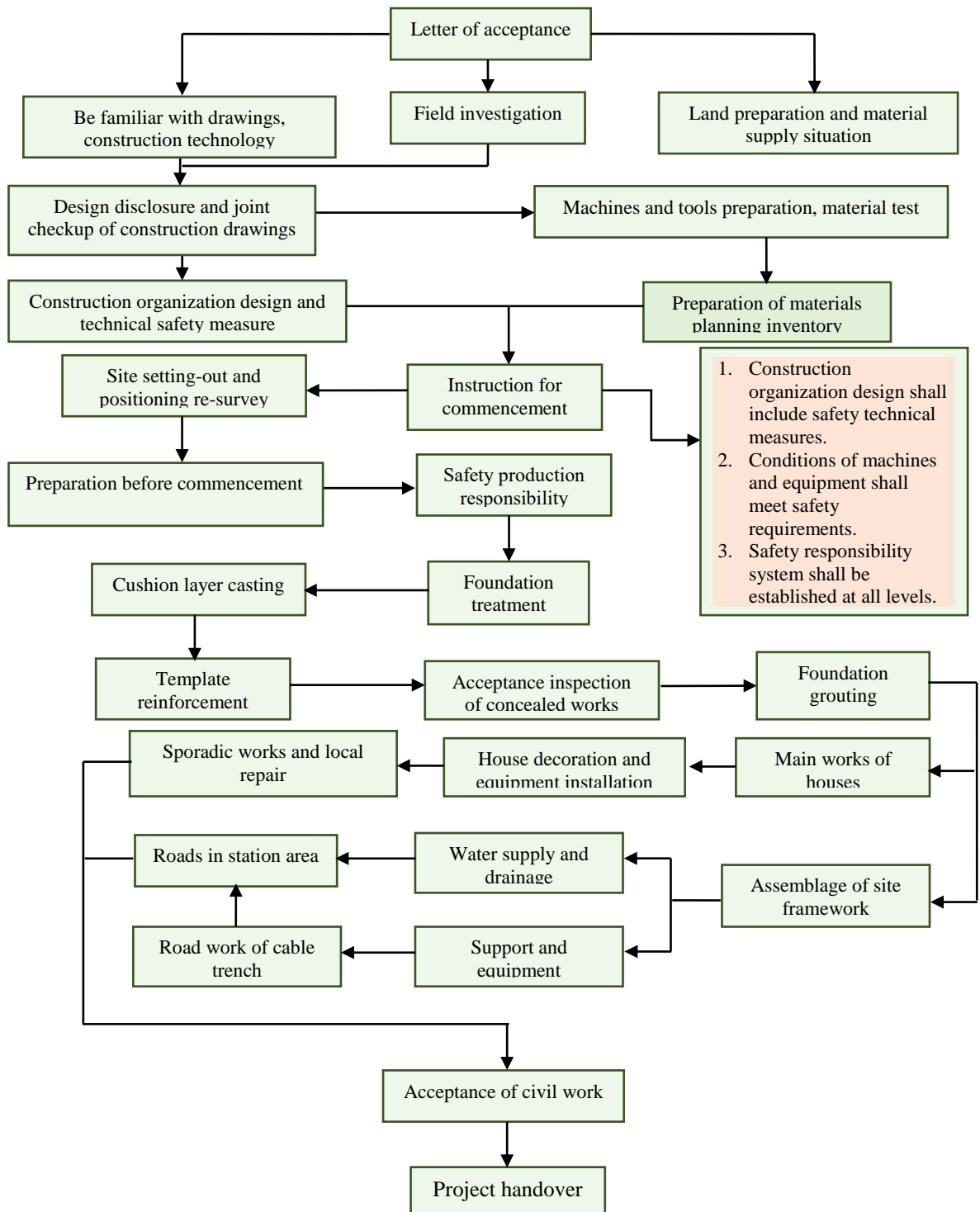
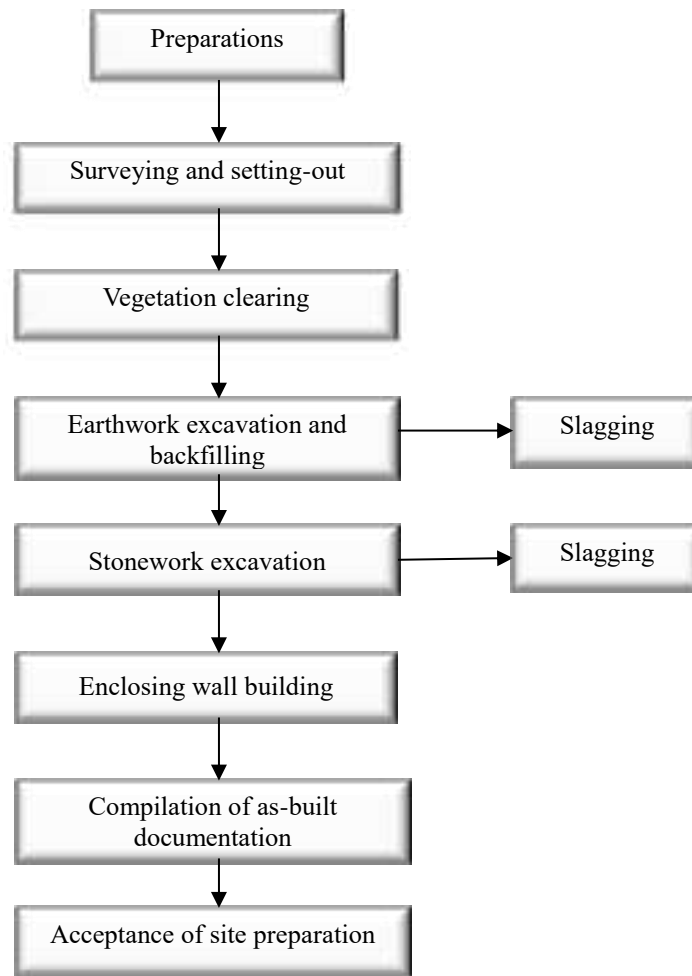


Figure 1.7-1: Construction Procedures for Substation Civil Works



**Figure 1.7-2: Construction Process Flow Chart for Site Preparation**

## 1.7.2 Construction Measures for Main Civil Works

### Surveying and Setting-out

- (1) Layout of survey and control chart: According to the field hand over stake and the coordinate points provided in design drawings, a survey and control network is established for the entire project site; first it is required to survey the control network, and then, it is based on the control network to conduct positioning and setting out for all the buildings.
- (2) Develop survey plan: According to the substation conditions, construction surveying control network shall be properly arranged. No less than 4 control points shall be set up outside the construction area near the external of substation, the control points shall consist of solid and reliable concrete stakes, and result map shall be surveyed and drawn. Intervisibility between control points is required, and all control points shall be outside the boundary of the construction area to prevent them from being damaged during construction. Construction survey control points may be set up within the substation area if necessary; and intervisibility between control points within the substation area is required; control points within the substation area shall frequently close with control points outside the substation area and permanent survey pier mark to prevent deviation which results in rework.

- (3) Survey and controlling and observation shall be conducted by professional staff. Following work shall be done during survey and controlling, namely, calibration of dimension and height, settlement observation as per requirements; observation results shall be recorded, and bench mark point shall be set up within the substation.
- (4) Archive data: Arrangement of survey control network and survey results shall be properly archived as technical data and serve as the basis of final survey, and survey control network diagram shall be drawn, properly signed and filed for future use.

### **1.7.3 Land Preparation**

Land preparation construction of substation stated in the Contract mainly includes earth excavation, rock excavation, earth backfilling, and grouted rubble retaining wall, etc.

#### **1. Construction Detour**

Construction detour shall be constructed as per construction layout plan, and construction machinery and equipment and materials shall be transported to the job site via construction detour;

#### **2. Constructing Temporary Intercepting Drain**

Constructing temporary intercepting drain prevent surface water like rainwater from scouring and damaging the excavated surface.

#### **3. Earth Backfilling**

For locations lower than the design elevation, earth backfilling shall be conducted with qualified excavated material.

#### **4. Building Enclosing Wall**

Construction of enclosing wall shall be conducted after the earth-rock excavation of land preparation and the construction of cement concrete pavement completed;

#### **5. Constructing Drainage Ditch Within the Construction Site**

Upon completion of land preparation, drainage ditch within the construction site shall be built promptly as per design requirements to drain the hydrops within the site in order to facilitate the construction of buildings and structures on site.

#### **6. Construction Process of Site Preparation**

Construction process flow chart for site preparation is shown in Figure 2.4-3.

### **1.7.4 Construction of Truss, Support and Equipment Foundation**

#### **1. Establishment of Surveying Control Network**

- (1) The first thing to be done is to initially locate the point of square grids. Positioning of square grids shall be conducted based on the main axis which has already been surveyed on the site;
- (2) Based on this, the locations of points shall first be measured on the site as per design positions, followed by elevation difference correction with level gage, and then the locations of points will finally be determined (which shall be points on the axis of truss and support);
- (3) Then the square grids shall be refined to specifically set out the axis control pile point of each foundation;
- (4) Finally the building square grids shall be comprehensively surveyed and checked on site, and then gray line shall be made for excavation.

#### **2. Vertical Control**



Based on the principle of intervisibility and basically equal distance, benchmarks shall be set up on site, locating in the east, west, south and the central. After multiple closures by surveying until the measuring accuracy meets requirement, a measurement results is produced for future reference. Earth excavation and concrete construction of foundation shall make height determination according to this to ensure the accuracy of foundation elevation. Thus the foundation elevation is effectively controlled; moreover, height determination is conducted for many times during the construction (earthwork excavation, foundation pad, basic template, final glass bottom leveling).

### **3. Construction of Truss, Support and Equipment Foundation**

- (1) **Earth excavation:** As the earthwork amount of foundation pit is pretty big, a construction method combining machinery and manpower is adopted; and support shall be provided or not provided according to the soil type and excavation depth of foundation pit to prevent landslip. In case the excavation depth exceeds allowable depth, slope shall be made as per specification in foundation pit excavation. And the foundation pit excavation shall not damage the underground soil structure. Before excavation, preparations for drainage shall be in place to drain the water timely and prevent damaging the soil structure.
- (2) **Construction of foundation pad:** Before construction of foundation pad, a consulting engineer shall be invited to check the foundation subsoil; Only when the design bearing capacity of foundation is met can frame erecting process be proceeded; if the bearing capacity of foundation fails to meet the design requirement, the foundation shall be processed again after a written opinion on foundation treatment is provided by the consulting engineer. When foundation subsoil check is qualified, a check record shall be filled in and signed by parties concerned, then it is allowed to precede the next procedure.
- (3) **Formworks:** Foundation above the ground shall be supported by typified combined steel formworks, the inside of steel formworks is bonded with a layer of PVC board with strong bonding agent to increase the surface smoothness of exposed foundation; To prevent the edges from dropping out, concave lines are provided at internal corners of the formworks to beautify the foundation appearance. PVC board can be used repetitively for 4-5 times.
- (4) **Steel bar binding:** Steel bar shall be fabricated and placed as per drawings. Check against drawings whether the type, diameter, numbers, and spacing of steel bar are correct; whether they are firmly bound together and check for loose binding and deformation; check whether the concrete protective layer meets requirements; After self-inspection is qualified, an on-site consulting engineer shall be invited to perform inspection and acceptance of formworks and steel bar; After inspection qualified and parties concerned sign on the inspection record for concealed works of steel bar works, it is allowed to proceed the next procedure.
- (5) **Concrete construction:** Framework foundation is large bulk concrete foundation, for which the water cement ratio and concrete slump shall be strictly controlled in concrete mixing, and the working mix proportion shall be frequently adjusted and determined according to the site conditions, namely, the dosage of water, sand, stone shall be adjusted from time to time. Aggregate and cement must be tested and analyzed in batches; During transportation, it must make sure that the concrete will be free of delamination, segregation, and leak slurry, and the slump shall comply with the specifications when the aggregate and cement are delivered to the grouting location. Concrete shall be placed and vibrated evenly around the formworks to prevent the core

cup formwork from floating upward or shifting in all directions. Penetrating vibrator is to be used for concrete vibrating, and concrete shall be placed in layers and vibrated in layers with the thickness of each layer no more than 1.25 times of the length of vibrating tube. Vibrating of the upper concrete layer shall be conducted before the initial set of the lower concrete layer to prevent construction joint from being produced; while in vibrating, a secondary vibration method shall be adopted to ensure good contact and increase the compactness; Concrete surface bleeding shall be drained timely. At the contact face between the stepped foundation and the formworks, in order to avoid the phenomenon of voids, pits, a method of adjusting the sand content in the mix proportion of concrete mixture is adopted to reduce the secrete water and improve the workability. Upon completion of concrete placing, cup core formworks is loosened by striking with hammer, crow bar. The formworks are then pulled out after being loosened by chain hoist or double hook. In case the cup-core formwork is floated, the concrete in the bottom of the cup-core formwork shall be cleared timely to ensure the design depth cup rim. During concrete placing the on-site consulting engineer shall supervise the construction at site, and concrete samples shall be taken and preserved as per specification requirements.

- (6) **Concrete curing:** Specific concrete curing measures shall be developed according to the construction season and weather conditions, and a curing method of moisture-retention and heat-insulation shall be adopted.
- (7) **Foundation form removal:** Form removal can only be conducted when concrete strength reaches 2.5MPa to prevent foundation surface and edges from being damaged by form removal; In case of slag cement, the curing temperature shall be 15°~25°C, and curing time 3~5 days.

## 1.7.5 Construction Measures for House-building Projects

### 1. Construction of Foundation

House foundations are usually strip ones. The foundation trench is excavated by machinery and finished by manpower. Before earthwork excavation, well preparation for drainage shall be made to ensure prompt drainage in excavation and avoid damage to the foundation mechanism. For master control building with independent column foundation, the foundation shall be excavated by the combination of manpower and machinery.

### 2. Construction of Main Structures

#### (1) *Masonry works*

As required in the design drawings, the masonry materials shall not be used until they are acceptable in the field sampling test in batches; cement shall be provided with the certificate of quality and shall not be used until it is acceptable in the filed sampling analysis and test in bathes; mortar sand shall not be used until it is acceptable in the field sampling analysis and test and the construction mixture ratio shall be determined by trail-mix and pressure test and site conditions.

Before construction, the elevation, dimension and axis location shall be rechecked, then the floor shall be cleaned up; during construction, the site to be constructed shall be watered and the corners and connections shall be constructed at the same time; at the connections, outside straight tendon shall be reserved and tie bars shall be added.

During construction, story pole shall be made and the method of snapping the line shall be adopted; it is required that the wall shall be smooth, the mortar joint shall be even and the mortar shall be plump.

For constructional column within the block wall, bricks shall be laid before the concrete is poured and the slump of concrete shall not be less than 80mm in order to flow into finger joint and bond with the wall.

Additionally, the opening dimensions and construction elevations shall be strictly controlled.

### **(2) Formworks**

Beam shall be made from shaped and combined steel formworks. The supporting system shall be the ordinary steel pipe scaffolds. Before supporting formwork is constructed on the cast-in-place slab of foundation, the backfills shall be flattened and compacted to keep the supporting system from falling down. During formwork erection of constructional column, waste cleaning openings shall be reserved on the bottom, which shall be plugged after the wastes are cleaned out. During the reinforcement of ring beam formwork, it shall be aligned with line, and when the stair formwork is erected, it shall be set out in line with the story height, during which the formwork of landing beam shall be erected before that of the stair ramp beam and the step formwork shall be erected after the assembly of reinforcement.

### **(3) Reinforcement works**

Besides it shall be fabricated as per the specifications, do make sure that the finished products are well protected. The shaped reinforcement shall be stacked at the specified location and be laid on sole timbers to avoid deformation and corrosion of reinforcement and oil stain. A gangway shall be erected during the enlacement of slab reinforcement and make sure that you never stamp on the reinforcement. Also, do not touch and make the embedded parts, formworks at openings, water and electricity pipelines or other facilities move. Make sure that the embedded pipelines are laid in the correct locations, if any contradiction occurs; it is allowed to bend the vertical reinforcement along the plane and bend the horizontal reinforcement from the top to the bottom, bypassing the embedded pipelines. However, the thickness of the protective layer shall be guaranteed and make sure that the reinforcement never be cut randomly. Additionally, make sure that the reinforcement never be contaminated when you brush dusting agent on the surface of formwork. Operators in all types of works shall never trample on, break off or cut the reinforcement. Do not trample on or walk on the moment reinforcement and negative moment reinforcement of formwork after they are enlaced. The reinforcement workers shall be specially assigned to do repairs when pouring concrete to make sure the moment reinforcements are in the right place. During construction, the debris on the base course shall be cleaned up, especially the debris at places such as the internal and external corners, the parts protruding from the roof, water outlets and pipe sections extending out from the roof and all dusts shall be clean out so as to make combined course and water-proof course. The cement for cement mortar used by leveling course shall be the common Portland cements and shall never be the pozzolan or slag cements, the strength grade of which should not be lower than that required in the contract; the sand for cement mortar should be medium sands; if medium sands are unavailable, fine sands may be used as well; the silt and silty particle content shall not be higher than those required in the contract regardless of sands, otherwise the sands shall be processed and floated.

## **3. Decoration works**

### **(1) Plastering works**

The plastering of wall is essential in decoration works, during which the following shall be noted:

- a. Plastering of base course: before plastering, the mortar, dirt, dust and other debris remained on the wall shall be cleaned out and the wall shall be watered to moist; when the ceiling is plastered, cement mortar shall be brushed exclusively, with the brushing followed by the plastering; if plastering cannot be made immediately after brushing the cement mortar which is dried by air before the plastering continues, the part at the boundary where the cement mortar is not sticky when it is touched by hands shall be removed and re-brushed before the plastering continues.
- b. Before plastering, the cement pad shall be well prepared and the internal and external corners should be made by snapping the line to ensure the smoothness; for cement with a plastering thickness of more than 15mm, it shall be plastered by the layer and shall never be plastered in a time. For the top surface of wall that is already plastered, hollowing and cracking with an area of 10mm<sup>2</sup> shall not occur.
- c. Cement mortar painting, made to prevent damage. When the surface is overlaid by heavy calcium carbonate powder, before which the base course shall be clean up and during which the surface shall be flat and smooth, without leakage and the internal and external shall be vertical, square and upright, with smooth and straight lines.
- d. During construction, the quality inspectors shall enhance the quality inspection, the part that dissatisfies the medium plastering requirements shall be reworked without exception.
- e. It is required to improve the decoration criteria of main structures to some extent on the premise of satisfying the design requirements and not increasing the costs of the Employer.
- f. During the decoration, the principle of aesthetics and coordination shall be comprehensively considered and the details shall be done well.

***(2) Latex paint finishing works***

Repair and clean up the defects on the original wall, then putty thoroughly to level, and then polish with sands to level after the putty is dried, making sure the surface is flat and smooth, with smooth and straight lines; the latex paint shall be applied by the roller painting method and the internal and external corners and the openings on top and bottom shall be brushed with broad brush to level. Puttying and polishing to level and the applying procedures are required to be made twice.

***(3) Wall and floor tile works***

Dip the wall and floor tiles and skirting in water before pavement; pave terrazzo on the floor and rough the mortar floor and wall, being watered to moisture and painted with cement mortar for priming; snap the line to show the level and elevation; level the combined course with 1:3 cement mortar, brush a 1:1 cement mortar on the back of the polished tile and level it in place before pavement, hammer slightly with rubber hammer to make the tile and mortar bonded tightly and calibrate the surface smoothness and joint width; at 15 days before the floor construction, level the floor with cement mortar and then dry it, test the levelness, during which the levelness per square meters shall not exceed 3mm, lay a water-proof ground cushion before construction and then lay the floor, and the joint and height difference shall not be higher than 0.5mm.

## **1.7.6 Construction of Cable Trench**

### **1. Control of Survey**

Since the substation is arranged in the open air, covering a large area and the straight segment of cable trench is relatively large, survey is the key point of control to ensure the straightness of cable trench. Thus, it is required to project the central line of cable trench to

the wall on both sides with the total station, survey the elevations on both sides of the cable trench with level meter, and calculate the elevations at all central segments of cable trench to make it the basis for control.

## **2. Control of Gradient at the Bottom of Cable Trench**

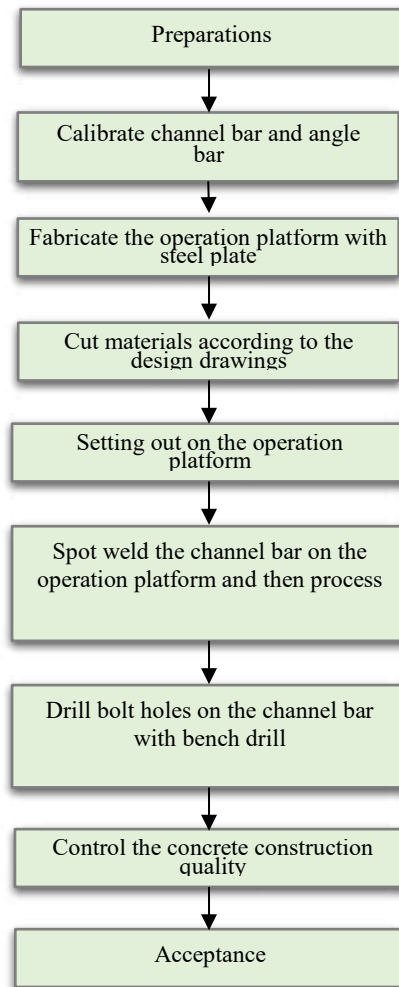
Level the bottom of cable trench preliminarily in line with the cushion. Besides, survey the elevation of each segment accurately in line with the design elevation of trench bottom; after the brick masonry of cable trench is finished, and then snap the trench wall with inked line to make it the basis for a second level. In addition, it is required to ensure the drainage gradient at the trench bottom to avoid water accumulation in cable trench.

## **3. Control of Embedded Parts on the Wall of Cable Trench**

Referring to the embedding method of channel bar in the past, two lines of dowel bars are allowed to be embedded on the wall of cable trench, fix the calibrated strap iron in those two lines of dowel bars, adjust the contact of strap iron and dowel bar until the two strap irons on the top and bottom are on the same vertical plane, then weld them tightly and plastering them level with sand mortar. This not only satisfies the installation requirements of cable tray, but also makes it straight and beautiful.

## **4. Control of Cable Trench Capping**

- (1) Shaped mold shall be made of channel bars and angle bars. ①In order to keep the cable trench capping flat and smooth and the formwork easy to remove and move around, channel bars and angle bars shall be used. ②The method of erecting formwork in the air shall be adopted in line with the capping dimensions and the specifications of cable trench.
- (2) See the formwork fabricating procedures in Figure 1.7-3.



**Figure 1.7-3: Flow Chart of Formwork Fabricating Procedures of Cable Trench**

## **5. Control of Cover Fabrication of Cable Trench**

The followings are the fabricating measures of cable trench cover:

- (1) During cutting, the grinding disk of cutting machine shall be changed from single piece to double pieces, which may make the grinding disk short of hardness and make the joint of angle iron loose due to long time cutting of angle iron frame.
- (2) Before batch welding of angle iron frames, an angle iron frame with standard geometric dimension and smoothness shall be fabricated as mold. The rests shall be manufactured based on it, which can ensure the quality stability of angle iron frame welded by batches.
- (3) Polish the welding joints to level after the angle iron frame is welded completely. Then process all angle iron frames by hot-dip galvanizing method to avoid corrosion and ensure the consistent color.
- (4) The framework of angle iron frame is made of  $\Phi 6.5$  round bar, which can ensure the stiffness of cover and make it hard for cracks to occur due to lack of strength when pouring the concrete.

### **1.7.7 Substation Landscaping**

It shall be performed according to the contract and design requirements.



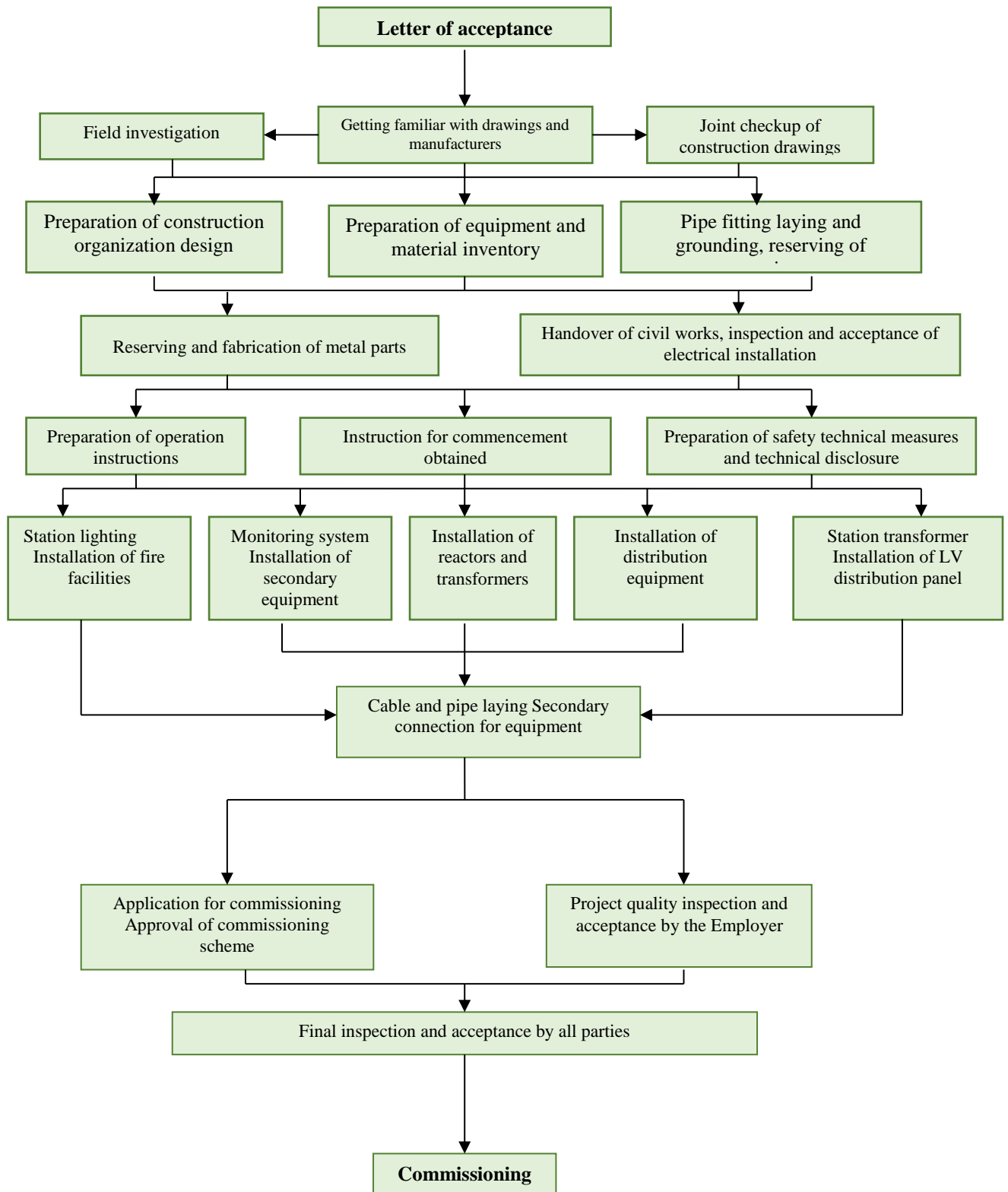
### **1.7.8 In-substation Road Construction**

In order to use the in-substation roads as access roads and ensure the normal operation of construction at all parts, the subgrade of construction road shall be constructed previously. In order to protect the pavement, the in-substation pavement will be constructed after the completion of main structures of the substation according to the arrangement to avoid damage of pavement due to frequent access of construction vehicles in the construction peak and ensure the favorable appearance at the hand-over time. Make sure that the subgrade is well protected after construction to avoid perturbation due to immersion in water. The pavement concrete within the substation shall be mixed with manual 1.0m<sup>3</sup> forced mixers, poured into the storage with dumper and vibrated with immersion vibrator, coordinated with vibrating beam.

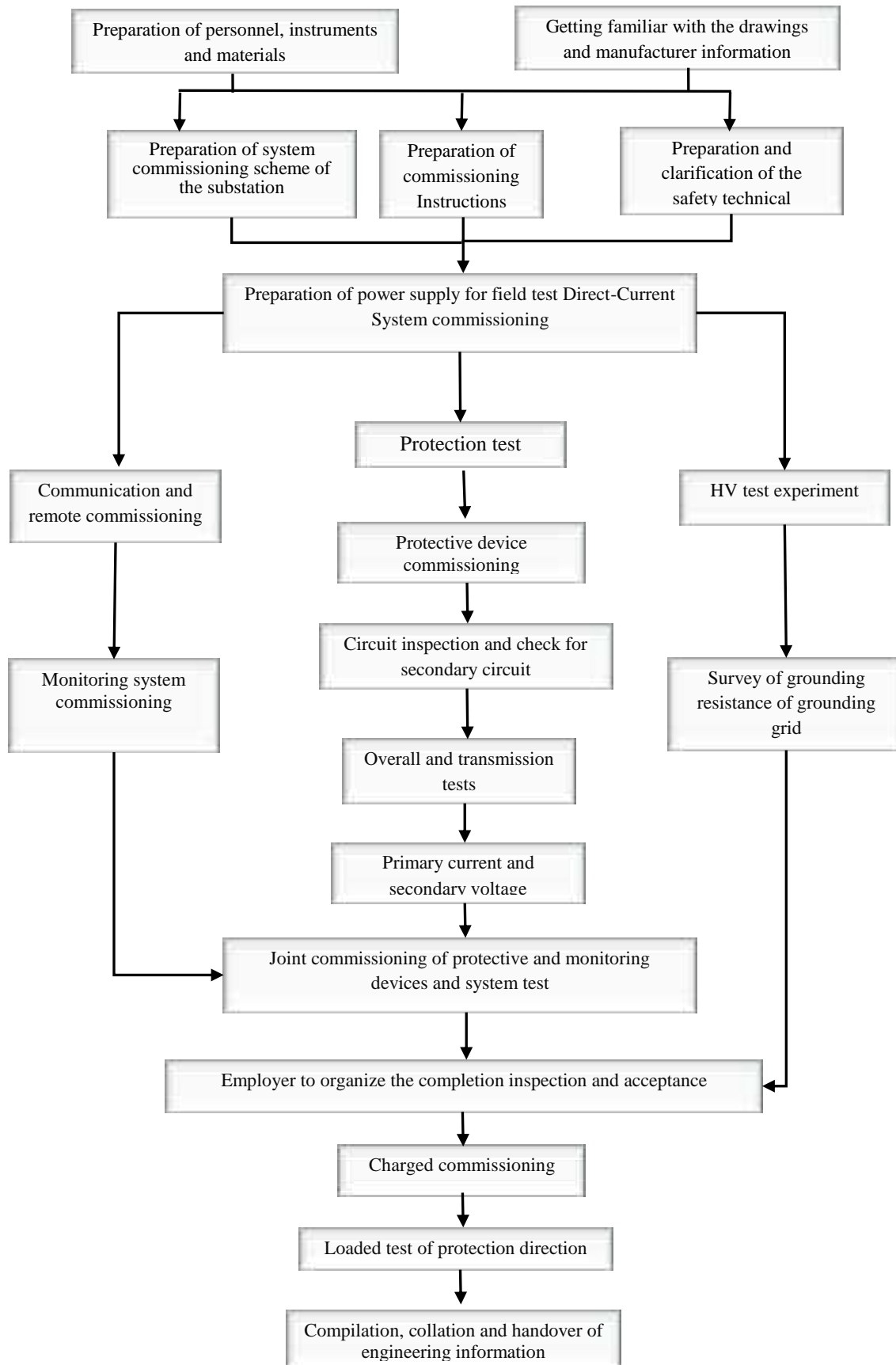
## **1.8 Construction Measures for Main Installation Procedures of Electric Equipment**

### **1.8.1 Flow Chart for Electric Installation**

- (1) See the process flow chart for electric installation in the substation in Figure 1.8-1.
- (2) See the process flow chart for electric commissioning in the substation in Figure 1.8-2.



**Figure 1.8-1: Process Flow Chart for Electric Installation in the substation**



**Figure 1.8-2: Flow Chart for Electric Commissioning in the substation**

### **1.8.2 Protection Measures for Electric Equipment**

- (1) On the arrival of huge objects such as transformers and shunt reactors, it is required to erect a temporary shack around the device with scaffold and seal it up with color fabric after the device is unloaded to the right place.
- (2) On the arrival of panel/cabinet and control box, if they cannot be installed at that moment, then they shall be stored in the permanent equipment warehouse and the bottom shall be raised to avoid rainwater moisture erosion.
- (3) For accessories of all electric equipment, if they are not installed at that moment, they shall be stored in the permanent equipment warehouse and shall be more than 0.5m from the ground.
- (4) Plastic films shall be posted on the installed panel/cabinet, control box and porcelain brushing sleeve of outdoor equipment to avoid moisture and dust.

### **1.8.3 Installation and Laying of Grounding Device**

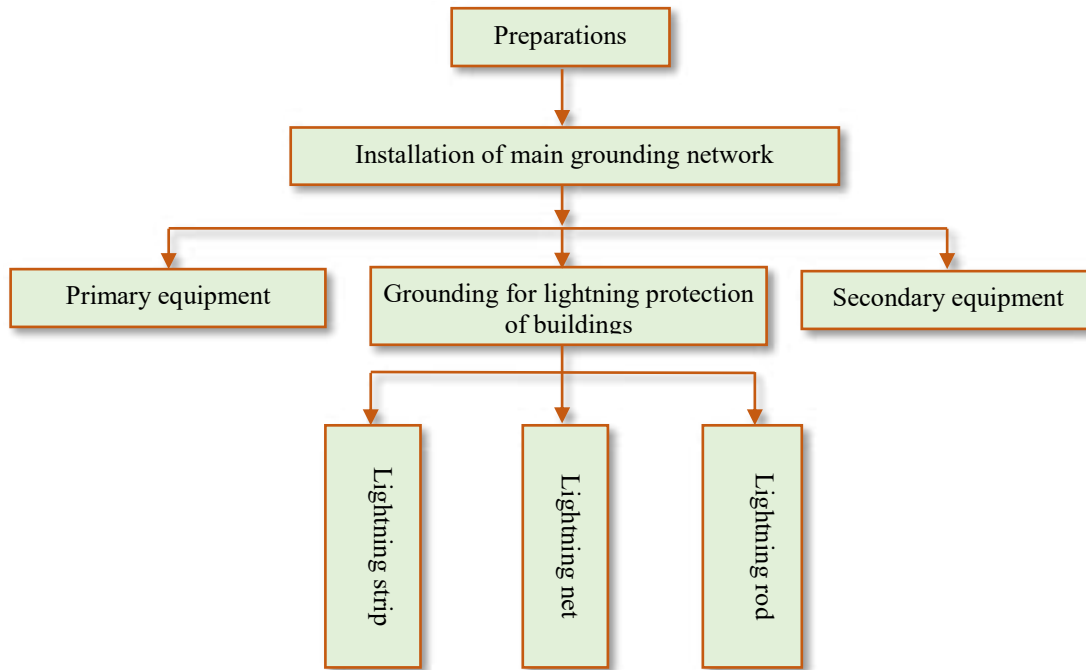
The grounding works in the substation cover the working grounding system of electric equipment and protective grounding system of protective equipment; the former is supported by the grounding network composed of grounding electrode and grounding main line and the branch lines leading from grounding device of electric equipment. The material and cross section of grounding body, and the overlap length, welded surface, laying depth of grounding body shall comply with IEC specifications and design requirements. The overlap of grounding body shall be welded by reasonably qualified welder and provided with anti-corrosion measures. Concealed grounding works shall be jointly inspected and accepted with the consulting engineer after the construction before the backfilling. All branch grounding lines of electric equipment shall be separately connected in parallel into the main grounding network and the grounding body shall be protected by specific measures at the joints it runs through, such as settlement joints and expansion joints.

#### **1. Construction Procedures of Grounding Device**

- (1) Be familiar with the construction drawings and comprehensively understand the positions and requirements of embedment;
- (2) Prepare tools and instruments, electric welders, and cutting equipment and cut and fabricate the grounding embedded parts as per the construction drawings;
- (3) Lay the grounding electrode, connect the grounding wire and process the welded positions with anti-corrosion measures;
- (4) Connect the grounding wire with electric device and process the welded positions with anti-corrosion measures;
- (5) Inspect and accept the concealed grounding works before backfilling; and
- (6) Inspect the grounding device and measure the grounding resistance.

#### **2. Operation Flow of the Grounding Device**

The operation flow of the grounding device is shown in Figure 1.8-3 below.



**Figure 1.8-3: Operation Flow Chart for the Grounding Device**

#### **1.8.4 Embedment of Electrical Lines**

Embedment of electrical lines covers the foundation for cable rack and cable tray, the embedded parts for busbar support, panel/ cabinet foundation, embedded parts for substation foundation, cable conduits and lighting lines.

Natural grounding body shall be fully utilized in the embedment; and any damage to and movement of embedded parts shall be avoid in the concreting of embedded parts; exposed embedded parts and thread of embedded foundation bots shall be protected; the installation position and error shall be inspected and reviewed after embedment.

##### **1. Cable Rack and Busbar Support**

The embedded parts for cable rack shall be arranged straight horizontally and vertically, firmly secured, and evenly spaced. The embedment of embedded parts for busbar support shall be completed after the floor rebar binding in civil works and before the concreting and be subject to the position review of embedded parts.

The cable rack shall be processed and fabricated as per the design drawings before applying the anti-rust primer and aluminum paint as the finish. The cable rack is welded by designations onto the embedded parts on both sides of cable trench, where the cotton thread shall be used to calibrate the levelness; the rack shall be firmly welded and straight horizontally and vertically with horizontal error no more than 5mm; for an inclined trench, the rack shall be fixed at the same slope grade as that of cable trench; the rack welded on both sides shall be staggered; the distance from the top layer of cable rack to the trench top and the distance from the bottom layer to the trench bottom shall comply with design requirements; the galvanized flat steel shall be used on both sides of cable trench to connect with all racks, for reliable grounding.

##### **2. Embedment of Channel Bar Foundation for Panel/ Cabinet**

Foundation embedment for panel/cabinet shall be performed during the 1st stage concreting of civil works; the channel bar shall be installed when the foundation meet the strength requirement; a level shall be used during the installation of channel bar foundation

for levelness calibration, which is required to comply with specifications, and the top thereof shall be 10mm higher than the screened ground. The weld joint is ground with angle grinder after this, and the channel bars and main grounding network shall be connected for reliably grounding.

The allowable deviation of channel bar foundation for panel/ cabinet shall follow the Table 1.8-1.

**Table 1.8-1: Allowable Deviation for Channel Bar Foundation**

Item	Allowable Deviation	
	mm/m	mm/full length
Nonstraightness	<1	<5
Levelness	<1	<5
Positional error and nonparallelism	<1	<5

### 3. Embedment of Cable Conduit

Ends leading the cable out of conduit and the grounding body shall be exposed outside the external concrete edge and the height from conduit orifice to the ground shall comply with design requirements. Orifices of cable conduit and wiring tubes shall be well sealed and capped to avoid blockage by sediment and concrete; embedment shall be in coordination with the civil works and the measures like sleeve shall be provided when the conduit runs through joints. For indoor cables running outwards, a significant downward slope shall be formed to prevent water intrusion.

Metal cable conduit shall be coated with anti-rust paint with asphalt paint applied on the exposed part for anti-corrosion purpose. The height of conduit orifice extending out of the ground shall comply with design requirements. The orifices of conduits arranged in parallel shall be kept in alignment, before being grounded, beveled and capped. Sleeve-weld joint shall be used to connect the cable conduit.

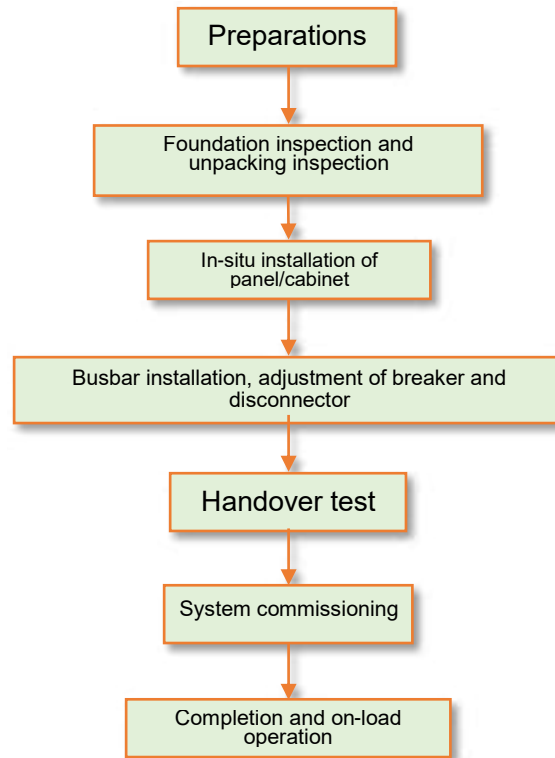
Termination of cable conduits shall be set on electrical box or equipment where they are fixed with templates to ensure correct position.

## 1.8.5 Installation of HV Switch Cabinet

### 1. Installation Flow of HV Panel/Cabinet

The installation flow of HV panel/cabinet is shown in Figure 1.8-4.





**Figure 1.8-4: Installation Flow Chart for HV Panel/Cabinet**

## 2. Allowable Deviation of HV Panel/Cabinet Installation

The allowable deviation of HV panel/cabinet installation is shown in Table 1.8-2.

**Table 1.8-2: Allowable Deviation of HV Panel/Cabinet Installation**

Item		Allowable Deviation
Perpendicularity (per m)		< 1.5
Horizontal	Tops of two adjacent panels	< 2
	Tops of panels in a line	< 5
Panel surface	Edges of two adjacent panels	< 1
	Tops of panels in a line	< 5
Joint between panels/cabinets		< 2

## 3. Connection of Hard Busbar

The busbar surface shall be clean and smooth, free of any crack or deformation; the busbar shall be arranged in the correct phase sequence as per design requirements and marked with clear label. The busbar surface shall be checked carefully before installation; in case of any obvious burr, it shall be grounded with abrasive cloth.

Key points of installation inspection: after leading the busbar into the cabinet, flush the connecting holes of bolts; place small number of positioning screws in position; check the pressure of busbar and adjust the position in case of excessive pressure or displaced hole; apply some conductive past on the contact surface and place and tighten all screws in place. Check the contact surface with torque spanner for tightness as shown in Table 1.8-3; and check the electric clearance of the busbar to different positions inside the cabinet and check the phase sequence as well.

Clean the internal cabinet to remove dust and impurities; recover the cover and close the cabinet upon inspection. The electrical test of cabinet shall be performed as per IEC onsite test standards.

**Table 1.8-3: Tightening Torque for Steel Bolts**

Bolt Specs (mm)	Torque (N•m)	Bolt Specs (mm)	Torque (N•m)
M8	8.8~10.8	M16	78.5~98.1
M10	17.7~22.6	M18	98.0~127.4
M12	31.4~39.2	M20	156.9~196.2
M14	51.0~60.8	M24	274.6~343.2

#### **4. Adjustment of Circuit Breaker and Disconnect**

- (1) adjustment of circuit breaker (applicable for carriage type and fixed type switches): vacuum breaker in HV switch cabinet have been adjusted by manufacturer and is not allowed to be adjusted on site; should the mechanical properties of the breaker do not comply with requirements its manufacturer shall be promptly notified for onsite adjustment;
- (2) adjustment of disconnect (applicable for fixed type switch): check if the switch complies with specifications; if not, its manufacture shall be promptly notified for on-site adjustment. The switch shall be checked for the three phase synchronization, eccentricity of contact terminal and the contact between contact terminal and contact finger.

### **1.8.6 Framework and Conducting Wire Installation**

#### **1. Re-survey of Foundation Level and Axis**

- (1) Re-survey of level gauge is to be used to re-measure the bottom level of foundation in order to achieve measurement leveling according to the design elevation. When leveling, reference points are to be marked around the foundation, and cement mortar or fine aggregate concrete are to be used for floating. When the foundation bolts is to be buried directly, the elevation of the top surfaces of the foundation and the bolt shall be re-surveyed. Moreover, the bottom elevation of the heel of bracket structure shall be set out on the bolt, which is to be adjusted as per the elevation.
- (2) Re-survey of axis Theodolite, stay wire and steel ruler are to be used to re-survey the basic axis, and the limit line is to be marked with red paint on the foundation surface according to the diameter of framework pillar and the square-rooted size of A-pillar. The axis of foundation bolt shall be re-surveyed when the foundation of bolts is to be buried directly.

#### **2. Secondary Component Hauling and Pole Arrangement**

- (1) The route for transport vehicles and the plan of the component pole arrangement are to be formulated before pole arrangement is performed according to the overall construction site plan.
- (2) During secondary hauling, crane is to be adopted for loading and unloading, so the components shall be properly transported to the designated places by appropriate transport tools and methods. Unloading with direct rolling is strictly prohibited. When rolling the steel pole manually on the ground, the personnel shall be coordinated with

no person standing in front, and when moving horizontally, wooden wedges shall be used to fix the steel pole firmly all the time.

- (3) The numbers of components and foundation shall be checked carefully before the pole arrangement is conducted so as to ensure the position and direction of the structural support, and the end of pole shall be arranged in the vicinity of the foundation; during pole arrangement, the components shall be leveled up and straight, and at least two points of support shall be ensured for each section of the pole.

### **3. Component (welding) Assembly**

#### ***(1) Welding of steel tubular pole***

**a.** The weld crater including its vicinity area with a diameter of 10-15cm is to be cleaned and the weld crater is to be polished to reflect metallic luster. Furthermore, it is required to align the wheel ring, so when the clearance of wheel ring is different, the pole shall be turned for adjustment; if it fails to be adjusted, gas cutting shall be adopted; however, groove shall be cut and filler welding is prohibited.

**b.** Spot welding for fixing shall be performed immediately after the alignment of the pole section. For each weld crater, spot welding shall be performed at four symmetric points (first vertically and then horizontally) with the length of spot welding 2-3 times of the thickness of tube. For tube with more than two weld craters, the vertical spots shall be spot welded prior to the horizontal spots. The material used for spot welding shall be identical to formal welding. The connection segments of steel pole shall be checked for stretch bending upon the completion of spot welding. The pole spot-welded shall be welded on the same day, or it shall be checked for bending and sinking the next day before welding to see whether measures are needed for correction.

**c.** Multi-layer welding with v-groove shall be adopted and the junctions of multi-layer welding shall not be overlapped. Moreover, it is required that the first two layers be welded by eight segments.

In order to prevent the pole body from bending caused by the weld stress, symmetrical welding shall be adopted and the weld crater shall be filled in during welding closing (the last layer of weld joint shall be welded continuously). A weld crater shall be welded continuously. In principle, a steel pole shall be welded by the same welder.

**d.** For A-truss and A-truss with stay-pole, straight pole and stay-pole body shall be straight. The end of the pole shall be aligned when arranging to keep the center line of the pole body identical, and welding shall be performed when the measurements have been reviewed to be correct.

**e.** Upon the completion of the welding and correction of local deformation, antiseptic treatment shall be performed as per the design requirements.

#### ***(2) Assemble of structural support***

**a.** When the structural supports joint with each other, the outer wall of the components shall remain flushed and be clamped with clamping apparatus. Moreover, the bracket (or the support) for the tube shall be secured without moving, and abutting joint with brute force shall be avoided with local error no more than 20% of the wall thickness and 3mm. When each segment of the steel tube is jointed, the axis error shall be no more than 2mm.

**b.** The iron plate surface of the pole top shall be perpendicular to the axis of A-pole, and the center line of the side of top plate shall be on the same surface as the axis of the two legs of A-pole.

**c.** When assembling A-truss and A-truss with poles, it is recommended to have temporary support at the bottom in order to ensure the root open distance and length to be in

conformity with the design requirements of drawings. For the convenience of hoisting, when A-pole is assembled on the ground, it shall be arranged along the direction of axis of framework (beam) and the pole leg shall be close to each corresponding foundation cup.

**d.** Components such as steel ladder and ground terminal shall be mounted in place on the truss bar as per the perspective of truss. Note that the position and direction are not allowed to be wrong.

**(3) Steel beam assembly**

**a.** When assembling the steel beam, it is recommended to abide by the assemble procedure, i.e., assemble the bottom chord prior to the top chord and principal material prior to auxiliary material.

**b.** When assembling the steel beam, the bottom chord of the steel beam shall be supported as per the design and process requirements, i.e., appropriate pre-camber amount is to be reserved at the designated position to ensure that the vertical deflection of the beam is within the design value. Tighten all the bolts 2-3 times in sequence to prevent steel beam from deformation.

**(4) Bolt Installation**

**a.** The bolts is to be mounted in the same direction: The flange bolt of steel column is to be run through from bottom to top whereas the bolt on the gusset plate of the lower surface of the steel beam is to be run through from top to bottom and the bolt of gusset plate on the side is to be run through from inside to outside. Moreover, the requirements for the strength of coupling bolts shall be reconfirmed as per the drawings to avoid using the wrong model. The gusset plate for high-strength bolt connection and the butt joint faces of installation which must be used shall be comply with the design requirements and the use intensity shall be no less than the high-strength bolt required by the design.

**b.** Ordinary wrench is to be used to screw the bolt initially while torque wrench is to be used to screw the bolt finally, where the torque value is to be in accordance with the specification.

**c.** Acceptance of ground facilities: mainly including checking the direction and firmness of the bolt, the perpendicularity of the pole, the foot spacing and length of steel pole, the tortuosity sagittal height of steel pole, the tightening surface of flange, the arch value of steel beam, the total length after assembling, hole spacing between the mounting holes on the support and the center deviation of wiring board. The mounting shall be performed upon the completion of acceptance.

**d.** Component assembly: When the components are assembled on a specialized platform, it shall avoid damage to the zinc coating and prevent the components from deformation.

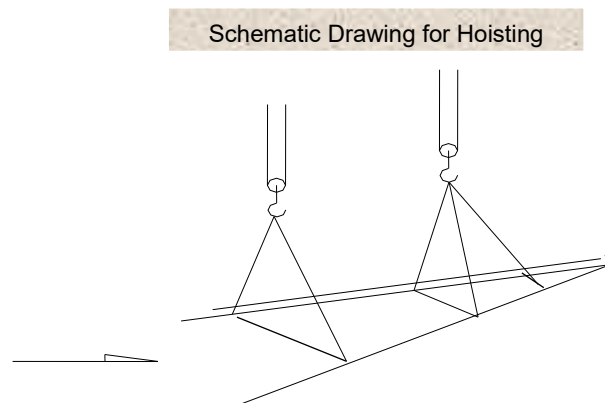
**4. Hoisting of Truss/Support**

(1) Foundation leveling as per the actual length of the framework pole to ensure the elevation and levelness of framework beam and the base elevation is to be adjusted with sizing block. It is also required to consult the acceptance inspection. Moreover, the center-of-gravity position of the component is to be calculated to determine the binding and hoisting method. When hoisting, measures shall be taken to avoid damage to the zinc coating and component deformation. Hoist and load lifting device is to be selected as per lifting weight.

(2) The zinc coating on the surface of truss/support shall be checked for quality and deformation prior to hoisting.

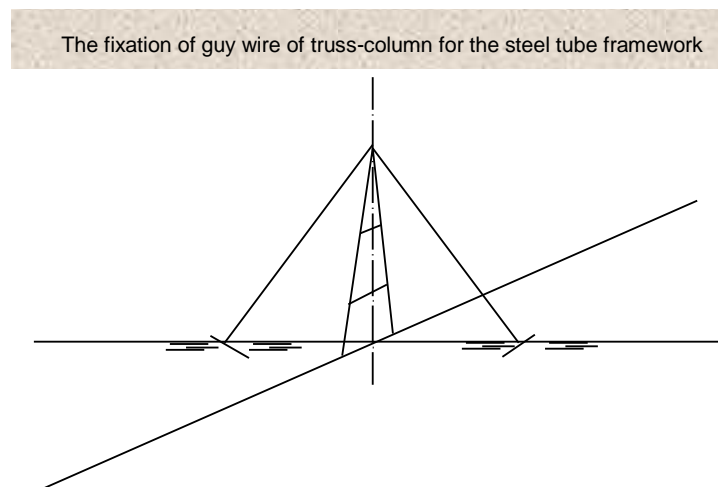
(3) When hoisting, the location and perpendicularity of the axis of truss/support shall be strictly controlled and the working fastening shall be secure.

- (4) The welding quality of the framework shall be guaranteed, i.e., the welded joints shall be fully-welded, the surface shall be smooth without obvious bubbles. Furthermore, the bolts of steel framework shall be fastened.
- (5) During the transport and assembly of components, they shall be moved lightly to avoid damage to the zinc coating and prevent the components from deformation. Note to check the model, specifications, quantity and fastenings of the components, and pile up them according to the types and numbers so as to prevent any error during assembling. During mounting, the construction detour for hoisting equipment and transport vehicles shall be ensured to be clear so that the hoist is not to bump against the components when the hoist is rotating backwards. Note the direction of hoisting to avoid direction adjustment in the air so as not to affect construction progress and safety.
- (6) Hoisting of framework : Calculate the maximum hoisting height and weight according to the drawings, and the results are to be used to determine the binding points, the length of hoisting arm required and relevant tool. When the steel tubes used as framework poles are bound and hoisted, use one 25t lorry-mounted crane to hoist and another one to assist (for securing the stand hoisting). See Figure 1.8-5.



**Figure 1.8-5: Schematic Drawing for Hoisting**

The binding and fastening of guy wire: The guy wire of truss-column is secured as shown in Figure 1.8-6:



**Figure 1.8-6: The fixation of guy wire of truss-column for the steel tube framework**

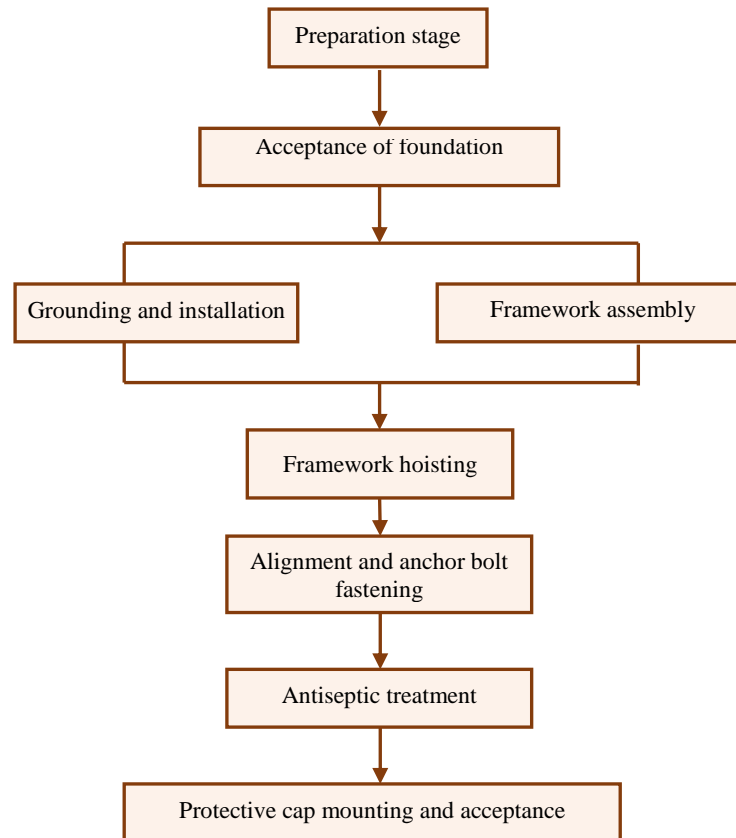
A pile type ground anchor is used for fixing the guy wire, i.e., wood piles (1.5-2.0m long) are driven into the ground obliquely with the buried depth no deeper than 1.2m,

and a fender skid is buried at 0.4m from the ground. Two or three piles connected are to be driven as per the loading requirements. The binding points for the steel crossbeam shall be on the joints of top chord and are symmetrical to the gravity of cross beam. The quantity and positions of hoisting point are relevant to the form and span of the cross beam. When the span is longer than 30m, cross hanging beam is to be considered to use so as to lower the height for binding. The angle between the hoist cable and horizontal plane shall be no less than  $45^\circ$  in order not to put too much pressure on the beam, so  $45^\circ$  is recommended.

- (7) Alignment and final fixation of framework pole: Alignment includes plan position alignment and perpendicularity alignment. Two theodolites are adopted for the perpendicularity inspection, i.e., the mounting center of the pole is checked for the perpendicularity from the two adjacent axles on the foundation of the framework pole. The allowable value for the deviation of perpendicularity shall be  $1.5/1000$  of the height of the pole and no more than 25mm when  $H \geq 10\text{m}$ . Method for alignment: when the deviation of perpendicularity is small, the alignment is to be achieved by screwing the anchor bolts with corresponding direction or using more or less iron blocks; when the deviation value is large, jack or buy wire shall be adopted for alignment. The pole shall be fixed finally immediately after the alignment of the framework pole, and the anchor bolts shall be screwed and fastened as per the specified torque. Then the whole row of framework is hoisted according to the above procedures.
- (8) Hoisting machinery shall be determined on the basis of the sizes, the maximum hoisting weight, the maximum hoisting height, topographic condition (working radius for hoisting) and the performance parameters of the hoist. Furthermore, the hoist belt (or wire rope) used for hoisting, the model of clamp, the length of temporary cable and the loading of ground anchor shall be calculated so as to select hoisting equipment with qualified inspection.
- (9) Wire rope and hoist belt shall be used for the binding during hoisting. When the wire rope is adopted, soft padding (such as linen) shall be added for the contact area between the wire rope and the end of the pole to not only prevent the wire rope from wear and breakage result from hard contact but also avoid the wear of the anticorrosive coating of the component. The wire rope or hoist belt shall be bound securely and auxiliary trip mechanism on the ground shall be provided. The angle between the hoist cable and component is generally  $45^\circ \sim 60^\circ$  to reduce the horizontal pressure of the hoist cable on the component. Calculate the maximum hoisting height and weight according to the drawings, and the results are to be used to determine the type of hoisting equipment.
- (10) When the component is hoisted to the height 0.1m from the ground surface, hoisting shall be paused for a moment for checking any abnormality, and hoisting can be continued if no abnormality occurs.
- (11) When the components are hoisted, they shall be held by personnel to put into the foundation cup or the directly-buried bolt on the foundation with careful hoisting. Speedy operation is prohibited!
- (12) When the framework is hoisted, reliable ground shall be done without delay especially in the thunderstorm season. Framework with lightning conductor shall be grounded immediately after the hoisting. If the ground grid has not been laid, the framework shall be connected with temporary ground device with ground resistance meeting the specifications.



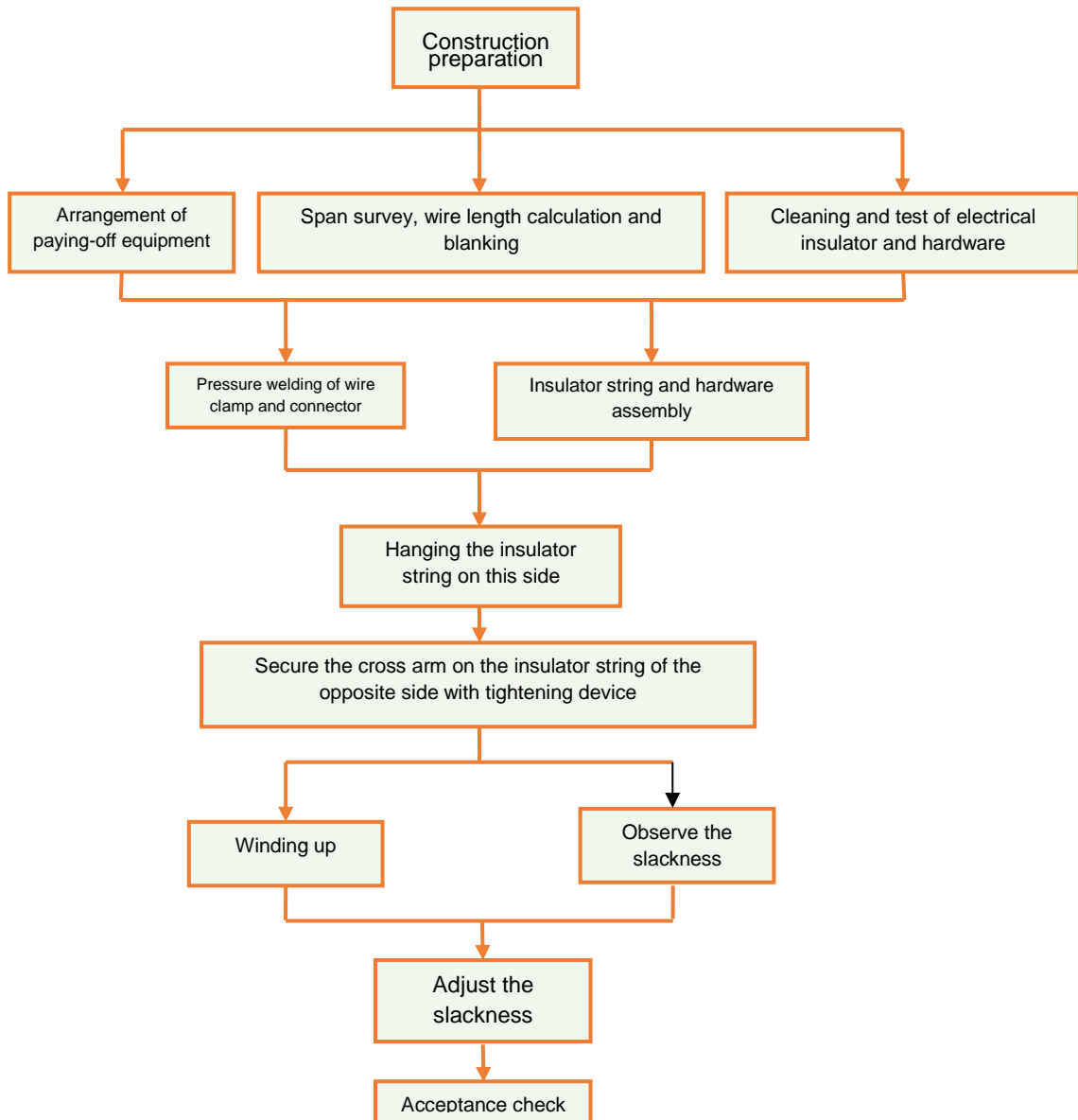
- (13) The cross beam shall be hoisted after the framework on both sides have been mounted and fixed. The cross beam shall be bound with hemp rope before hoisting in order to control the beam swinging and lead it in place. Upon the placement, adjust the position of the girder and the perpendicularity of the framework. When the design requirements are met, use bolts to fasten the connection framework. Figure 1.8-7 is shown the Flow Chart for Hoisting and Assembly Procedures.



**Figure 1.8-7: Flow Chart for the Installation Procedures of Support and Framework.**

## 5. Wire Installation

- (1) Check the hardware, wire and electrical insulator thoroughly for defect before installation. Hardware shall be sampled proportionally for anti-destructive testing. Accurately survey the span between wires and trace allowance is reserved according to the span length when blanking. The length of the wire shall be rechecked in front of the tension clamps on both ends of the hydraulic crimping wire.
- (2) Do not damage the wire when the electrical insulator, hardware and wire are assembled, and the direction the screw is run through shall be in line with the design requirements.
- (3) Adjust the slackness of the wire when winding up.
- (4) Safety belt must be fastened and helmet must be worn when working aloft. Personnel on the ground shall be aware of falling objects all the time.
- (5) Check the charged equipment in the vicinity of operation point for the safe distance from the operation point. If it fails to meet the requirements of safety construction, safety measures such as insulation, shielding and power cut shall be taken.
- (6) See Figure 1.8-8 for the installation flow chart of wire (see the page below).



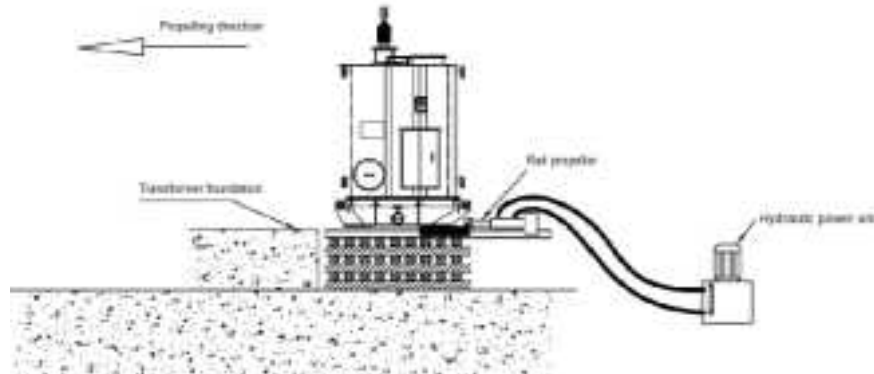
**Figure 1.8-8: Installation Flow Chart of Wire**

### 1.8.7 Outdoor Electric Equipment Installation

#### 1. Installation of Main Transformer and Shunt Reactor

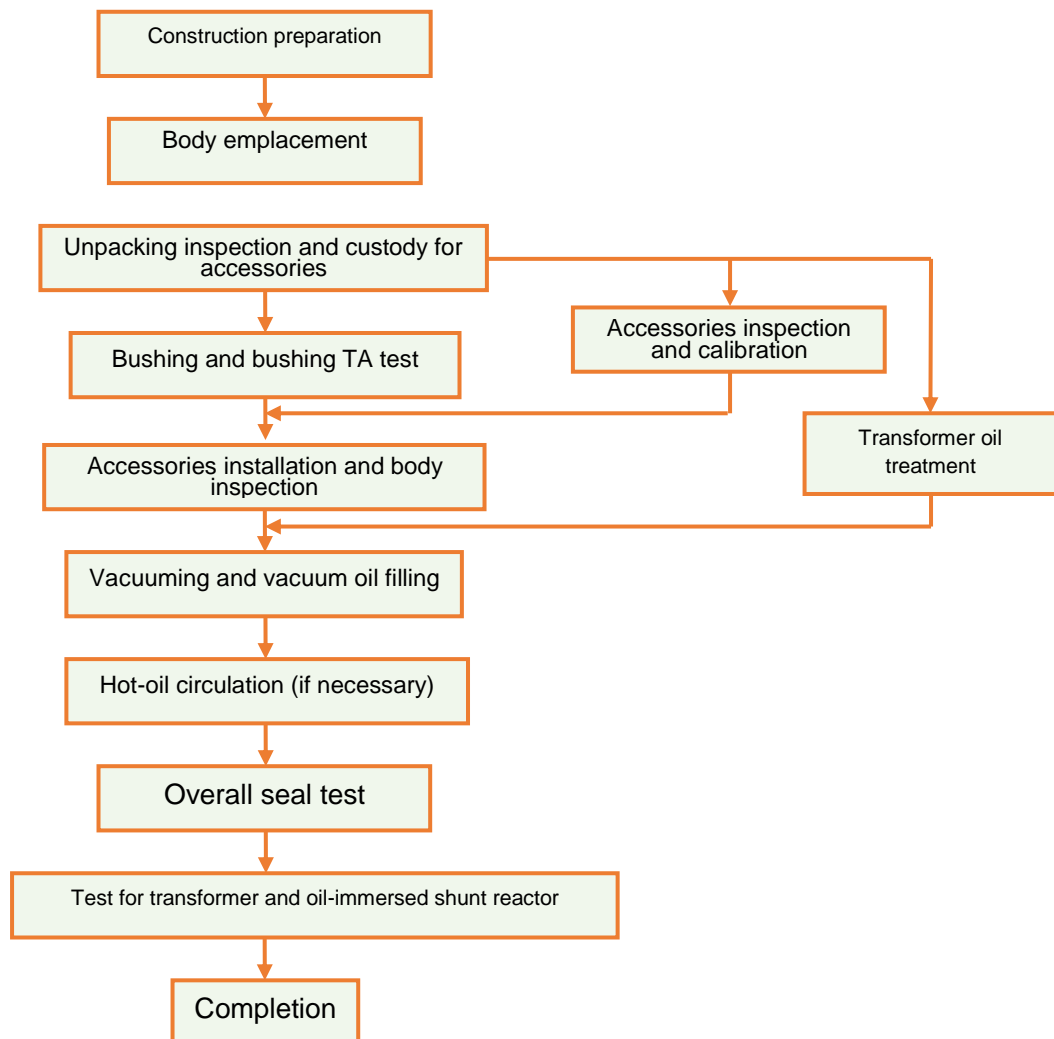
- (1) The transformers and shunt reactors, after being hauled to the site shall be first subject to visual inspection. The inspection is made to see whether the body shows any damage, crack, deformation, and bump, whether the nameplate, product technical data, and conformity certificate are complete and consistent with the design and ordering contract.
- (2) The collision recorder is inspected to determine whether any collision exceeding the specified g value occurs. According to the installation experience of international similar substations, when the collision g value is less than the required factory default value, it is unnecessary to inspect the core suspension so as to reduce the probability of coil wetting.
- (3) Prior to the installation of transformers and shunt reactors, the bushing type current transformers, capacitive bushings shall pass the field handover test. Buchholz relay, temperature measuring device and pressure relief valve shall properly calibrated.

- (4) Accessories installation: The accessories to be installed include the radiator, oil pipeline, explosion-proof tube, oil filter, monitoring meter, gas relay, bushing, turret, conservator, on-load tap-changer, breather, and internal connections.
- (5) Oil filling: The vacuum oil filling method is adopted for oil filling, after the oil is placed still for 24 hours, and then the air is vented.
- (6) Emplacement diagram for the transformer and shunt reactor is shown as Figure 1.8-9:



**Figure 1.8-9: Emplacement Diagram for the Transformer and Shunt Reactor**

- (7) Installation diagram for the transformer and shunt reactor is shown as Figure 1.8-10.



**Figure 1.8-10: Installation Diagram for the Transformer and Shunt Reactor**

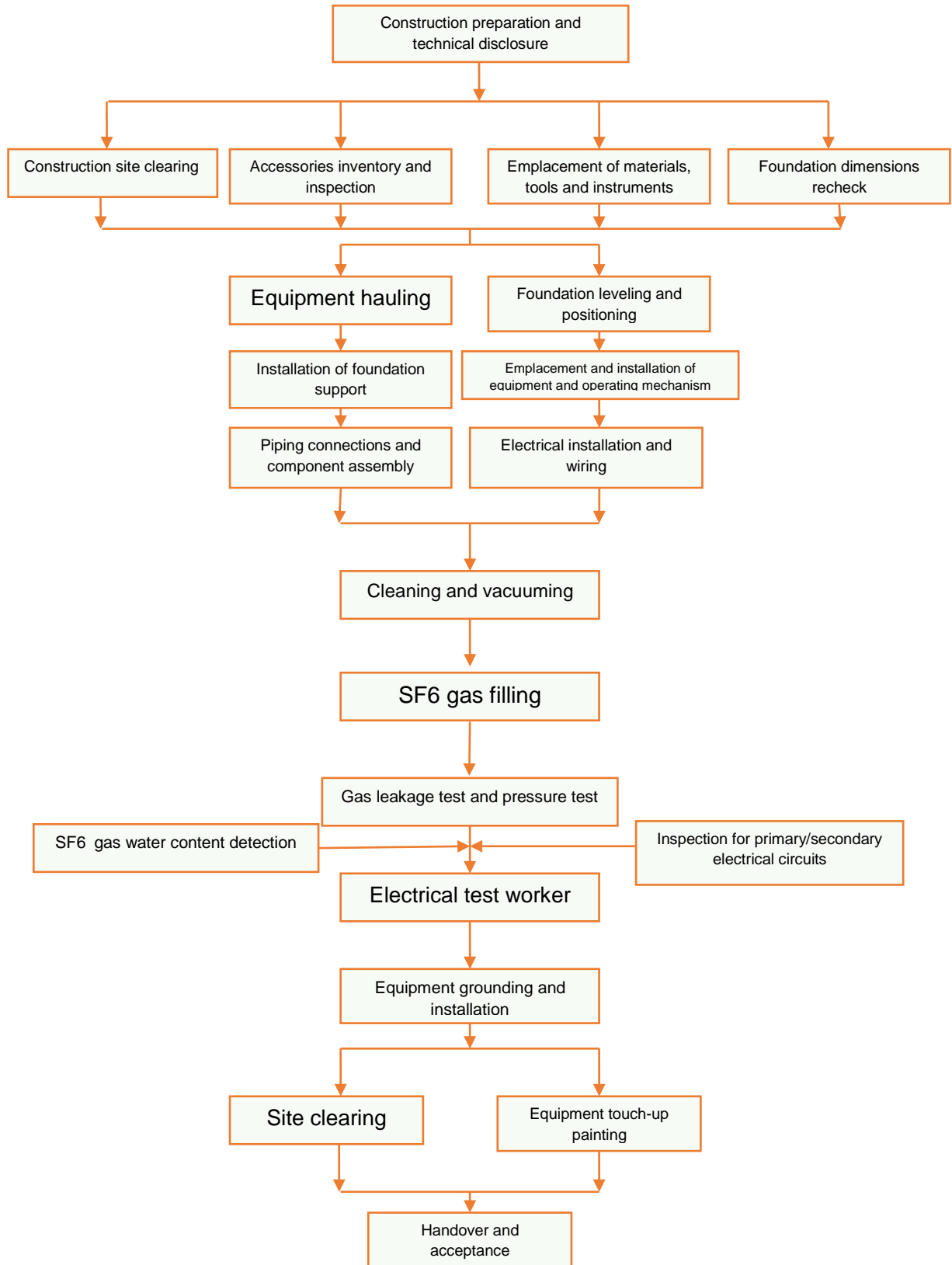
## **2. SF6 Circuit Breaker Installation**

SF6 circuit breakers shall not be subject to inversion, tipping, collision, and severe vibration in the process of shipping and handling. Field inspection: The packaging shall be free of defects and damages, all components, accessories, spare parts and special tools and instruments shall be complete without damage, deformation and corrosion; porcelain pieces and insulation parts shall be free of cracks and breakage; for the transport units or components filled with sulfur hexafluoride gas, the pressure value shall be consistent with that specified in the technical specifications; the factory documents and technical data shall be complete.

The principles below shall be strictly followed during installation:

- (1) The check shall be made to ensure the horizontal error of SF6 circuit breaker base and embedded parts shall not exceed the value specified in technical conditions for the product.
- (2) The enclosed components, prior to assembly, shall undergo the following inspections: All parts shall be intact; porcelain pieces shall be free of cracks, insulation parts shall be free of moisture, deformation, peeling and breakage; wiring terminals, connectors and current carrying portions shall be smooth without corrosion; the pressure and water content of the gas in the gas chamber gas shall comply with the technical requirements for the product; fastening bolts for each component shall be complete without loosening; various connectors, accessories and installation materials shall meet the technical requirements for the product in terms of materials, specifications and quantity; supports and grounding leads shall be no rust or damage; density relays and pressure gauges shall pass the test; porcelain bushing shall be internally smooth without burrs; explosion-proof membrane shall be intact.
- (3) The electric components assembled in the manufacturing plant shall not be subject to inspection under disassembled conditions during site assembly, if the components are necessary to be disassembled on site due to defects, the consent of the manufacturer and consulting personnel shall be obtained, and the disassembly shall be conducted under the guidance of the factory personnel.
- (4) SF6 circuit breaker shall be assembled under the conditions of no wind & sand, no rain & snow, and air relative humidity of less than 80 %, and the measures shall be taken for protecting against dust and moisture; the assembly shall conform to the number and procedure specified by the manufacturer, and disorderly assembly is not allowed; the cleaning agents, lubricants, seal grease and wiping materials used shall meet the technical requirements for the product; the seal groove faces shall be clean without scratch marks during contact; the used seal gasket shall not be used again; the seal grease during application shall not flow into the inside of the gasket to contact with SF6 gas; the lifting appliances and lifting point shall be selected as per technical regulations by the factory.
- (5) SF6 gas filling shall meet the following requirements:  
SF6 gas shall be attached with a delivery test report and conformity certificate, and the gas has been inspected in water content on site and the water content meets the requirements; prior to gas filling, the filling equipment and pipes shall be clean without water and oil; and the pipeline connections shall be free of leakage; the equipment, before the gas is filled, shall turn into vacuum state according to the technical conditions; while vacuuming, the backward flow due to sudden pump stop or disoperation shall be prevented.

- (6) SF6 gas is a kind of asphyxiating gas, which is heavier than air and not easy to exhale, so safety precautions should be taken to avoid suffocation poisoning due to gas leakage, and the valve nozzle is prohibited to face the personnel during gas filling.
- (7) See Figure 1.8-11 for the installation flow chart of SF6 circuit breaker (see the page below).



**Figure 1.8-11: Installation Flow Chart of Sf6 Circuit Breaker**

### 3. Installation of Transformer, Lightning Arrester and Post Insulators

#### (1) Transformer installation

When the voltage (current) transformer is installed, the lead connecting to the transformer shall not apply excessive lateral tension to the transformer ends; attention shall be paid to the right direction of the primary polarity and the match with the secondary protection polarity; upon the completion of installation, the flange seal shall be checked to ensure that no oil leakage occurs, the oil level is in line with operational requirements, and the corrugated bellows within the cover shall be flexibly retractable and subject to normal breathing; for the transformer of which the lead is connected to the end-screen terminal, the end-screen terminal shall be reliably grounded, and this terminal is only opened during the dielectric loss angle test.

#### (2) Lightning arrester installation

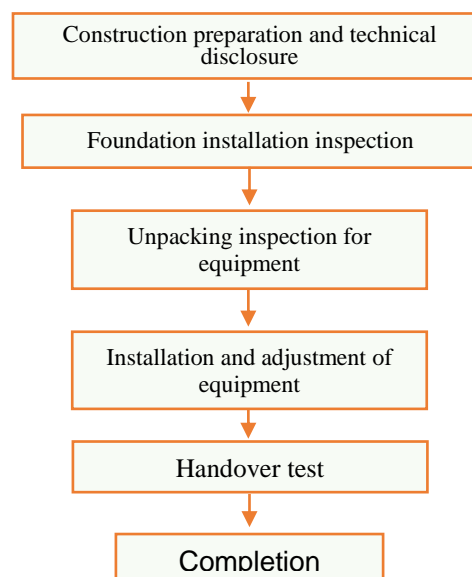
The following inspections shall be made prior to the installation of lightning arresters: Porcelain pieces shall be free of cracks and damages, porcelain bushing shall be firmly bonded with iron flanges, the flange scuppers shall be unblocked; during transportation, the upper and lower covers for protecting the metal oxide arresters explosion-proof disk shall be removed, and the explosion-proof disk and the safety devices shall be intact; the exhaust passage shall be unblocked, the gas is vented in the right direction, and the exhaust gas will not cause interphase flashover or ground flashover; the position of each section shall be consistent with the factory number during assembly; the arrester lead shall not apply stress exceeding the allowable value to the terminals; the nameplate shall be located on the same side for easy observation, and the verticality shall comply with the regulations; the discharge counters shall be properly sealed and subject to reliable action.

#### (3) Post insulators installation

The insulator base level error shall be not greater than 3mm, the centerline error of post insulators within straight busbar section and the vertical error of the stacked post insulators shall be is not greater than 2mm.

#### (4) Installation flow chart of transformers, lighting arresters and post insulators

Figure 1.8-12 shows the installation flow chart of transformers, lightning arresters and post insulators.



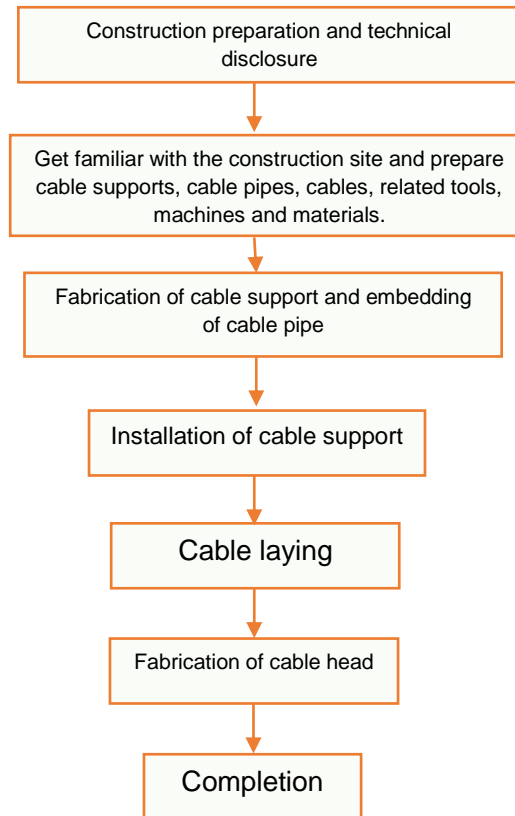
**Figure 1.8-12: Installation Flow Chart of Transformers, Lightning Arresters and Post Insulators**



### 1.8.8 Cable Laying and Installation

Scope of cable laying and installation includes: MV cable laying, manufacturing and installation of cable terminal, laying and installation of LV power cable, laying and installation of control cable and secondary wiring.

- (1) Prior to cable laying, statistics for the cable quantities and routes required in cable list shall be made, and the cable circuit line number and signboard shall be made. The signboard characters shall be clear and durable, including cable number, specification, starting point and ending point.
- (2) Cables shall be arranged by layers in conformity with the requirements of design and specifications, and the arrangement sequence from top to bottom is as follows: MV cable, LV power cable and control cable. Turning radius of cable is as specified in specifications: 10D for LV power cable and control cable, and 15d for cross-linked polyethylene insulation MV power cable. Computer communication cable shall be separately laid from other cables as much as possible.
- (3) Manufacturing and installation of MV cable terminal  
MV cable terminal shall be manufactured by skilled workers with rich manufacturing experiences in strict accordance with Guidelines for Installation and manufacturing procedures.  
The insulating layer shall not be damaged in the process of semi-conductive layer stripping, and the outdoor cable terminals shall be provided with moisture-proof measures if they will not be used temporarily.  
Cable terminal is of cold shrinkable terminal type. Surroundings shall be clear and dry during manufacturing to make sure the stripping position free from pollution. The insulating position shall be cleaned with cable cleaning solvent after stripping for conductor. At compacting terminal block, the phases at two sides shall be reserved longer than the middle phase, and the insulating sleeve shall be protected free from damage during threading. The grounding wire shall be grounded reliably and correctly threaded at threading the zero sequence current transformer
- (4) Secondary wiring of control cable  
The insulating layer of cable conductor shall not be damaged at stripping cable, and the armor plate of armored cable and the shielding layer of shielding cable shall be provided with reliable grounding. Tightly wrap the root part of conductor with phase-splitting color tape to protect and seal it, and then put the control cable head. The cable heads are fixed in a row with cable hoop, and the cable hoops shall be fixed on the cabinets with bolts. The cable signboard shall be easy to be observed and consistent in height.
- (5) See Fig. 1.8-13 for the flow chart of cable laying and installation (see the page below).

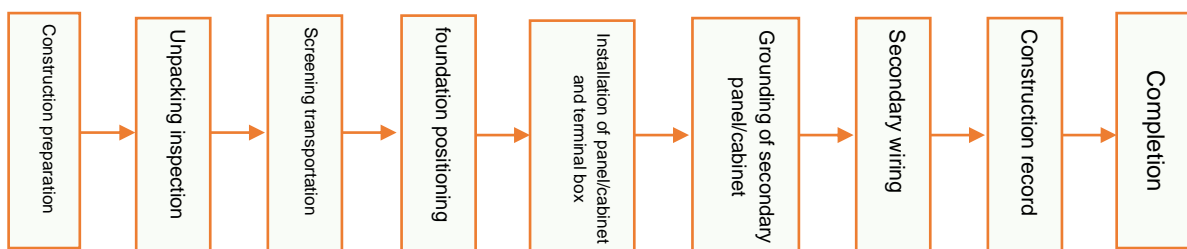


**Figure 1.8-13: Flow Chart of Cable Laying and Installation**

### 1.8.9 Installation of Secondary Electrical Equipment

Secondary electrical equipment mainly includes console, monitoring, protection, communication and DC panels/cabinets, LV panels for station and communication power supply device.

Fully and correctly understand the electrical principle of wiring for panels/cabinets during installation of secondary equipment, get familiar with drawing specifications and technical conditions, inspect the integrity of elements and functional modules one by one, carefully and comprehensively perform secondary wiring to ensure construction as per drawings and reliable, correct and well-insulated circuit connection.



**Figure 1.8-14: Installation Flow Chart of Secondary Equipment**

### 1.8.10 Installation of Communication System Equipment

#### 1. Equipment Panel/Cabinet Installation

Carrier, cable tray, power cabinet, dispatching telephone control board and other indoor equipment are installed on the base of channel steel.

The cabinet shall be reliably fixed and grounded, and the painting surface of cabinet shall be integral, clear and tidy.

Electric elements installed in the cabinet shall be integral and complete, and shall be firmly fixed in place.

Correct wiring, reliable connection, clear and complete marks and insulation in conformity with requirements are provided in the cabinet.

Cabinet and cable pipe shall be provided with fire-proof sealing measures after installation.

## 2. Cable laying and outdoor communication route

Prior to cable laying, inspect the embedding quality and quantity of pipes and boxes and repair if failing to meet the requirements.

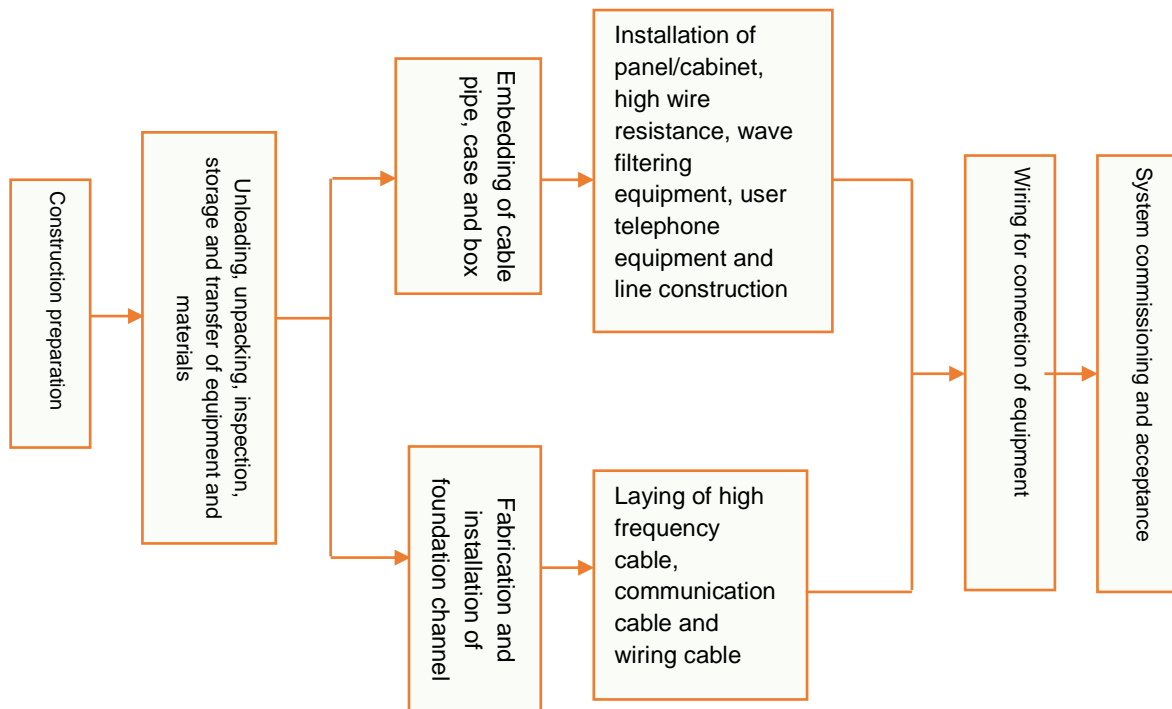
As the strength of communication cable and telephone wire is small, operate moderately during construction to avoid breakage. The telephone wire shall have no joint, and it shall be connected in the junction box if the distance is long.

The cables and telephone wires in communication room and central control room shall be laid under the static floor in bundles and order

The insulating resistance of cable conductors or wires shall be tested before wiring.

## 3. Installation flow of communication system

Figure 1.8-15 shows the installation flow of communication system.



**Figure 1.8-15: The installation flow of communication system.**

### 1.8.11 Installation of Accumulator

Accumulators shall be placed gently during transportation and installation, and strong shock, vibration, inversion and heavy-bearing are forbidden.

The platform and pedestal to place accumulator, as well as the space are in conformity with design requirements. Accumulator is installed stably with even spacing, and the accumulator tank in the same row shall be placed orderly in consistent height.

The wiring for connection strap and tap of accumulator shall be correct, and the insulating torque wrench shall be used to avoid short circuit of accumulator. The accumulator shall not be pulled by connection strap if using connection strap to make the tap bear additional stress. The bolts of joint shall be fastened.

After connection, the connection position shall be derusted and polished with abrasive paper and painted with electricity composite resin in order to reduce contacting resistance and to prevent corrosion.

The negative and positive electrode of outlets of accumulator shall be marked with plastic color tape. The positive electrode is in ochre, and the negative electrode is in blue.

### 1.8.12 Installation of Illumination System

**Installation sequence:** Embedded pipes shall be installed together with the construction of civil works. Power cords shall be threaded firstly according to design drawings after the framework is dismantled upon completion of civil works pouring. The illuminating lamps shall be installed after completion of decoration. The illuminating lamps for main control room with good condition may be installed firstly to meet the electricity needs and facilitate the keeping. However, the system commissioning needs shall prevail.

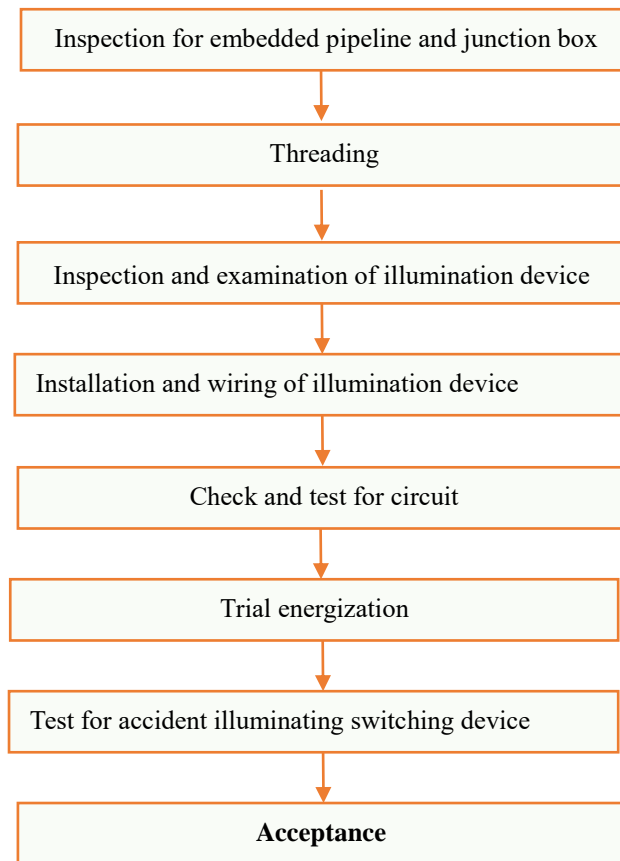
Cable laying, load distribution and appliance installation shall conform to the requirements of design and specifications. Exposed pipe (if any) shall be laid as per design elevation and technology requirements, trying to coordinate with building decoration.

Conductors are connected in accordance with requirements of technology specification, and the neutral wire shall not be regarded as grounding wire. The lamp socket, housing and other uncharged parts shall be provided with integral and firm grounding.

The accident illuminating switching device shall be tested as per design and contract, and its functions, technical requirements and properties shall meet the requirements of design and specifications.

**Signs:** Number, code and name of equipment, appliance, cable and circuit shall be printed completely on a plastic card or uniform signboard.

**Safety precautions:** Only appliances with package are allowed to transport, which shall be unpacked with special tools to avoid collision to grass appliances. Ladders, handrails and safety belts for high-altitude operation shall be firmly fixed to avoid falling. Strengthen management over lamps and materials to avoid loss or appropriation. Inspect insulation performance and voltage before power test to avoid short-circuit and over-voltage. Take protection measures to prevent the decoration surface from damage.



**Figure 1.8-16: Installation Flow Chart of Illumination Equipment**

### 1.8.13 Installation of Fire System

The portable dry powder extinguisher shall be equipped in each power distribution room at the accessible places, and the specific place shall be determined according to design and site conditions, but the following configuration principles shall be followed: It shall be installed at accessible places with high risk of fire, densely-populated place, safety exit, etc. The extinguisher shall be provided with delivery certificate and validity certificate.

The fire-resistant shield shall be installed at the entrance of cable trench into power distribution room.

The nozzle of cable pipe and the hole of cable trench shall be filled with fire-proof blocking materials.

## 1.9 Electrical Test and Comprehensive Automatic System Commissioning

Before commissioning, all the electrical primary and secondary equipment shall be separately and jointly tested as per the provisions of the Product Technical Specification.

### 1. Electrical Test

Electrical tests aim to check whether the installed equipment is in good electrical performance and whether the installation wiring is right and make all the elements and functional modules meet operation requirements through adjustment and ensure the safe and reliable running of equipment.

### 2. Electrical Performance Test

Electrical performance tests include electrical insulation test, electrical parameter determination test, verification and operation tests on automatic elements of instruments and grounding resistance test. The tested equipment includes: Power transformer, circuit breaker, switch gear, voltage (current) transformer, lightning arrester, reactor, MV cables, busbar and automatic elements of instruments; The main separate test items are as follows:

### **3. Power Transformer**

(1) Test items before commissioning of transformers

① Test prior to installation of capacitive HV bushing

- a. Insulation resistance measurement;
  - b. Measurement of the tangent ( $\tan\delta$ ) of dielectric loss angle and electric capacity
- ② Test items on the transformer Body
- a. Insulating oil test;
  - b. Measurement of insulation resistance, absorption ratio or polarization index of the windings and bushings
  - c. Winding DC resistance measurement;
  - d. Voltage ratio (of each tap) and link group measurement
  - e. Measurement of dielectric loss angle tangent ( $\tan\delta$ ) and electric capacity of windings and bushings;
  - f. Tests on combining direct current withstand voltage and leaked current of windings and bushings
  - g. Measurement of insulation resistance of fasteners insulated from iron core and outgoing bushings of iron core grounding wire against the casing;
  - h. AC withstand voltage test for windings and bushings;
  - i. Winding deformation test;
  - j. Combined AC withstand voltage test for windings and bushings

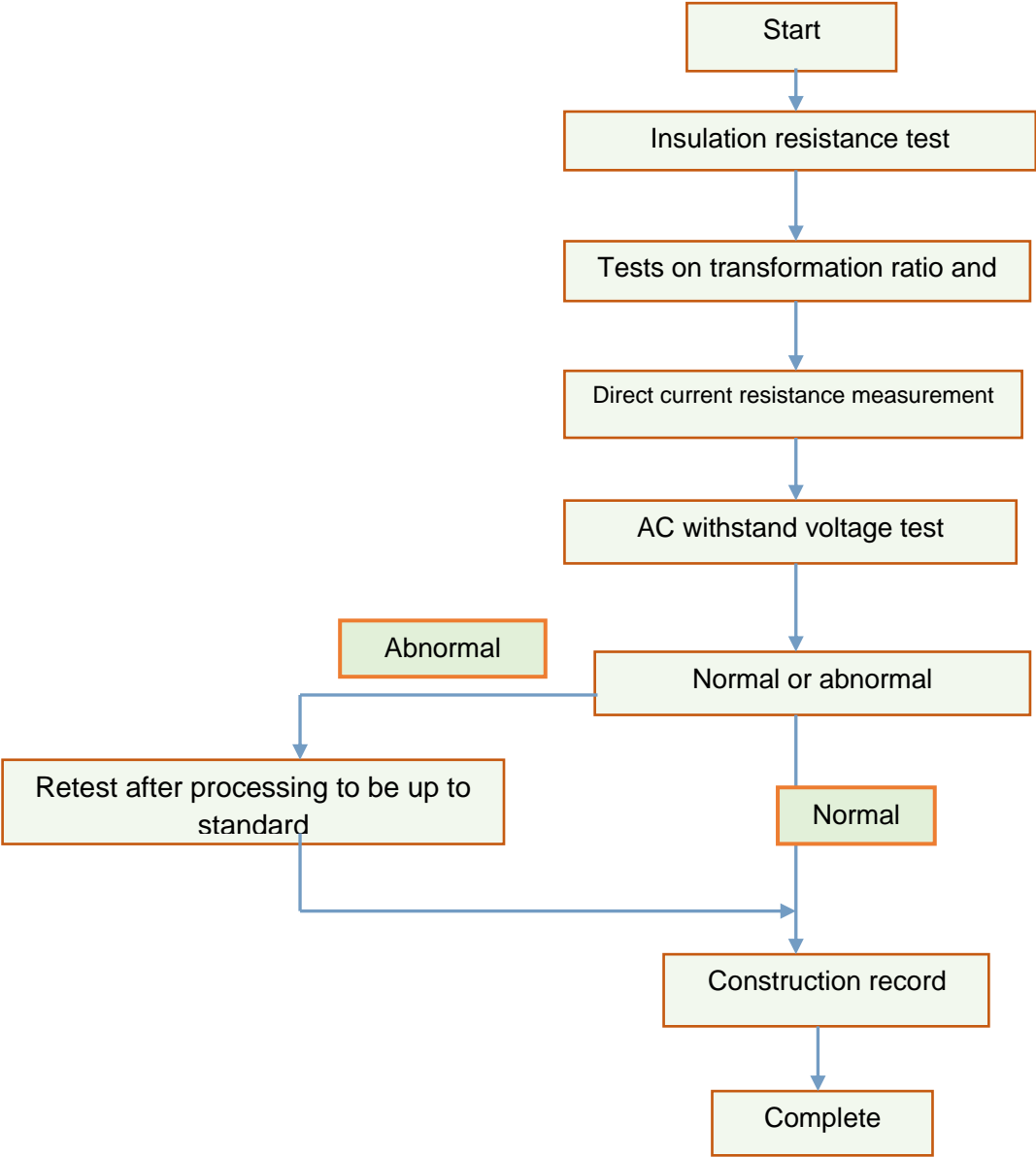
Notes: Items mentioned in b, c, d, g and h shall be conducted on dry type transformers.

③ Test items upon commissioning

- a. Impact closing test under rated voltage;
- b. Inspection on phases;
- c. Noise measurement.

Notes: Items mentioned in **a** and **b** shall be conducted on dry type transformers.

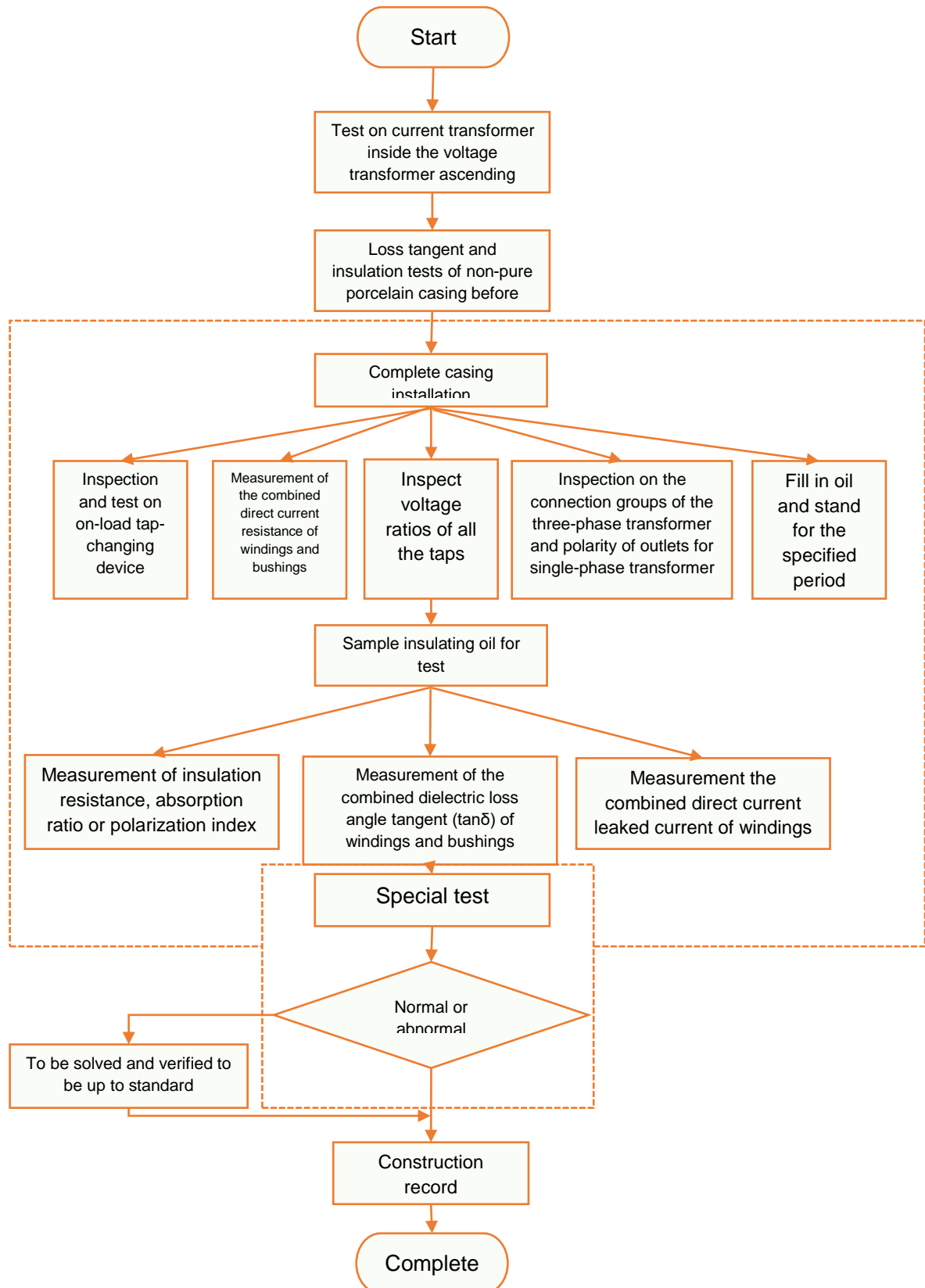
④ See Figure 1.9-1 for the dry type transformer test flow chart (see page below).



**Figure 1.9-1: Dry Type Transformer Test Flow Chart**

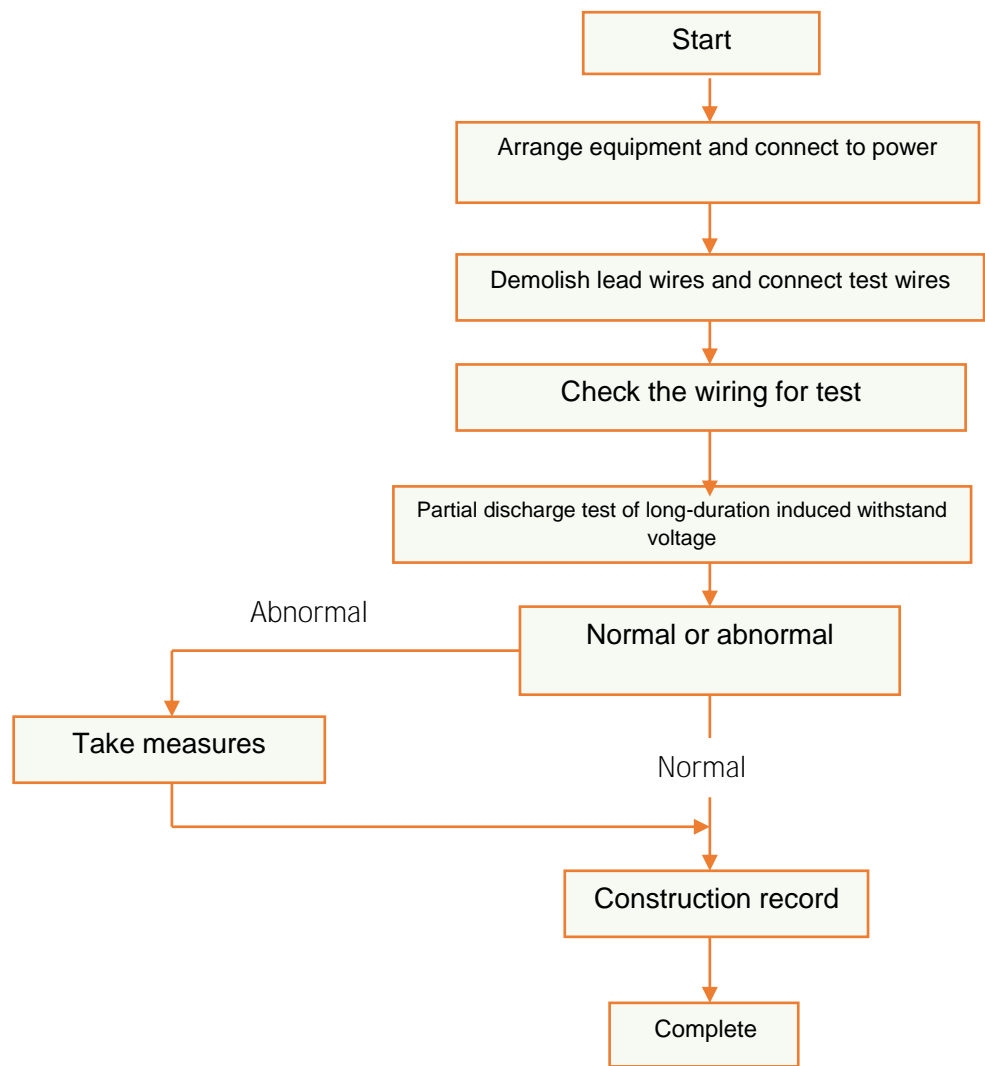
⑤ See Figure 1.9.2 for the flow chart for partial discharge test of oil-immersed transformer (see page below).





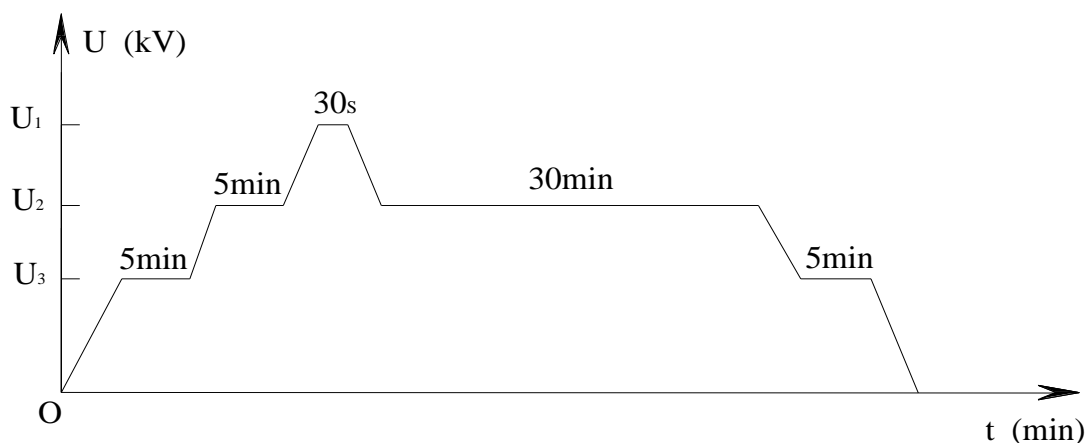
**Figure 1.9-2: Flow Chart for Partial Discharge Test of Oil-immersed Transformer**

- ⑥ See Figure 1.9-3 for partial discharge test flow chart of oil-immersed transformers



**Figure 1.9-3: Partial Discharge Test Flow Chart of Oil-immersed Transformers**

⑦ See Figure 1.9-4 for voltage rising procedures in long-duration induced withstand voltage test and partial discharge measuring test for transformers.



**Figure 1.9-4: Voltage Rising Procedures in Long-Duration Induced Withstand Voltage Test and Partial Discharge Measuring Test for Transformers**

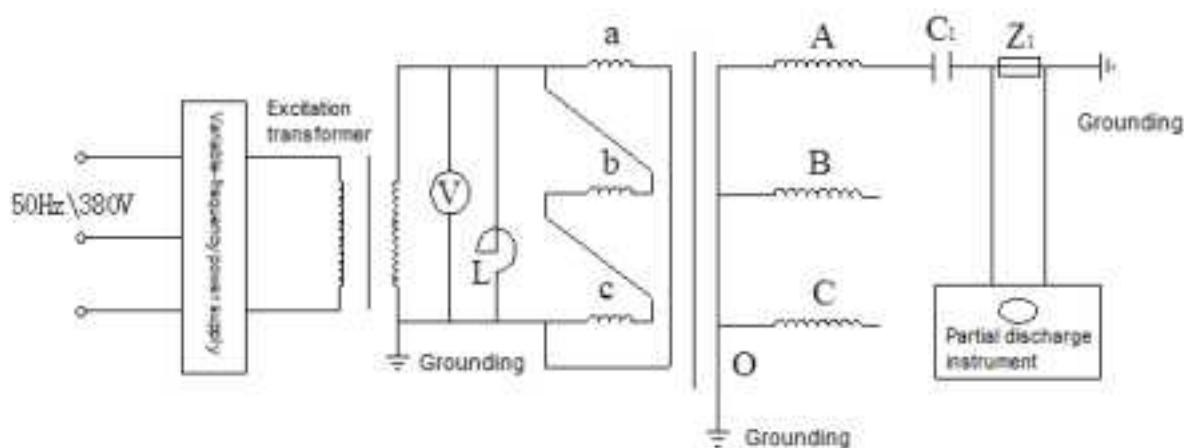
Wherein, the voltages to be pre-charged are:

Um stands for the highest voltage of the system

$$t = 120 \times (\text{Rated frequency} / \text{test frequency}) \text{ (second)}$$
$$t=120 \times 50 / 200$$

t=30(seconds)

- ⑧ See Figure 1.9-5 for the schematic diagram of long-duration induced withstand voltage test and partial discharge measuring test for oil-immersed transformers.



**Figure 1.9-5: Schematic Diagram of Long-Duration Induced Withstand Voltage Test and Partial Discharge Measuring Test for Transformers**

#### 4. Reactor and Extinction Coil

- (1) Test items before commissioning of reactors and extinction coils

- ① Test prior to installation of capacitive HV bushing

- a. Insulation resistance measurement;
- b. Measurement of the tangent ( $\tan\delta$ ) of dielectric loss angle and electric capacity

- ② Test items of reactors and the extinction coil body

- a. Insulating oil test;
- b. Measurement of insulation resistance, absorption ratio or polarization index of the windings and bushings
- c. Winding DC resistance measurement;
- d. Measurement of the combined dielectric loss angle tangent ( $\tan\delta$ ) of windings and bushings
- e. Tests on combined direct current withstand voltage and leakage current of windings and bushings;
- f. Measurement of insulation resistance of fasteners insulated from iron core and outgoing bushings of grounding wire against the casing;
- g. Combined AC withstand voltage test for windings and bushings

Notes: Items mentioned in b, c, f and d shall be conducted on dry type reactors.

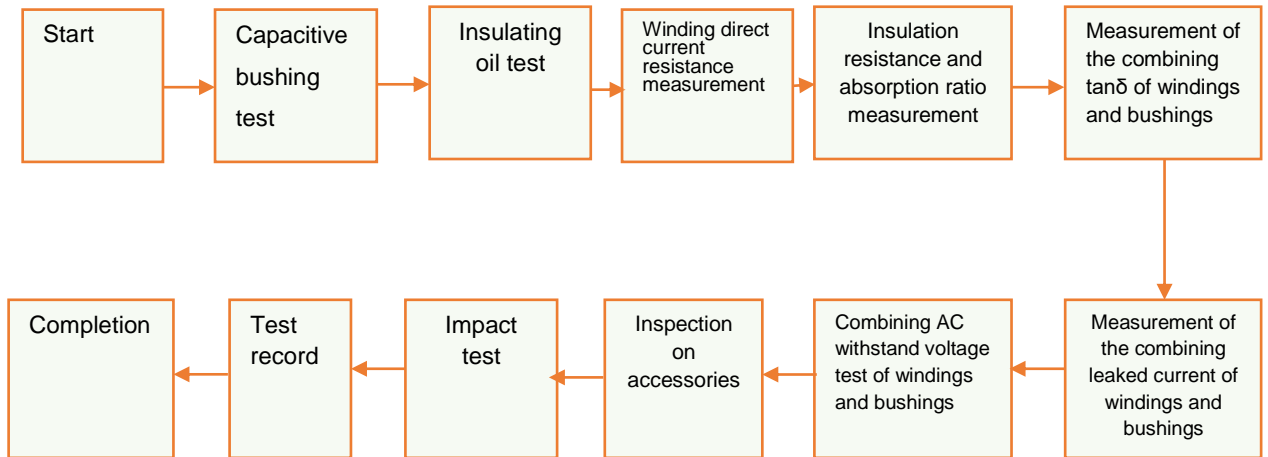
- ③ Test items upon commissioning

- a. Impact closing test under rated voltage;
- b. Inspection on phases;

**c. Noise measurement.**

Notes: Items mentioned in **a** and **b** shall be conducted on dry type reactors.

④ See Figure 1.9-6 for test flow chart of reactors and extinction coils



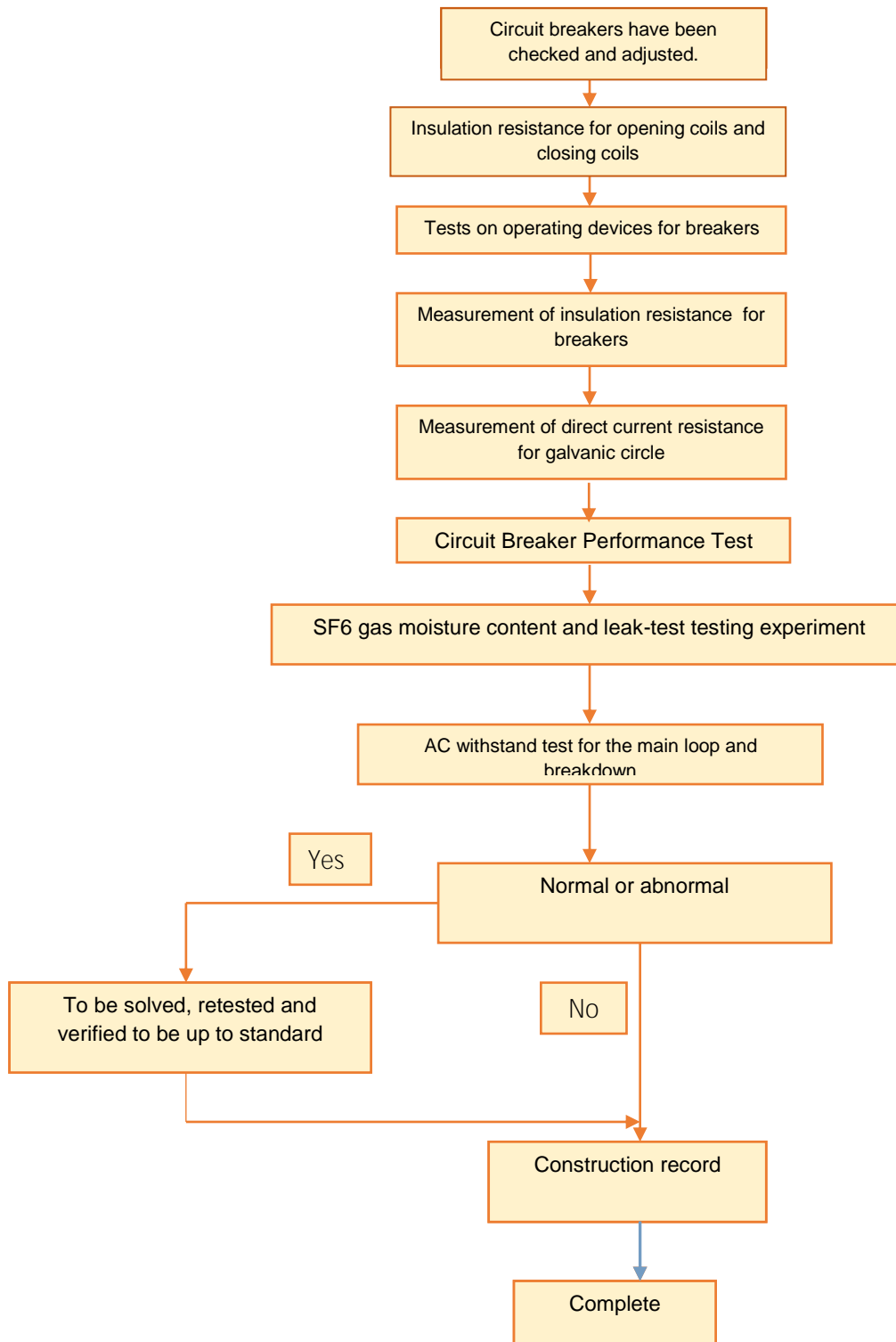
**Figure 1.9-6: Test Flow Chart of Reactors and Extinction Coils**

## 5. Circuit Breaker

① Test items on circuit breakers

- a.** Insulation resistance measurement;
- b.** Measurement of contact resistance for galvanic circle;
- c.** Measurement of insulation resistance of opening coils and closing coils;
- d.** Lowest open-close voltage measurement;
- e.** SF6 Gas leakage detection (for SF6 circuit breakers);
- f.** Tests on open-close time, speed and synchronism;
- g.** Water content measurement (for SF6 circuit breakers);
- h.** Tests on operating devices for breakers;
- i.** Power frequency AC withstand voltage test

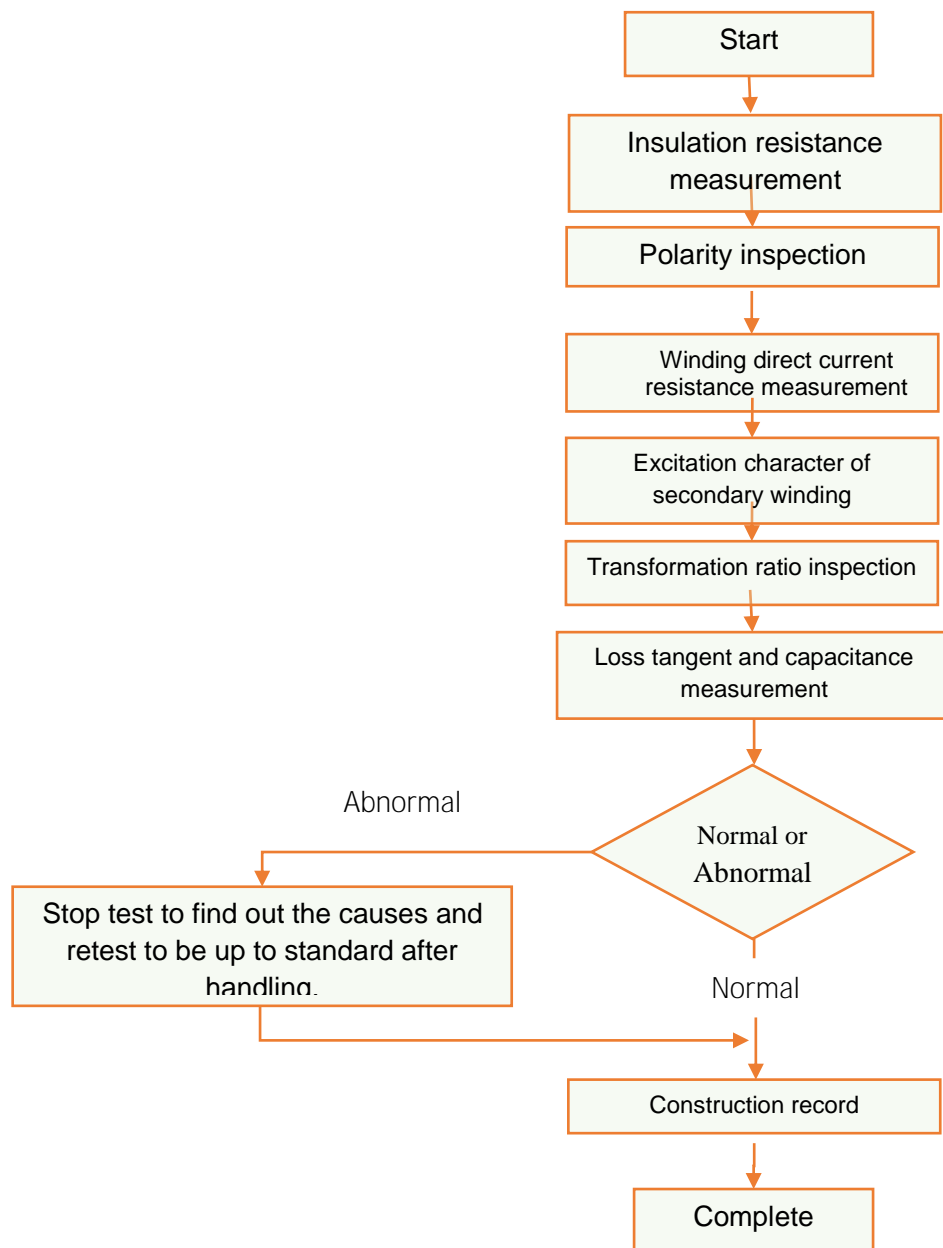
② See Figure 1.9-7 for the test flow chart of circuit breaker.



**Figure 1.9-7: Test Flow Chart of Circuit Breaker**

## 6. Current Transformer

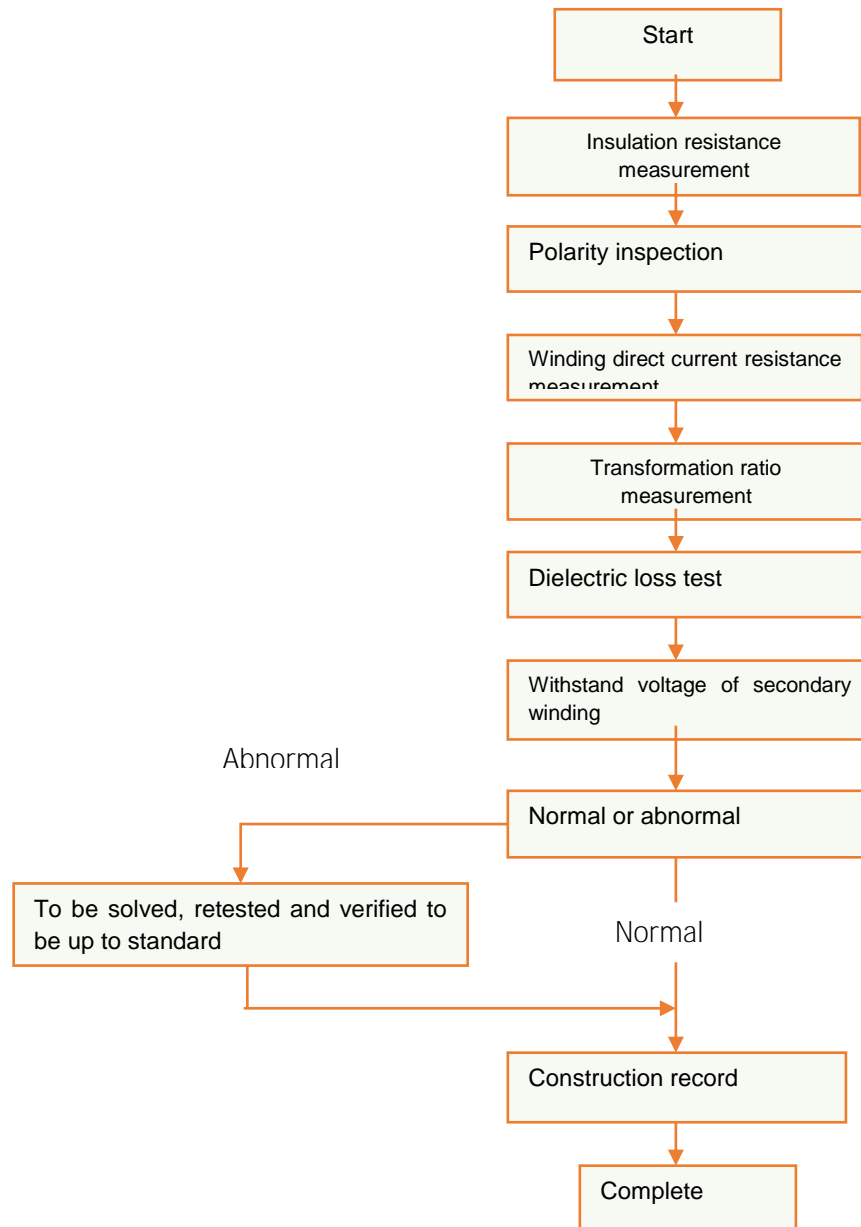
- ① Test items for current transformers
- ② The test flow charts for dry type current transformers, SF6 gas type current transformers and oil-immersed current transformers are generally the same. See Figure 1.9-8 for the test flow chart of oil-filled current transformers which is taken as an example.



**Figure 1.9-8: Oil-immersed Current Transformer Test Flow Chart**

## 7. Voltage Transformer

- ① Test items for current transformers
  - a. Insulation resistance measurement;
  - b. Polarity measurement;
  - c. Transformation ratio measurement;
  - d. Insulation oil electrical strength test (oil-immersed);
  - e. Measurement of the tangent ( $\tan\delta$ ) of dielectric loss angle;
  - f. No-load current and no-load loss measurements;
  - g. Direct current resistance measurement;
  - h. volt-ampere characteristics measurement;
  - i. Power frequency AC withstand voltage test (or induced withstand test)
- ② The dry type voltage transformers and capacitive transformers are generally the same. See Figure 1.9-9 for the test flow chart of capacitor transformers which is taken as an example (see page below).



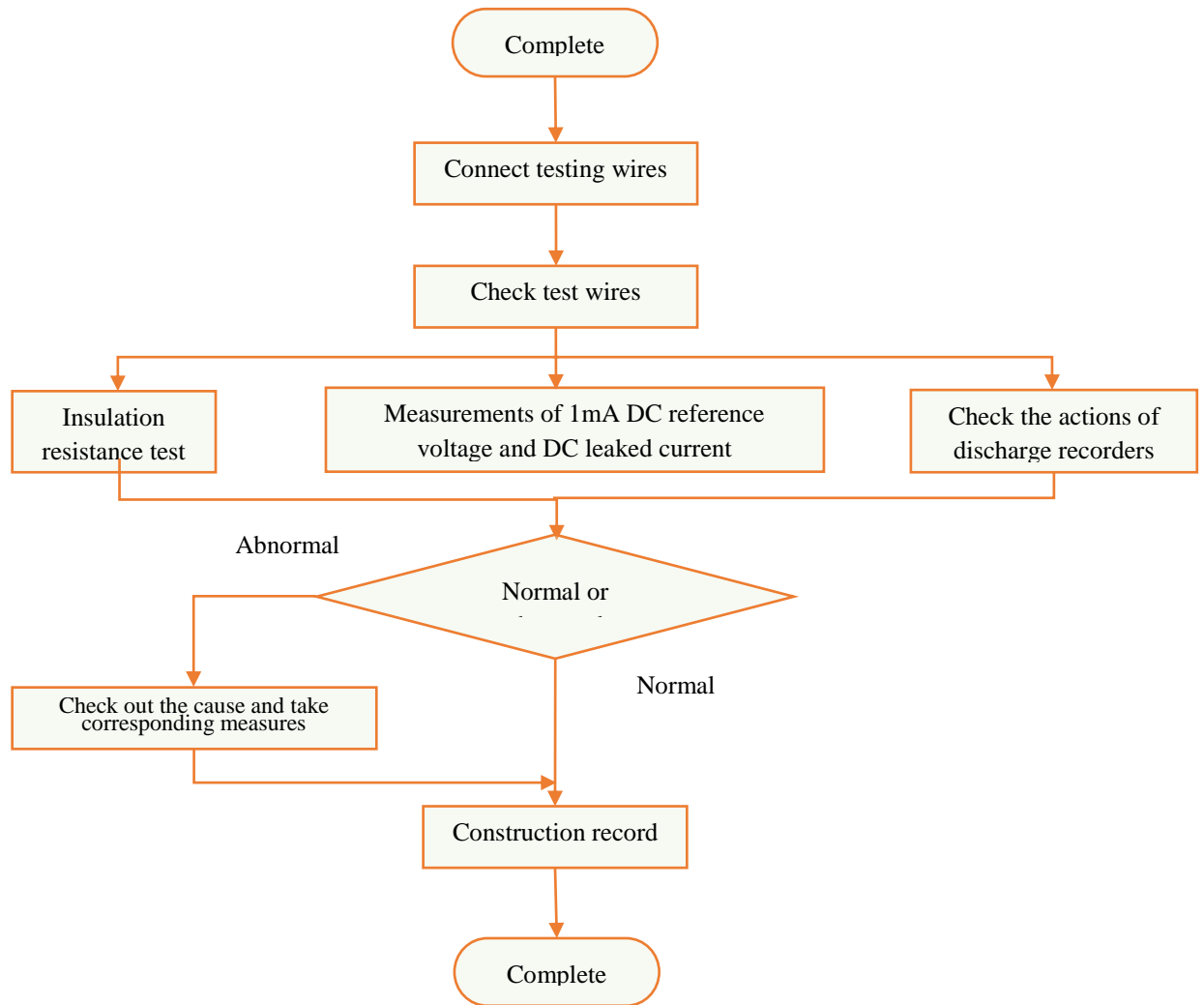
**Figure 1.9-9: Capacitive Potential Transformer Voltage Transformer Test Flow Chart**

## 8. Metal Zinc Oxide Arrester

### ① Test Items of Metal Zinc Oxide Arrester

- a. Measurement of insulation resistance for metal zinc oxide arrester and bases;
  - b. Measurements of 1mA DC reference voltage and DC leaked current;
  - c. Measurements AC leaked current under running voltage;
  - d. Inspection on actions of discharge counters and detective current meters
- ② See Figure 1.9-10 for the test flow chart of metal zinc oxide arrester (see page below).





**Figure 1.9-10: Test Flow Chart of Metal Zinc Oxide Arrester**

## 9. MV Cable Test

- a. Insulation resistance measurement;
- b. AC withstand voltage test;
- c. Inspection on phases

## 10. Commissioning and Calibration of Computer Monitoring System and Microcomputer Relay Protective Device

- (1) Inspection and test items of relay protective devices;
  - ① Visual inspection and grounding inspection of protective devices;
  - ② Insulation of secondary circuit;
  - ③ Inspection on inverter power supply;
  - ④ Clock inspection;
  - ⑤ Inspect the action logic and constant values of protective devices;
  - ⑥ Check the modulus converter system of all the protective device;
- a. Zero drifting inspection;
- b. Inspection on input amplitude characteristics of analog quantity;
- c. Inspection on input phase characteristics of analog quantity
- ⑦ Group test;
- ⑧ Inspect the action logic of protective devices with circuit breakers.
- (2) Main commissioning items for computer monitoring system:

Visual inspection and grounding inspection of monitoring system devices;  
 Insulation resistance of secondary circuit  
 Test point check  
 Control function  
 Unit power regulation  
 Clock synchronization  
 External communication function  
 Dual-machine switching function  
 System alarm function

(3) Integrated automatic system commissioning

Integrated automatic system commissioning is carried out by the installation unit in coordination with technical personnel from manufacturers. The integrated automatic system commissioning includes: master station commissioning, insulating layer commissioning and system joint commissioning

(4) Total station system commissioning

The System Commissioning Program is prepared according to the operating characteristics and methods of transformer substations, and the technical conditions for protective and measuring & controlling devices of relays as well as the analog fault conditions and is submitted to the consulting engineer for approval. Employer, Manufacturer, Contractor and the Consulting Unit are organized to hold jointly the joint technical coordination meeting and jointly make the commissioning plan.

Before commissioning the system, fully check all the performance of communication devices, measuring & controlling devices and telecontrol equipment to ensure smooth communication, normal operation of protective devices and measuring & controlling devices for relays and the right data exchange between and stations at various levels.

## 1.10 Information on project environment

### 1.10.1 Land Use/Vegetation

During construction, the construction footprint will be confined to within a 150ft. ( $\approx$  50m) wide RoW. During construction and operation, vegetation below 3m will be retained within the RoW where land is not required for tower footprint or access. The area required for transmission line RoW: In areas of steep topography not all of the forest within the RoW will require clearing. The actual area of the RoW that will require clearing to maintain conductor clearance can be based on an assumed cleared length of the RoW. For a particular transmission line project cleared length should be assessed (in %) and using this value the likely areas of forest that will be cleared for the Project can be calculated.

**Table 1.10-1: Areas of land use along transmission line RoW**

Facility	Land Use
Transmission line First Part – Start from Bamaw (50km)	Degraded dry deciduous forest
Second Part (10.5km)	Agricultural Land
Third Part (37km)	Degraded dry deciduous forest
Fourth Part – (3.5km)	Agricultural Land
Fifth Part, towards Nabar (20km)	Degraded dry deciduous forest

The land use of two substations was provided in the following Table.

**Table 1.10-2: Land use of two substations**

Facility	Land Use
Bamaw Substation (New Build)	Government Land
Nabar Substation (Extended existing Substation)	Government Land

### **1.11 Alternative Project Site**

The transmission line route and sub stations have been chosen by Department of Electric Power Transmission and System Control (DPTSC), Ministry of Electricity and Energy. So no alternative study has been considered.

## **2 IDENTIFICATION OF THE PROJECT PROONENT**

### **2.1 Proponent Information**

**Project Owner:** Union Resources & Engineering Co., Ltd. (UREC)  
**Address:** No.35, Pyay Road, 7 Quarter, Mayangone Township, Yangon, Union of Myanmar  
**Email:** travis1256@hotmail.com  
**Contact Person:** Mr. Travis Liu, Deputy Chief Representative  
**Website:** <http://www.urec.com.cn>

As an international resources integration enterprise, the UREC is engaged in international engineering contracting, import and export of complete sets of equipment, mechanical and electrical products and all sorts of other products, materials and raw materials together with provision of complex trade services. Besides, investment and development of real estate is also included in the business scope of the company.

UREC has been an active player in the engineering contracting arena worldwide since 1980s. As a general contractor, UREC provides project management in the whole process for the project owners and clients who include the tasks in different phases covering preliminary study, financing, design, construction, manufacture, purchase, installation, commissioning and operation management. Through years of efforts, UREC has established tight and good collaborative relationships with the cooperative parties and partners both domestic and abroad such as financial institutes, consultation institutes, construction enterprises and equipment manufacturers.

### **2.2 Quality Policy**

UREC will take it as its goal to satisfy the requirements of the customers and to supply qualified products and perfect services through every effort. UREC pays much attention on the environmental protection in the process of project exploitation and implementation and tries to contribute to the harmony and continuous development of the local society. UREC sticks to the production and service principle of “safety first, prevention first” and keep serious management and improvement for the work so as to reduce the occupational harms and risks to the lowest extent and to guarantee the safety and health of both the employees and other people..

### **2.3 Investment and Resources Development**

Based on the comprehensive advantage of management, human resources, fund and market, UREC actively explores and engages in various investment modes, and has established some Sole proprietorship and joint-venture enterprises in China and foreign countries. In addition to supporting the key export-oriented manufacturers, UREC has invested to build the Dali Cangshan Passenger Ropeway and Lijiang Yulong Passenger Ropeway at tourist attractions in Yunnan Province. Each and every invested project has its own characteristics and has the complementary advantages with UREC one another, so as to strengthen the capability of UREC and create a better framework for mutual development. The organization chart of UREC is shown in Figure 2.1-1.



Figure 2.1-1: The Organization Chart of UREC

## 2.4 Construction Organization

Decision-making level of Project Dept. consists of Project Manager, Chief Engineer and Deputy Project Manager. According to the characteristics of different construction periods, a number of construction teams are specifically formed to meet engineering construction needs, with organization and staff composition allocated in the principle of dynamic, efficient and capable per different construction periods. Block Diagram for Engineering Organization is shown in Figure 2.1-2.

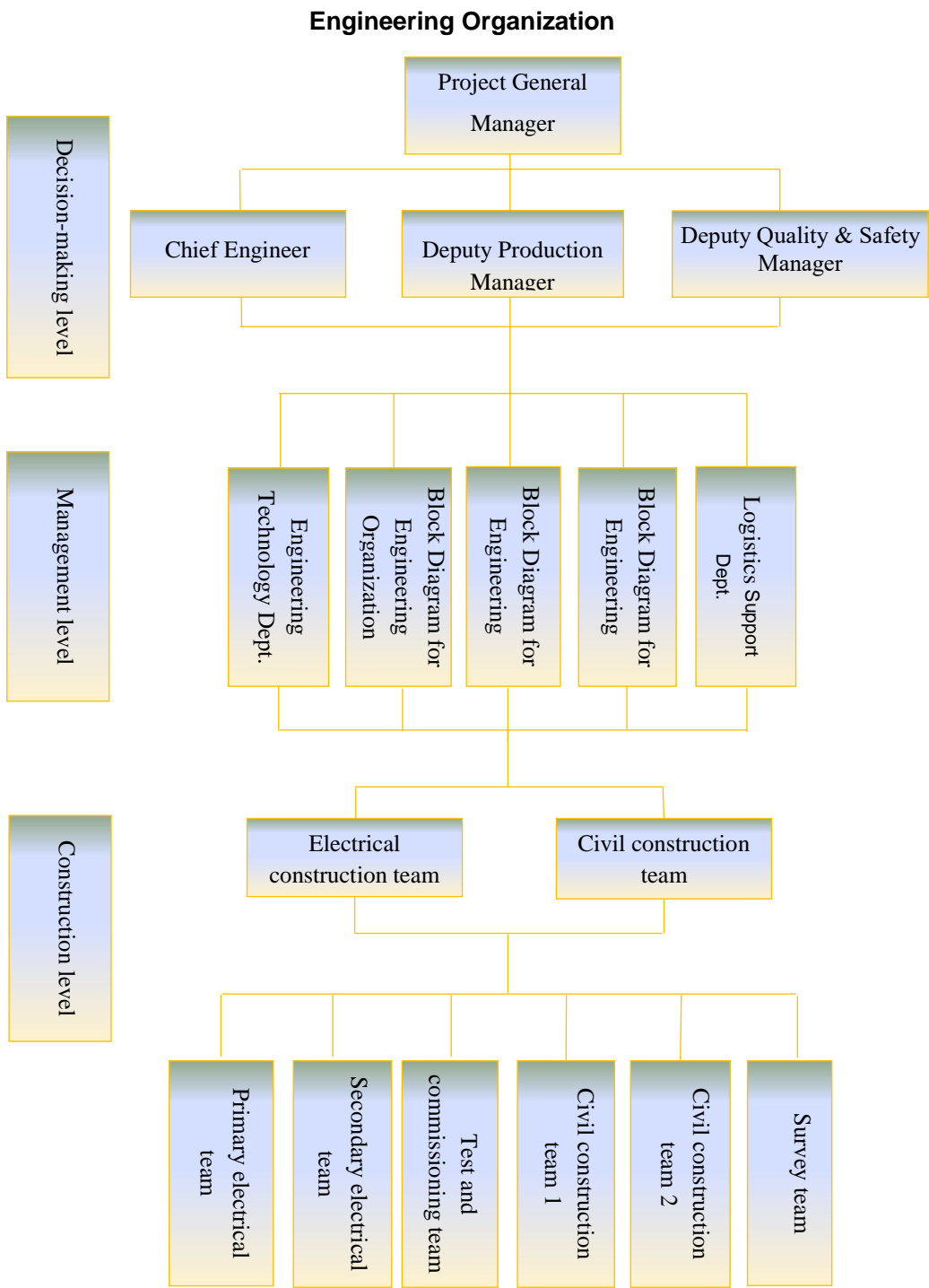


Figure 2.1-2: Block Diagram for Engineering Organization

## **2.5 Resources Allocation and Scheduling**

### **2.5.1 Allocation of Construction Resources**

Civil construction and electric equipment installation project of Bamaw and Nabar substations will last for 34 months as specified in the contract, for which we will reasonably arrange staff and equipment mobilization based on the schedule and construction intensity, in order to meet construction needs.

### **2.5.2 HR Staffing**

Staffing of all construction work types will be under dynamic management for optimization according to the construction tasks during different periods when considering construction organization design.

## **2.6 Salient Features of the Project**

The Project, as one of the key projects in the “North-to-South Power Transmission Project” of Myanmar Electric Power Enterprise, aims to transmit the electric power generated by Tapain Hydropower Plant to central Myanmar and supply the power load center in South Myanmar after connected to the 230kV National Grid, developing the 230kV transmission system that covers the whole nation. The Project, mostly located in Sagaing Region, the north-central Myanmar, consisting of two 230kV substations and two 230kV double circuit transmission lines (290 miles in total), includes the survey, design, supply, construction, installation and commissioning on EPC basis.

The Total Contract Price is USD 133,470,000.00. Thirty-five percent (35%) of the Total Contract Price shall be made by irrevocable Letter of Credit at sight, and sixty five percent (65%) of the Total Contract Price shall be paid by irrevocable deferred Letter of Credit as deferred payment. The time for Completion of the whole Project is thirty-eight (38) months from the Effective Date of the Contract. The Defect Liability Period is counted for two (2) years from the date of Operation Acceptance of the Project.

For connection of Northern Kachin State to 230kV National Grid, this project includes the construction of 230kV transmission line between Bamaw and Nabar with the length of about 121 km, two newly -built 230kV/66kV substations and one extended substation aiming at power supply for area along the Northern Mandalay to Kachin State. The Project Area Situated in the northern region of Mandalay, where has the better natural condition with the average temperature of 20° C and 33.9° C in January and April, respectively.



### **3 IDENTIFICATION OF THE IEE EXPERTS**

#### **3.1 Scope of ESIA**

Scoping is an important component in IEE methodology. During scoping, main environmental and social issues are identified. This mainly aims at:

- Provide guidance and assistance to various stakeholders involved in the IEE process.
- Assist the regulatory agency and IEE practitioners to understand the main areas of concern and use that understanding to enhance the quality of the IEE study and report.
- Inform the regulatory agency and IEE practitioners about the best environmental management practices in the transmission line sector.
- Assist the regulatory agency to better assess the IEE report and arrive at a sound decision.

The scope of work for IEE included the followings:

- a) Identification of the legal and policy framework applicable to the Project;
- b) Description of the principal project features and technical specifications, including pre construction, testing and commissioning, operation and maintenance (as provided by MOEE);
- c) Summary of approach adopted by MOEE for design of the transmission line and assessment of alternatives available for the Project together with an overview of outcome of the key decisions already taken up by the company for the transmission line route;
- d) Description of the existing environmental and social baseline of the Project in terms of key sensitivities and potential constraints on the construction and operation and maintenance of the transmission line;
- e) Assessment of the land use, air, noise, water, and the natural (biological) environment including parameters of human interest (social issues) based on primary surveys and available secondary data;
- f) Identification of potential adverse environmental and social impacts during erection and operation of the transmission line and mitigation measures to be adopted by MOEE and
- g) Suggestion to develop Environmental and Social Action Plan (ESAP) outlining preventive and control strategies for minimizing negative impacts during construction and operation (including maintenance) phases of the proposed project along with the cost and time schedules for implementation of the ESAP.

##### **3.1.1 Approach & Brief Methodology**

Resource & Environment Myanmar will adopt the following approaches for the Project:

- a) Identification and reviewing of the applicable national and international environmental and social regulatory and institutional framework
- b) Establishing environmental and social baseline conditions along the stretch by the followings;
  - Reconnaissance survey to observe environmental and social characteristics on either side of the transmission line (primarily within 100m);
  - Primary baseline data collection on the route along the transmission line with respect to water, soil, noise quality, and traffic density on roads where the proposed area that the transmission line will cross;

- Socioeconomics survey to assess the socioeconomic status of the route involving cultural heritage issues within the private land 100 m on either side of the route
  - Ecological survey of flora and fauna prevailing along the transmission line route through primary and secondary surveys
  - Identification of land use of the stretch through satellite imageries of the whole stretch of the transmission line;
- c) Consideration of feasible environmentally and socially preferable alternatives (although the options available at this stage was minimum);
- d) Identification, prediction and evaluation of environmental and social impacts of the project by using IEE tools, such as matrix analysis, questionnaires, cost-benefit analysis methods;
- e) Development of mitigation measures or Environmental Management Plan (EMP) to minimize adverse environmental impacts;
- f) Preparation and suggestion to develop Environmental and Social Action Plan (ESAP) and management system. Specific methodology and techniques used will also be discussed in relevant sections of this study.

### 3.1.2 Limitations

The guiding principles of this IEE study are:

- Adoption of appropriate policies and legislation to guide the IEE process,
- All development projects to be subjected to the IEE process,
- Equity in allocation of and access to resources, poverty elimination, and promotion of social justice,
- Popular participation of all affected and interested parties including grassroots communities, in the IEE process,
- Accountability of all participating parties to the public,
- Transparency throughout the IEE process,
- The IEE process to take special consideration of the role played by women and children in resource management and any impacts on these groups,
- The IEE process to be a tool in the promotion of sustainable livelihoods and sustainable living.

This IEE study is based upon the application of professional judgment to certain facts with resulted subjective interpretations. However, professional judgments expressed herein are based on the facts currently available within the limits of the scope of work, information provided by the client or its representative, prevailing secondary data, budget and schedule. To extent that more definitive conclusions are desired by client are warranted by the currently available facts, it is specifically R & E's intention that the conclusions and recommendations stated herein will be proposed as guidance and not necessarily a firm course of action except where explicitly stated as so. We make no warranties, express or implied, including, without limitation, warranties as to merchantability or fitness for a particular purpose. In addition, the information provided to client in this report is not to be construed as legal advice.

## 3.2 IEE Study Team

**Leading Organization - Resource & Environment Myanmar Co., Ltd. (REM)**

Address: No. 702 B, Delta Plaza, Shwegonedaing Road, Bahan, Yangon.

Telephone: 959-73013448

Facsimile: 1-552901  
 Email: [service@enviromyanmar.net](mailto:service@enviromyanmar.net)  
 Contact Person: Mr. Thura Aung  
 Designation: General Manager  
 Website: <http://www.enviromyanmar.net>



The REM is located in the city of Yangon, Myanmar, in the country it is a leading resources and environment consulting firm that composed of geoscientists, engineers, biologist, botanist, socio-economic experts, cultural heritage experts, environmental engineers and physical resources management specialist.

#### **Secondary Organization - Sustainable Environment Myanmar Co., Ltd. (SEM)**

Address: B 503 Delta Plaza, Shwegondaing Road, Bahan, Yangon  
 Telephone: +959 261328891  
 Email: [services@sustainablemyanmar.com](mailto:services@sustainablemyanmar.com)  
 Website: <http://sustainablemyanmarsem.com>



The SEM provides Environmental & Social/Health Impact Assessment service for development projects in Myanmar. SEM has resources and capacity to handle environmental management issues as per the provisions of Environmental Conservation Laws 2012 including, EIA, ESMP, environmental monitoring and auditing.

### **3.2.1 Participants of IEE**

The following table shows list of participants involved in the present IEE study of 230 kV Project, Bamaw-Nabar Transmission Line. The curriculum vitae of the environmental consultants are attached in Appendix-2.

**Table 3.2-1: Resource and Environment Myanmar Project Team Member**

No.	Name	Position	Organization	Responsibility
1.	U Thura Aung	GM/Principal Consultant	REM	Physical Environment, Environmental Baseline Data
2.	U Ngwe Moe	Principal Consultant	REM	Environmental, Health and Safety
3.	U Zaw Naing Oo	MD/Principal Consultant	SEM	Environmental Impact Assessment & Environmental Management
4.	U Than Oo	GM/Principal consultant	SEM	Hydropower and transmission line Analyst
5.	U Zay Maung Thein	Principal Consultant	SEM	Avifauna
6.	Dr. Tin Tin Khaing	Principal Consultant	SEM	Vegetation and Flora
7.	Daw Swe Wut Hmone	Consultant	SEM	Vegetation
8.	Daw Naing Naing Win	Senior Consultant	SEM	Wild Life
9.	Daw Than Than	Senior Consultant	SEM	Entomologist

	Htay			
<b>10.</b>	Daw Myat Thet Khaing	Consultant	SEM	Aquatic Ecology
<b>11.</b>	U Chit Myo Lwin	Senior Consultant	SEM	Environmental Geology
<b>12.</b>	U Myat Ko Ko Hein	Consultant	SEM	Forest
<b>13.</b>	U Nyan Lin Maung	Consultant	SEM	Water Quality
<b>14.</b>	Daw Poe Mon Mon Kyaw	Consultant	SEM	Environmental Engineer, EHS
<b>15.</b>	Daw Phyo Khaingzar Wint	Senior Consultant	REM	IEE report compilation
<b>16.</b>	Daw Nu Yin	Senior Consultant	SEM	SIA and Public Consultation
<b>17.</b>	Daw Myat Thitsar Naing	Senior Consultant	SEM	SIA and Public Consultation
<b>18.</b>	Dr. Nyomie Razak	Principal Consultant	SEM	SIA and Cultural

## 4 LEGISLATION AND GUIDELINES

The present Project was reviewed and benchmarked against:

- Myanmar environmental and social laws and regulations (Section 3.1);
- Applicable international requirements with particular reference to the IFC PSs, (Section 3.2).

Legislation of Myanmar and international standards for the issues of interest are presented in the following sections in order to figure out a set of regulatory or reference limits and to address the best management practices for each considered environmental and social aspects relevant for the Project. The following text summarizes the key instruments of the national environmental policy, legislation, and regulatory framework; all of which would have to be in compliance with the implementation of the 230 kV Transmission Line and Substation (Package-1) Project. The Project, as one of the key projects in the “North-to-South Power Transmission Project” of Myanmar Electric Power Enterprise, aims to transmit the electric power generated by Tapain Hydropower Plant to central Myanmar and supply the power load center in South Myanmar after connected to the 230kV National Grid, developing the 230kV transmission system that covers the whole nation.

### 4.1 Myanmar Legislation

The National Environment Policy of Myanmar 1994 is the basis of Myanmar’s environmental statutory framework. This was supported by the 2008 Constitution that empowers Government to conserve Myanmar’s natural environment and enables Parliament to enact environmental laws and which stated as:

**Section 356** - The Union shall protect according to law movable and immovable properties of every citizen that are lawfully acquired.

**Section 370** - Every citizen has, in accord with the law, the right to conduct business freely in the Union, for national economic development.

**Section 371** - The Union may assist the access to technology, investment, machinery, raw material, so forth, for national economic development.

Accordingly, the Ministry of Natural Resources and Environmental Conservation (MONREC) has recently enacted the 2012 Environmental Conservation Law and was charged with assessing compliance (see following Figure).

The 2012 Environmental Conservation (EC) Law is based on the “polluter pays principle”, with compensation for environmental impacts to be paid to a fund which was set up by the MOECF. In addition to the framework Environmental Conservation Law, there are several laws with some form of obligations on operators in respect of pollution, disposal, and other harmful impacts on the environment and local society.

The objectives of 2012 EC Law are mentioned in Section 3 of the Law and include:

- To enable to emerge a healthy and clean environment and to enable to conserve natural and cultural heritage for the benefit of present and future generations;
- To reclaim ecosystems as may be possible which are starting to degenerate and disappear; and
- To enable to manage and implement for decrease and loss of natural resources and for enabling the sustainable use beneficially.

Section 7 of the EC Law defines MONREC duties and powers relating to environmental conservation as follows:



**Figure 4.1-1: Myanmar National Environmental Conservation Organization Chart**

- To prescribe the terms and conditions relating to effluent treatment in industrial estates and other necessary places and buildings and emissions of machines, vehicles and mechanisms;
- To lay down and carry out a system of Initial Environmental Examination (IEE) as to whether or not a project or activity to be undertaken by any Government department, organization or person may cause a significant impact on the environment; and
- To manage to cause the polluter to compensate for environmental impact, cause to contribute fund by the organizations which obtain benefit from the natural environmental service system, cause to contribute a part of the benefit from the businesses which explore, trade and use the natural resources in environmental conservation works.

EC Law Section 13 states that the Ministry shall, under the guidance of the Environmental Conservation Committee (ECC), maintain a comprehensive monitoring system and implement by itself or in co-ordination with relevant Government departments and organizations in the following matters:

- Carrying out waste disposal and sanitation works;
- Carrying out development and constructions; and
- Carrying out other necessary matters relating to environmental pollution.

Responsibilities of Project Proponent/ Business Owner for Reducing Environmental Impact are defined in Sections from 14 to 16, as follows:

- **Section 14:** a person causing a point source of pollution shall treat, emit, discharge and deposit the substances which cause pollution in the environment in accord with stipulated environmental quality standards;
- **Section 15:** the owner or occupier of any business, material or place which causes a point source of pollution shall install or use an on-site facility or controlling equipment in order to monitor, control, manage, reduce or eliminate environmental pollution. If it

is impracticable, it shall be arranged to dispose the wastes in accord with environmentally sound methods; and

- **Section 16:** a person or organization operating business in the industrial estate or business in the SEZ or category of business stipulated by the Ministry: (a) is responsible to carry out by contributing the stipulated cash or kind in the relevant combined scheme for the environmental conservation including the management and treatment of waste; (b) shall contribute the stipulated users' charges or management fees for the environmental conservation according to the relevant industrial estate, SEZ and business organization; (c) shall comply with the directives issued for environmental conservation according to the relevant industrial estate, SEZ or business.

The ECC is a national interministerial committee composed of 37 members (including representatives of the MONREC, Ministry of Electricity and Energy, Ministry of Home Affairs, Ministry of Labor) with the following responsibilities:

- **General management:** (i) procedures and management systems to identify, control, prevent or minimize all adverse impacts, (ii) procedures to ensure compliance with all environmental commitments, (iii) procedures to implement the measures described in the EMP, Construction Phase EMP, and/or Operational Phase EMP, as the case may be, (iv) procedures to improve the environmental performance of the Project, (v) organization with qualified environmental personnel, v) Documentation and reporting procedures;
- **Emissions:** (i) emissions not allowed, (ii) emission limit values in terms of types, substances, loads, concentrations, rates, timing, duration, frequency, seasons, project phase, (iii) emission points, (iv) form and media, (v) recipients, (vi) contribution to environmental quality standards, (vii) statistical methods for determining compliance;
- **Use of energy and natural resources:** amounts, type, origin of resource, rates, effectiveness of use, waste generation;
- **Pollution prevention:** effectiveness of production or construction methods or waste storage and treatment facilities to (i) prevent or, where this is not practicable, to minimize pollution, and to (ii) prevent or minimize the risk of pollution;
- **Nature conservation and management:** (i) sites, environments or species, (ii) effectiveness of environmental measures to prevent or minimize adverse impacts on certain environments or species;
- **Hazardous or toxic materials including waste:** (i) limits to the types, categories, and amounts, (ii) methods and systems of collection, storage, handling, transport, treatment and disposal;
- **Waste management:** (i) limits to the types, categories, and amounts of waste (liquid, solid, atmospheric) generated, (ii) methods and systems of collection, storage, handling, transport, treatment and disposal, (iii) recycling or reuse of wastes;
- **Transport and access:** (i) access points, (ii) means of transport of materials and people to and from the Project, (iii) transport routes for products, materials or waste, (iv) access control measures;



- **Decommissioning, rehabilitation, clean-up and closure:** (i) sites, areas /environments and facilities, (ii) objectives and standards, (iii) site conditions and after use, (iv) timing, (v) controls and monitoring;
- **Control measures:** (i) prevention of accidents, (ii) measures and procedures in case of accidents, incidents, and operational irregularities, (iii) control and maintenance of pollution prevention / minimization measures, (iv) safety zones;
- **Monitoring:** i) parameters, ii) methods, iii) sampling and analyses, iv) point of monitoring, v) frequency, vi) timing, vii) data management, viii) maintenance and control of monitoring equipment, ix) documentation and reporting;
- **Documentation and reporting:** (i) parameters and issues that must be documented and reported, (ii) types and methods, (iii) frequency and timing, (iv) quality controls, (v) recipients;
- **Financial guarantee:** (i) type of guarantee, (ii) amount, (iii) timing, (iv) application, (v) type and financial capacity of guarantor; and
- **Funding of inspection by the Ministry:** (i) amounts, (ii) payment procedure, (iii) timing and frequency.

#### 4.1.1 Environmental Impact Assessment

The IEE procedure, issued on 29 December 2015, defines the requirements for the IEE and states that: *“An IEE investigation shall consider all biological, physical, social, economic, health, cultural and visual-components of the environment, together with all pertinent legal matters relating to the environment (including land use, resources use, and ownership of and rights to land and other resources) that may be affected by the Project during all project phases including pre-construction, construction, operation, decommissioning, closure, and post-closure; and shall identify and assess all Adverse impacts and risks that potentially could arise from the project.*

**Article 7** – *This Procedure does not address specific matters in relation to resettlement or in relation to Projects that may have an Adverse Impact on Indigenous People. Projects involving resettlement or potentially affecting Indigenous People shall additionally comply with separate procedures issued by responsible ministries, and in the absence of such procedures all such Projects shall adhere to international best practice on Involuntary Resettlement and Indigenous People.”*

Three different steps are foreseen for the IEE process which is described in the following sections:

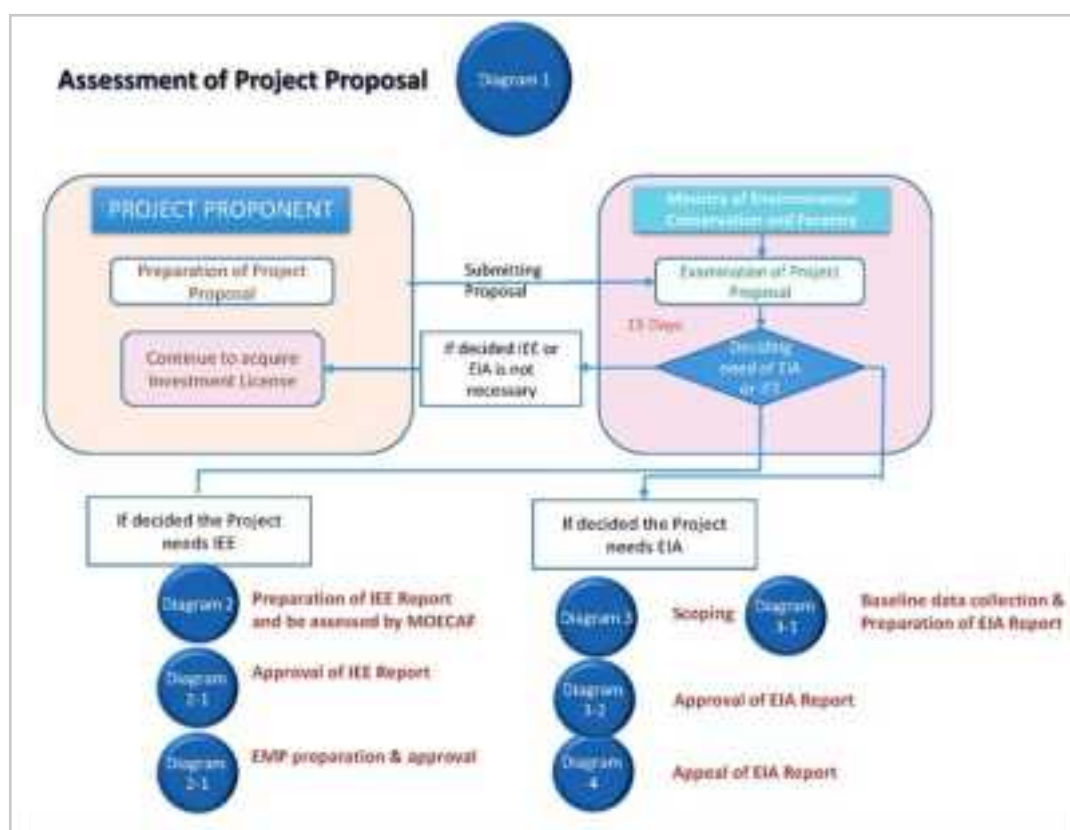
- Screening phase;
- Scoping phase; and
- IEE Investigation and Report Preparation

##### a. Screening Phase

The IEE process starts with the screening process as shown in the Figure 4.1-2. The MONREC is empowered and has the exclusive authority to define the screening criteria for a project.

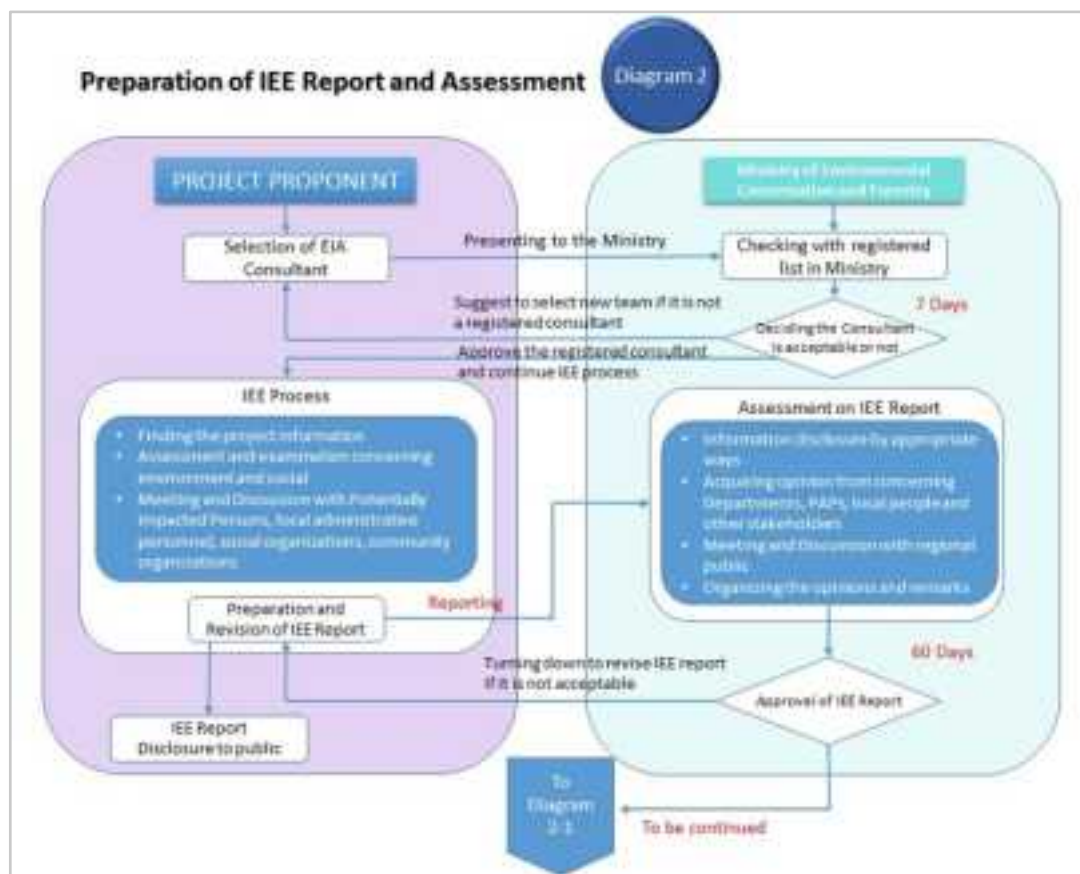
Guidance is provided as to which projects or activities should carry out an Initial Environmental Examination (IEE) or EIA, as presented in the Annex to the law. If, as a result of that determination, an IEE or an EIA is required, then the proponent of the project

or activity has to prepare, obtain approval for, and implement an appropriate Environmental Management Plan (EMP) in respect of the proposed project or activity. Any appeal from such determination must be made in accordance with the IEE Procedure. The Annex shows for each type of economic activity, the criteria for selection of whether IEE or EIA apply to the proposed economic activity. The MONREC determines whether the project is an IEE type project, or an IEE type project or if it is exempted from undertaking any environmental assessment.



**Figure 4.1-2: IEE and EIA Process Screening Phase**

The Project Proponent might be required to submit a project proposal (completed in accordance with MONREC's guidelines) to the EC department of MONREC for screening. Within 15 days from receiving the complete project proposal, the MONREC shall determine the required type of environmental assessment (EIA, IEE, or none) and shall inform the Project Proponent in writing about its determination. In addition, the MONREC can change the status of an IEE Type Project to be an EIA Type Project if any of the above additional factors are relevant in this sense.



**Figure 4.1-3: IEE Process**

### **b. IEE Investigation and Report Preparation**

The Project Proponent has to ensure that the IEE investigation properly addresses all adverse impacts and is undertaken in accordance with the approved TOR. The IEE investigation shall consider all biological, physical, social, economic, health, cultural and visual components of the environment, together with all pertinent legal matters relating to the environment (including land use, resources use, and ownership of and rights to land and other resources) that may be affected by the Project during all project phases, including pre-construction, construction, operation, decommissioning, closure, and post-closure; and shall identify and assess all adverse impacts and risks for environment, social and, if relevant, health that potentially could arise from the Project.

The IEE Procedure does not address the social impacts of involuntary resettlement or which relate to indigenous people. Separate procedures shall be issued by responsible ministries, and in the absence of such procedures all such Projects shall adhere to international practice on involuntary resettlement and indigenous people.

The Project Proponent is obliged to use, comply with and refer to applicable national standards, international standards adopted by the Government and/or the MONREC, or, in the absence of relevant national or adopted international standards, such standards as may be agreed with the MONREC.

The IEE Report shall consider the views, concerns, and perceptions of stakeholders, communities and individuals that could be affected by the Project or who otherwise have an interest in the Project. The IEE should include the results of public consultations and negotiations with the affected populations on the environmental and social issues. Public

concerns should also be taken into account in assessing impacts, designing mitigation measures, and selecting monitoring parameters. After completing all investigations and public consultation and participation processes required for IEE Type Projects, the Project Proponent shall submit the IEE Report to the MONREC in both digital and hard copy, together with the required service fee.

The MONREC shall within 10 days after submission disclose the IEE Report to civil society, PAPs, concerned government organizations, and other interested stakeholders. The MONREC shall submit the IEE Report to the IEE Report Review Body for comment and recommendations and also arrange for public consultation meetings at national and State/ Regional/ local levels where the Project Proponent shall present the IEE Report. All received comments and recommendations, including those of the IEE Report Review Board, will be collected and reviewed by the MONREC prior to making a final decision on approval of the IEE Report.

In conclusion, the IEE approval process can be summarized as reported in the following Table 4.1-1.

**Table 4.1-1: The IEE Approval Process in Myanmar**

IEE Process	Duration	MIC Permission	Duration
IEE/EIA/NON Proposal Screening	15 days	Proposal Screening	15 days
		MIC Permission	90 days
IEE Process			
- Approval of IEE experts	7 days		
- IEE report preparation	-		
- IEE report approval	60 days		

## 4.2 Commitments of Proponents (UREC's Environmental Policy)

UREC is committed to responsible environmental management in all its operations during construction, operation, decommissioning, closure and post-closure monitoring of the Project. To this effect the company adopted the Operation and Maintenance Management of Transmission Lines Manual. The Operation and Maintenance Management of Transmission Lines Manual is shown in Appendix 6.

The entrusted operation and maintenance management mode for transmission lines refers to one kind of equipment operation and maintenance management mode where transmission line operation and management is entrusted to a qualified professional company. The Measures are hereby formulated in order to standardize entrusted operation and maintenance management of Union Resources & Engineering Co., Ltd. and ensure the safe, stable and reliable operations of the transmission equipment.

## 4.3 Environmental Target Values for Consideration of Surrounding Environment

According to Article 10 of the Environmental Conservation Law, MOECAP (MONREC) shall set the following environmental quality standards, with the approval of the Union Government and the Committee:

- (a) Suitable surface water quality standards for the public usage of rivers, streams, canals, springs, marshes, swamps, lakes, reservoirs, and other inland water sources of the public;
- (b) Water quality standards for coastal and estuarine areas;
- (c) Underground water quality standards;
- (d) Atmospheric quality standards;
- (e) Noise and vibration standards;
- (f) Emissions standards;
- (g) Effluent standards;
- (h) Solid waste standards; and
- (i) Other environmental quality standards stipulated by the Union Government.

As of December, 2015, emission guideline and target values of ambient air quality, air emission, wastewater, and noise levels were set in NEQG, while other standards have not been set yet by MONREC.

UREC will follow and comply the following target level of each component. Each quantitative target value to be applied is described below.

1. Air Quality
2. Water Quality
3. Noise
4. Vibration

### 4.3.1 Air Quality

#### Target Value of Ambient Air Quality

NEQG has set the ambient air quality for electric power transmission and distribution in Myanmar as shown in Table 4.3-1.

On the basis of the above standards, the target value for air quality in the Project, as shown in Table 4.1-2 has been set with the following considerations:

- Target parameters of ambient air quality in Myanmar's standards are applied if it has set (SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>2.5</sub>, and PM<sub>10</sub>).
- The averaging period adopted is 24 hours, which could be measured using the available equipment in Myanmar whereas currently it is impossible to implement continuous measurement for one month or one year at the project site due to battery/electrical capacities.

The power transmission and distribution sector does not typically give rise to significant effluents or air emissions. The major emission during construction period is only dust and exhaust gas from vehicles. So, the project company will comply with General Guidelines for air quality.

**Table 4.3-1: Air Emission Level set in NEQG**

Parameter	Averaging Period	Guideline Value µg/m <sup>3</sup>
Particulate matter PM10 <sup>a</sup>	1-year	20
	24-hour	50
Particulate matter PM2.5 <sup>b</sup>	1-year	10
	24-hour	25
Sulfur dioxide	24-hour	20
	10-minute	500

<sup>a</sup> Particulate matter 10 micrometers or less in diameter

<sup>b</sup> Particulate matter 2.5 micrometers or less in diameter

### 4.3.2 Water Quality

The potentially contaminated water run-off exists; site operations should comply with General Guidelines for surface water quality.

**Table 4.3-2: Effluent and Sanitary Discharges (general application)<sup>3</sup>**

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U. <sup>a</sup>	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

<sup>a</sup> Standard unit

### 4.3.3 Noise

#### Noise Level Set in NEQG

In NEQG, the noise level is set as shown in Table 4.1-4 and noise prevention and mitigation measures should be taken by all projects where the predicted or measured noise impacts from a project facility or operation exceed the applicable noise level guideline at the most sensitive point of reception. Noise impact should not exceed the levels shown below, or result in a maximum increase in background levels of three decibels at the nearest offsite receptor location.

**Table 4.3-3: Target Noise Level Set in NEQG**

Receptor	One Hour LAeq (dBA)	
	Daytime (7:00-22:00) (10:00-22:00 for public holidays)	Nighttime (22:00-7:00) (22:00-10:00 for public holidays)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Source: NEQG (December 2015)

### 4.3.4 Electric Field and Magnetic Field

Exposure limits for general public exposure to electric and magnetic fields should comply with International Commission on Non-ionized Radiation Protection guidelines for limiting general public exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz).

**Table 4.3-4: Target Electric and Magnetic Level Set in NEQG**

Frequency	Electric Field (V/m)	Magnetic Field (μT)
50 Hz	5000	100
60 Hz	4150	83



#### **4.3.5 Biodiversity and Sensitive Habitats**

Biodiversity and sensitive habitats in Myanmar are regulated by the Protection of Wildlife, Wild plants and Conservation of Natural Area Law and the National Biodiversity Strategy and Action Plan (NBSAP) of Myanmar.

##### **a. The Protection of Wildlife and Conservation of Natural Areas Law**

The policy context for the establishment of protected areas is given by the National Environment Policy, formulated in 1990, with the objective of strengthening wildlife management through the establishment of a network of national parks, wildlife reserves and sanctuaries. In addition, a further goal is to increase the coverage of protected areas to 5% in the first instance, and ultimately up to 10% of the area of Myanmar.

Moreover, the Protection of Wildlife, Wild plants and Conservation of Natural Area Law, which dates back to 1994, focuses on protecting wildlife including their habitats and formulating protected areas while stipulating penalties against offenses. The major objectives of the law are to implement the Government policy for wildlife protection as well as for natural areas conservation and to protect endangered species and their habitats.

Article 7 of the law defines the categories of natural area as follows:

- Scientific reserve;
- National park;
- Nature reserve;
- Wildlife sanctuary;
- Geo-physically significant reserve;
- Other nature reserve determined by the minister.

Article 15 of the Law defines the categories of the protected species as follows:

- Completely protected species of wild animals;
- Normally protected species of wild animals;
- Seasonally protected species of wild animals.

Myanmar is also a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora and to the Ramsar Convention on Wetlands of International Importance.

Section 3 described the objectives of Protection of Wild Life and Wild Plants and Conservation of Natural Areas Law (1994) are as follows:

- To implement the policy of protecting wild life and wild plants of the Government;
- To implement the policy of conserving the natural areas of the Government;
- To carry out in accordance with International Conventions adopted by the State in respect of the preservation of wild life and wild plants, living and non-living organisms and migratory birds;
- To protect wild life and wild plants liable to the danger of extinction and the habitats thereof;
- To contribute towards works of natural scientific research;
- To protect wild life and wild plants by the establishment of zoological gardens and botanical gardens.

##### **b. National Biodiversity Strategy and Action Plan**

The National Biodiversity Strategy and Action Plan (NBSAP) of Myanmar was adopted by the Cabinet on 03 May 2012. The strategy contains 10 strategic directions as followings:

- Strengthening conservation of priority sites;



- Mainstreaming biodiversity into other policy sectors;
- Implementing focused conservation actions for priority species;
- Supporting local Non-governmental Organization (NGOS) and academic institutions;
- Creating capacity to coordinate conservation investment in Myanmar;
- Scaling up implementation of in-situ and ex-situ conservation of agriculture, livestock and fisheries biodiversity and genetic resource management;
- Expediting the process of implementing the National bio-safety framework;
- Promoting the initiative to manage IAS;
- Facilitating the legislative process of environmental protection and environmental impact assessment; and
- Enhancing communication, education and public awareness on biodiversity conservation.

#### 4.3.6 Occupational Health and Safety

The Factories Act 1951 provides requirements concerning with working hours, working days, overtime, and certain health and safety measures. The following is a summary:

- **Working hours** - Normal working hour is 8 hours a day for a total maximum 48 hours a week. A worker is entitled to minimum thirty minute rest period after working continuously for five hours;
- **Working days** - Working days may be up to six days a week (for government services, 5 days a week);
- **Overtime** - Overtime is permissible. Its pay rate is twice the normal pay rate;
- **Safety & Health** - The employer has an obligation to protect workers from occupational hazards relating to the physical facilities, harmful substances, and environment factors at the workplace;
- The employer has other obligations, depending on the number of workers employed; and
- The workers can also get other rights in accordance with Leave and Holidays Act, 1951, Social Security Act, 1954 and the Worker's Compensation Act, 1923.

#### 4.3.7 Cultural Heritage

The Antiquities Act (enacted in 1957 and revised in 1962) is a law that governs movable and immovable cultural heritage that have archaeological and historical value. The Antiquities section provides stipulations for the movement of antiquities inside and outside the country, the protection and management of antiquities, the protection and restoration obligation and the compulsory acquisition right of the Director of the Burma Archaeological Survey, and penalties for violations of the above.

The Protection and Preservation of Cultural Heritage Regions Law (1998, amended in 2009 and 2011) is the organic law on the protection and preservation of cultural heritage regions and the cultural heritage in Myanmar. It mainly supplements the Antiquities Act with provisions that more widely cover cultural heritage.

In this law, the Ministry of Culture is tasked to issue notifications to designate a site which has one or more zones out of the three indicated as a cultural heritage region (ancient monumental zone, ancient site zone, and protected and preserved zone). The Ministry also carries out acquisition of any land within the cultural heritage region, if necessary.

Section 12 described as the functions and duties of the Ministry of Culture are as follows:

- Determining with the approval of the Government, the ancient monuments and ancient sites that should be determined as cultural heritage in the cultural region.

Section 13 stated that a person desirous of carrying out one of the following shall abide by the provisions of other existing laws and also apply to the Department in accordance with stipulations to obtain prior permission under this Law:

- Within the ancient monumental zone or the ancient site zone:

(1) Constructing or extending a building;

(2) Renovating the ancient monument or extending the boundary of its enclosure

Section 18 mentioned that no person shall, without prior permission granted under this law, construct, extend, renovate a building or extend the boundary of its enclosure in the ancient monumental zone or ancient site zone.

The objectives of the Protection and Preservation of Cultural Heritage Regions Law are:

- To implement the protection and preservation policy with respect to perpetuation of cultural heritage that has existed for many years;
- To protect and preserve the cultural heritage regions and the cultural heritage therein so as not to deteriorate due to natural disaster or man-made destruction;
- To uplift hereditary pride and to cause dynamism of patriotic spirit of citizens by protecting and preserving the cultural heritage regions;
- To promote public awareness and will as to the high value of the protection and preservation of the cultural heritage regions;
- To protect the cultural heritage regions from destruction; and
- To carry out protection and preservation of the cultural heritage regions in conformity with the International Convention approved by the State.

Relevant excerpts are as follows:

- “20. No person shall carry out any of the following in the cultural heritage region: (a) destroying an ancient monument; (b) wilfully altering the original ancient form and structure or original ancient workmanship of an ancient monument; (c) excavating to search for antiquities; and (d) exploring for petroleum, natural gas, precious stones or minerals;
- 21. No person shall, without prior permission granted under this Law, carry out any of the following in the cultural heritage region: (a) carry out renovation and maintenance work on an ancient monument; (b) carrying out archaeological excavation; (c) building road, constructing bridge, irrigation canal, embankment or extending the same; and (d) digging well, pond, fish-breeding pond or extending the same.”

According to Chapter IV of the Law, the Department of Archaeology, National Museum and Library is in charge of the following activities:

- **Article 9.** *The Department shall carry out works of protection and preservation of the ancient monuments and ancient sites situated in the cultural heritage region;*
- **Article 10.** *The Department may prohibit any person from ploughing and cultivating within the boundary of the ancient monument or ancient site or from carrying out any activity that may cause damage to the cultural heritage in the cultural heritage region; and*
- **Article 11.** *The Department shall, with the approval of the Ministry of Culture, carry out the following in the cultural regions: (i) determination of precincts of an ancient monument; and (ii) prescription of conditions to be abided by shops opened within the precinct determined under item.*

For the time being, there are no guidelines for cultural heritage management in Myanmar.

## **4.4 Applicable Law and Regulation**

The Project Proponent (The Company) shall prepare an Initial Environmental Examination (IEE) for the project in accordance with the requirements and regulations of the Ministry of Natural Resources and Environmental Conservation (MONREC).

The project proponent, UREC shall comply the all National Laws that related to the project activities. The followings are the list of laws and regulations that applied and commits to follow related to the present project.

1. The Environmental Conservation Law (2012)
2. The IEE Procedure (2015)
3. National Environmental Quality (Emission) Guidelines (2015)
4. Protection the Rights of Ethnic Nationalities Law (2015)
5. The Electricity Law (2014)
6. Employment and Skill Development Law (2013)
7. The Myanmar Insurance Law (1993)
8. Social Security Law (2012)
9. The Factories Acts (1951)
10. The Fire Force Law (2015)
11. The Law Amending the Workmen' Compensation Act, 1923 (2005)
12. The Leaves and Holiday Act (1951)
13. The Minimum Wages Law (2013)
14. Labour Organization Law (2011)
15. Prevention and Control of Communicable Disease Law (1995)
16. The Motor Vehicles Law (2015) and Rules (1987)
17. The Conservation of Antique Objects Law (2015)
18. The Protection of Wildlife, Wild Plants and Conservation of Natural Area Law (1994)
19. The Protection and Preservation of Cultural Heritage Regions Law (1998)
20. The Protection and Conservation of Antique Objects Law (2015)
21. The Forest Law (1992)
22. The Conservation of Water Resources and Rivers Law 2006

### **1. The Environmental Conservation Law (2012)**

The Environmental Conservation Law is enacted by the Pyidaungsu Hluttaw Law on 30<sup>th</sup> March, 2012 to construct a healthy and clean environment and to conserve natural and cultural heritage for the benefit of present and future generations; to maintain the sustainable development through effective management of natural resources and to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation.

### **2. The IEE Procedure (2015)**

The IEE Procedure formulated by MOECA (MONREC) in coordination with the Asian Development Bank (ADB) was enacted in December 2015. This IEE Procedure covers the following contents: screening of projects, qualification for conducting the initial environmental examination (IEE)/EIA, categorization of projects for IEE/EIA/ environmental management plan (EMP), preparation of IEE/EIA report and EMP, public involvement, procedure on how to get the approval of IEE/EIA report from the Environmental Conservation Department (ECD) under MONREC, environmental compliance certificate (ECC), and monitoring process after getting the approval of the IEE/EIA report.

### **3. National Environmental Quality (Emission) Guidelines (2015)**

MONREC formulated the National Environmental Quality (Emission) Guidelines (NEQG) in coordination with ADB in December 2015. The NEQG determines the guideline values for general emission such as air emissions, wastewater, noise levels, odor, and those for sector-specific emission such as emission from forestry, agribusiness/food production, chemicals, oil and gas, infrastructure, general manufacturing, mining, and power.

### **4. Protection the Rights of Ethnic Nationalities Law (2015)**

**Purpose:** To ensure to disclose to the resident ethnic nationalities about the project fully, moreover, to ensure cooperate with them.

**Section 5** - The project proponent will disclose to the resident ethnic nationalities about the project fully.

### **5. The Electricity Law (2014)**

**Purpose:** To ensure the compliance with the conditions of permission for productions of electricity, abiding by any stipulation, implementing with the best practices and paying compensation in line with above law.

### **6. The Development of Employment and Expertise Law**

**Purpose:** To ensure the job security and to develop the employee's skill with the fund of project owner.

### **7. The Myanmar Insurance Law**

**Purpose:** The project can cause the damages to the environment and injuries to public so to ensure the needed insurances are insured at Myanmar Insurance.

**Section 15** - If the project owner uses the owned vehicles the project owner has to insure the insurance for injured person.

**Section 16** - The project owner has to insure the insurance to compensate for general damages because the project may cause the damages to the environment and injury to public.

### **8. Social Security Law (2012)**

**Purpose:** The Project owner has to create the social security for the employees because the project is the business under the Myanmar Citizen Investment Law. To ensure the social security for employees of the project, the project owner has to register to the social security offices and to pay the prescribed funds.

### **9. The Factories Acts (1951)**

**Purpose:** The cement plant can be operated as a factory with the employees and to ensure the healthy, safety, welfare, fair working-times and clean environment for the employees. The law focuses all stipulations for the employer.

The project owner should abide by nearly all sections. The project owner has to abide by all provisions for healthy, safety, welfare, working-hours and other needs.

### **10. The Fire Force Law (2015)**

**Purpose:** To ensure to prevent the fire, to provide the precautionary material and apparatuses, if the fire caused in the project area to be defeated because the project is business in which electricity and any inflammable materials such as petroleum are used. So, the project owner has to institute the specific fire service in line with the above law.

**Sub-section (a) of section 25** - The project proponent promise not fail to institute the specific fire services.

**Sub-section (b) of section 25** - The project owner promise not fail to provide materials and apparatuses for fire precaution and prevention.

#### **11. The Law Amending the Workmen' Compensation Act, 1923 (2005)**

**Purpose:** To ensure the compensations to injured employee while implementing in line with the above law. To abide by the prescribed compensations in various kinds of injury.

**Section 13** - The project owner will pay the compensation in line with the provisions of said law.

#### **12. The Leaves and Holiday Act (1951, partially revised in 2014)**

**Purpose:** The employees can take the leaves and get the holidays legally and to ensure the right to get the holidays and leaves. The project owner will allow the leaves and holidays in line with the law.

#### **13. The Minimum Wages Law (2013)**

**Purpose:** To ensure the project owner pays the wages not less than prescribed wages and notify obviously this wages in work place, moreover to be inspected.

#### **14. Labour Organization Law (2011)**

**Purpose:** To ensure protection the rights of the employees, having the good relationships between the employees and employer and enabling to form and carry out the labour organizations systematically and independently.

**Section 17** - The project owner promises to allow the labour organization to negotiate and settle with the employer if the workers are unable to obtain and enjoy the rights of the workers contained in the labour laws and to submit demands to the employer and claim in accord with the relevant law if the agreement cannot be reached.

**Section 18** - The project owner promises to demand the re-appointment of worker is dismissed by the employer without the conformity with the labour laws.

**Section 19** - The project owner promises to send the representatives to the Conciliation Body in settling a dispute between the employer and the worker.

**Section 20** - The project owner promises the labour organization to participate and discuss in discussing with the government, the employer and the complaining employees in respect of employee's rights or interest contained in the labour laws.

**Section 21** - The project owner promises the labour organization to participate in solving the collective bargains of the employees in accord with the labour laws.

**Section 22** - The project owner promises the labour organization to carry out the holding the meetings, going on strike and other collective activities in line with the labour laws.

#### **15. Prevention and Control of Communicable Diseases Law (1995)**

**Purpose:** To ensure the healthy work environment and prevention the communicable diseases by the cooperation with the relevant health department.

The project owner will cooperate with the health officer in line with the clause (9) of sub-section (a) of section 3 of said law.

The project owner will abide by any instruction or stipulation for public health. Section 4.

The project owner will inform promptly to the nearest health department or hospital if the following are occurred: (section 9)

a) Mass death of birds or chicken

- b) Mass death of mouse
- c) Suspense of occurring of communicable disease or occurring of communicable disease
- d) Occurring of communicable disease which must be informed

The project owner will accept any inspection, anytime and anywhere if it is needed (section 11).

#### **16. The Motor Vehicles Law (2015) and Rules (1987)**

**Purpose:** When the construction period and if it is needed in operation and production period for all vehicles the project proponent will promise to abide by the nearly all provisions of said law and rules, especially, the provisions related to air pollution, noise pollution and life safety.

#### **17. The Conservation of Antique Objects Law (2015)**

**Purpose:** The antique object is non-valuable for national heritage. So, anybody has to inform if he or she has found any antique object.

**Section 12** - The project proponent will inform to the village-tract office antique object is found.

#### **18. The Protection of Wildlife, Wild Plants and Conservation of Natural Area Law (1994)**

**Purpose:** To ensure the protection of natural areas and wild life and wild plants which are in the natural areas.

**Section 35** - The project owner promises not to pollute the air and water, cause the damages to water way, poison into the water, dispose the poisonous substances or mineral-waste in the natural area.

**Section 36** - The project owner promises not to product, collect or destroy any protect natural plant without permission, destroy any natural existence or bio-diversity.

#### **19. The Protection and Preservation of Cultural Heritage Regions Law (1998)**

**Purpose:** To ensure the protection of cultural heritages and the cultural heritage area from the damage by the natural disaster or man-made.

**Section 13** - The project proponent will report to the village-tract or ward administrators if the project proponent will find any ancient monument under the ground or on the ground or under the water.

**Section 15** - The project proponent will obtain permission of Department of Ancient Research Museum if the project area is in the prescribed area of Ancient monument.

**Sub-section (f) of section 20** - The project proponent will obtain the prior permission, by written of Department of Ancient Research and National Museum if the project proponent disposes the chemical and solid waste in the Ancient Monument area.

#### **20. The Protection and Conservation of Antique Objects Law (2015)**

**Section 12** - The project proponent will inform to the village-tract or ward administrators if the project proponent will find any antique object in the project area.

#### **21. The Forest Law (1992)**

**Sub-section (a) of section 12** - The project proponent will obtain the approval of Ministry if the project area is included in the forest land or the land administrated by the government which covers the forest.

#### **22. The Conservation of Water Resources and Rivers Law 2006**



The project proponent shall follow the following sub-section of the law.

**Section 11** - No person shall:

(a) Dispose of engine oil, chemical, poisonous material and other materials which may cause environmental damage, or dispose of explosives from the bank or from a vessel which is plying, vessel which has berthed, anchored, stranded or sunk.

**Section 30** - Any government department and organization or any person desirous of constructing drainage, utilizing river water intake, constructing bridges spanning rivers, connecting underground pipe, connecting underground electric power cable, connecting underground telecom cable or digging in rivers and creeks, bank boundary and waterfront boundary, under the requirement of work, shall in order not to adversely affect the water resources and rivers and creeks, carry out only after obtaining the approval of the Ministry of Transport.

## 4.5 Myanmar's International Commitments

The main international and regional treaties concerning the environment to which Myanmar is a party (in chronological order) can be listed as follows:

- Plant Protection Agreement for the Southeast Asia and Pacific Region;
- Vienna Convention for the Protection of the Ozone Layer;
- Montreal Protocol on Substances that Deplete the Ozone Layer;
- MARPOL: International Convention for the Prevention of Pollution from Ships;
- MARPOL: International Convention for the Prevention of Pollution from Ships as amended 1978;
- Agreement on the Networks of Aquaculture Centers in Asia and the Pacific Region;
- London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer;
- United Nations Framework Convention on Climate Change;
- Treaty on the Non-Proliferation of Nuclear Weapons;
- ICAO: ANNEX 16 Annex to the Convention on International Civil Aviation;
- Environmental Protection Vol. I, II, Aircraft Noise;
- United Nations Convention to Combat Desertification;
- Convention Concerning the Protection of the World Cultural and Natural Heritage;
- Convention on Biological Diversity;
- United Nations Convention on the Law of the Sea;
- International Tropical Timber Agreement;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora;
- ASEAN Agreement on the Conservation of Nature and Natural Resources;
- Cartagena Protocol on Biosafety;
- ASEAN Agreement on Transboundary Haze Pollution;
- Kyoto Protocol to the United Nations Framework Convention on Climate Change;
- Stockholm Convention on Persistent Organic Pollutants;
- Ramsar Convention on Wetlands; and
- Copenhagen Amendment to Montreal Protocol on Substances that deplete the Ozone Layer.



## **5 DESCRIPTION OF THE SURROUNDING ENVIRONMENTAL AND SOCIAL CONDITIONS**

### **5.1 Methodology for Data Collection and Analysis**

Resource & Environment Myanmar conducted a base line study along 121 km long 230kV double circuit power transmission line from Bamaw substation to Nabar substation.

The base line data collection was based on the following methods.

- a) Identification and review of the applicable national and international environmental and social regulatory and institutional framework
- b) Establishing environmental and social baseline conditions along the stretch by the following;
  - Reconnaissance survey using satellite imagery to observe environmental and social characteristics along the transmission line;
  - Secondary data collection along the transmission line route with respect to water, soil, noise quality, and Socioeconomic condition
  - Ecological survey of flora and fauna using desk study prevailing along the transmission line route through primary and secondary surveys
  - Identification of land use of the stretch through satellite imageries of the whole stretch of the transmission line;
  - Identification, prediction of environmental and social impacts of the Project.

The transmission line is falling in the township of Bhamo, Shweku, Kathar and Indaw.

### **5.2 Environmental Baseline Study**

The baseline study was considered Area of Interest (AOI) including the single circuit 230 kV transmission line.

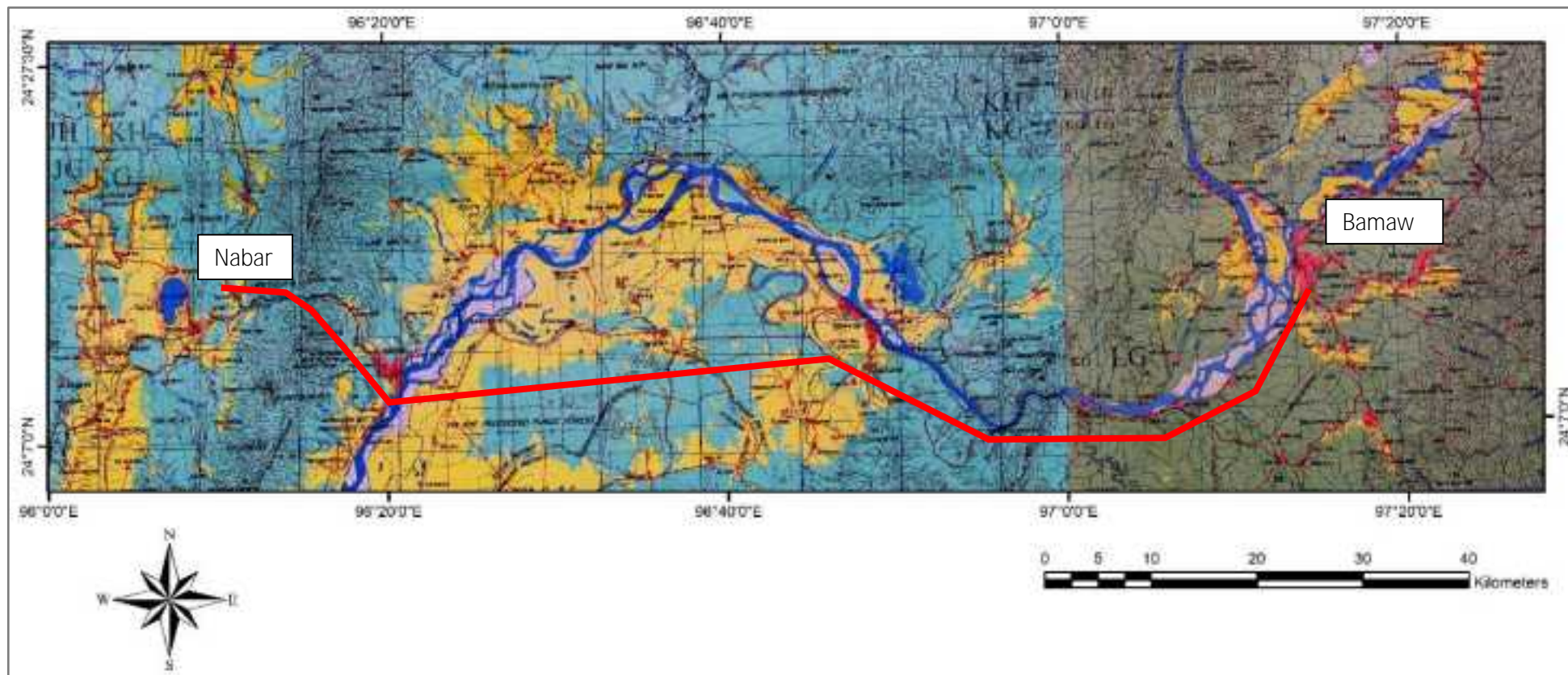
The environmental baseline data such as water, noise quality, traffic survey and ecological survey was conducted using desk study along the transmission route. The ecological survey was conducted to assess the type of flora and fauna prevailing along the transmission line. Topography, climate and meteorology, geology was collected through literature review and available data from Universities. Topography and geology along the transmission line was studied using available topographic maps and satellite imagery.

### **5.3 Physical Environment**

#### **5.3.1 Topography along the Transmission Line Corridor**

The proposed transmission line route between Bamaw and Kathar is located on the eastern bank of Ayeyarwady River and the line route between Kathar and Nabar is located on the western bank of Ayeyarwady River. The topographic unit passed by the transmission line route from the Bhamo substation to Nabar substation is nearly flat and average elevation is about 100 meter above sea level between Bhamo and Shwegu. The stretch between Shwegu and Kathar is also flat and the general elevation is about 100 to 150 m above sea level. The stretch between Kathar and Nabar is hilly, highly dissected, with moderate to steep slopes. The terrain in this stretch is topographically highly variable, with strips having elevation up to 600m to 850m above sea level (asl). The topographic map of the area between Bamaw and Nabar is shown in Figure 5.3-1.

The main Ayeyarwaddy River is flowing from north to south, east to west and finally down to the south between Bhamo Substation and Nabar Substation.



**Figure 5.3-1: Topographic map of the transmission line between Bamaw Substation and Nabar Substation**

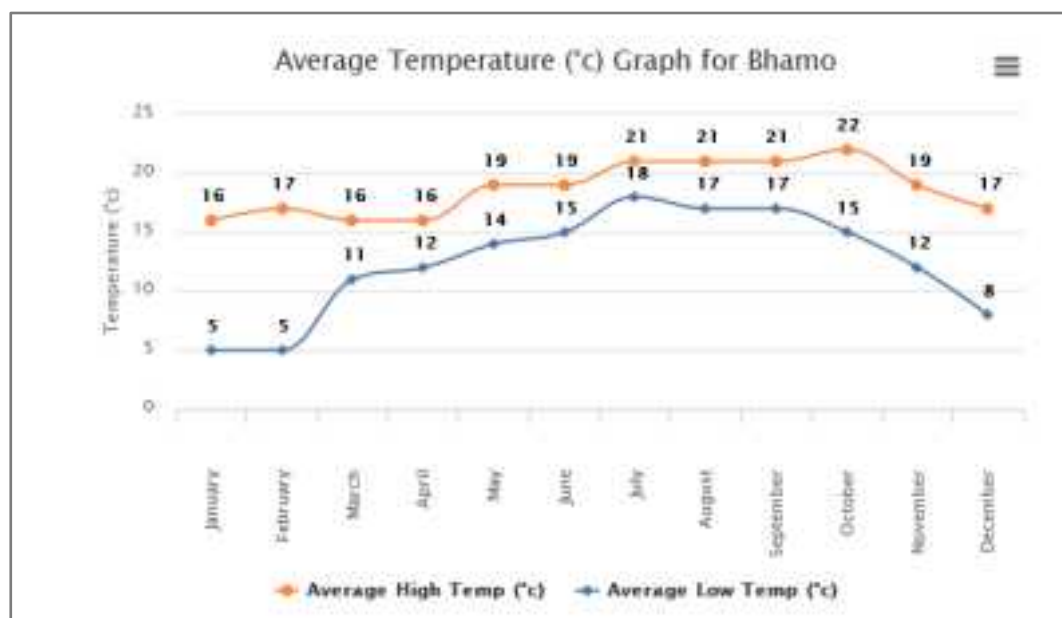
### 5.3.2 Climate

The meteorology and climate of Myanmar is controlled by the great monsoon circulation system of SE Asia and is influenced in detail by topographic peculiarities. The mountain ranges in Myanmar are generally running N-S, so that they present effective climate barriers for the SW monsoon in the summer and the NE monsoon in the winter. Therefore, the central part of the Inner Myanmar Tertiary Basin (Central Dry Zone) lies in rain shadow during the summer monsoon (June to September) and receives less than 500 mm of precipitation. The considerable differences in relief along the path of the monsoon lead to the formation of the following climatic zones. (DRUMMOND 1958):

Subtropical monsoon and subtropical mountain climates (the higher sections of the Indo-Myanmar and of the Shan Massif, north of 23° to 24° N), with mean temperatures of January is below 18° C and occasional frost during the winter months in the higher and northerly situated mountain regions; about 40 km in the western ranges and 190 km in the eastern plateau are in subtropical monsoon climate and 70 km in the eastern plateau is in subtropical mountain climatic condition.

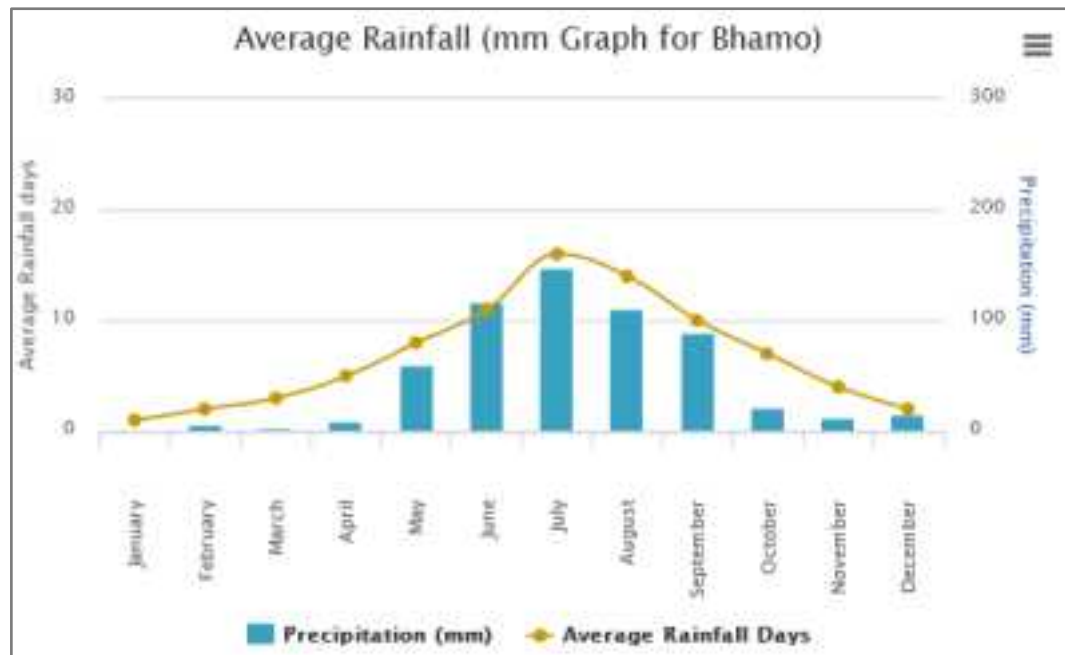
As one of the countries in Monsoon climate, it has three seasons namely summer (March to the middle of May), rainy season (middle of May to the end of October) and winter season (November to the end of February). Some researchers divided part of rainy season and winter into two periods such as the post-monsoon (October to November) and the cold dry season (December to February). Principal approach for meteorology and climate for Myanmar and the Project is collecting secondary data from concerning departments and review of previous available as hard copies and also on the web. Department of Meteorology of the Ministry of Transport and Department of Geography of the University of Yangon are of the important resources.

#### Climate of Bhamo (Bamaw)



Note: The data for charts above are taken from year 2000 to 2012.

**Figure 5.3-2: Average temperature of Bhamo Area**

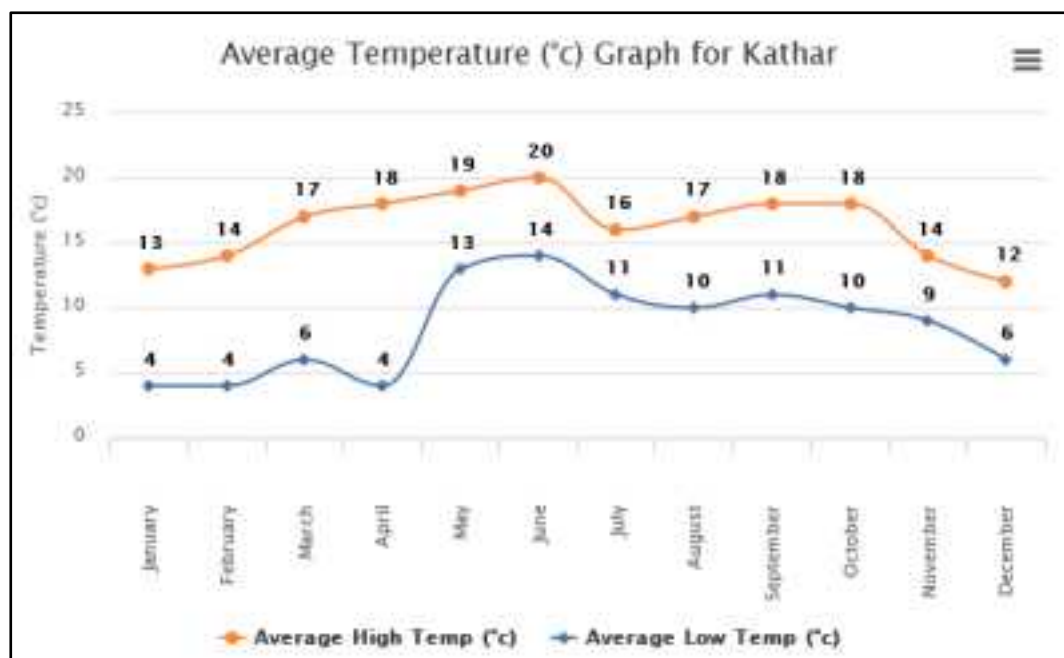


Note: The data for charts above are taken from year 2000 to 2012.

**Figure 5.3-3: Average precipitation of Bhamo Area.**

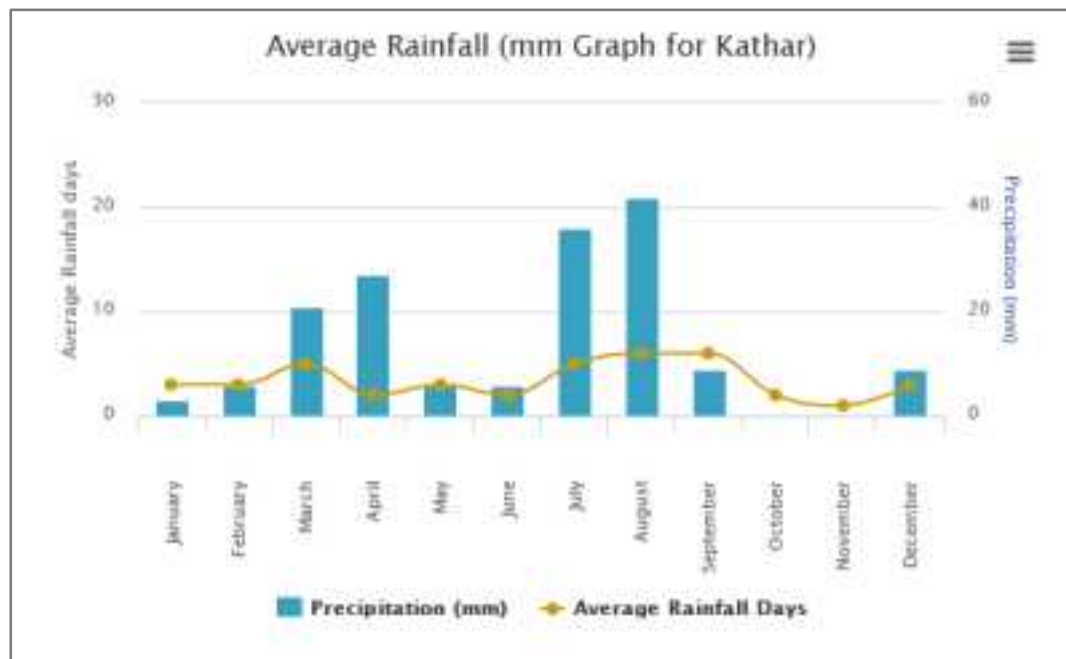
Bhamo's climate is classified as warm and temperate. The summers here have a good deal of rainfall, while the winters have very little. The climate here is classified as Cwa by the Köppen-Geiger system. The average annual temperature is 24.0°C in Bhamo. The rainfall here averages 1677 mm.

#### Climate of Kathar



Note: The data for charts above are taken from year 2000 to 2012.

**Figure 5.3-4: Average temperature of Kathar Area.**



Note: The data for charts above are taken from year 2000 to 2012.

**Figure 5.3-5: Average precipitation of Kathar Area.**

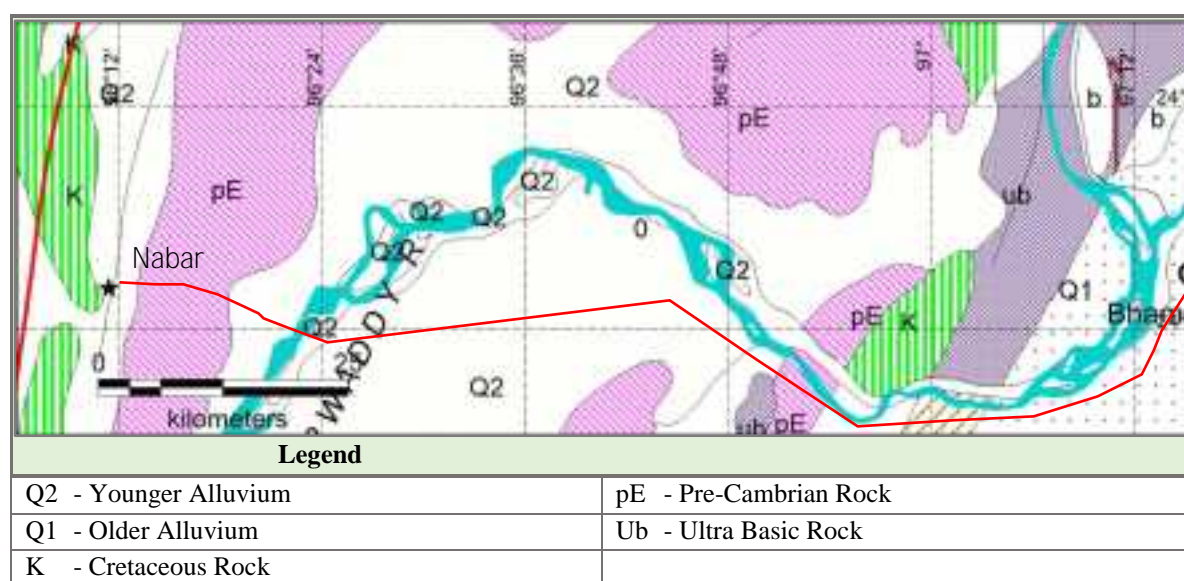
The average highest temperature in Kathar is 20°C in May and lowest average temperature is about 4°C in January. The average highest rainfall is nearly 40 mm in August and there was 20 rain days in August.

### 5.3.3 Geology

Geology of the area along the transmission line was studied mainly based on previous literatures, such as Chhibber (1934) and Bender (1983), and technical reports of the geoscientists from the University of Rangoon (Yangon) and Department of Geological Survey and Mineral Exploration.

The route of transmission line is generally occupied by flat topography with Alluvium near the Bhamo area and highly undulating with hilly terrains that occupied by ultrabasic rock and older Pre-Cambrian sediments and metamorphosed sediments between Shwegu and Kathar area. Another formation is Cretaceous clastic and carbonate rocks chiefly consists of sandstone, limestone and shale. Between Kathar and Nabar area, the transmission line passes through the Pre-Cambrian rocks again. (See in Figure 5.3-6).





**Figure 5.3-6: Geological map between Bhamo (Bhamaw) and Nabar which 230 kV transmission line stretch.**

### 5.3.4 Air Quality

Four locations for air quality monitoring were conducted during the field survey.

#### *Survey Item*

The survey result was evaluated by comparing with World Health Organization (WHO) guide line value and Myanmar National Environmental Quality (Emission) Guidelines, 2015.

**Table 5.3-1: Ambient air quality standard of Myanmar and other countries**

Item	Average Period	Myanmar	Japan	Thailand	Vietnam	WHO
SO <sub>2</sub>	10 mins	0.5 mg/m <sup>3</sup>	-	-	-	0.5 mg/m <sup>3</sup>
	1 hour	-	0.26 mg/m <sup>3</sup>	0.78 mg/m <sup>3</sup>	0.35 mg/m <sup>3</sup>	-
	24 hours	0.02 g/m <sup>3</sup>	0.10 mg/m <sup>3</sup>	0.3 mg/m <sup>3</sup>	0.12 5mg/m <sup>3</sup>	0.125 mg/m <sup>3</sup> (Interim target-1) 0.05 mg/m <sup>3</sup> (Interim target-2) 0.02 mg/m <sup>3</sup> (Guideline)
	1 year	-	-	0.1 mg/m <sup>3</sup>	0.05 mg/m <sup>3</sup>	-
NO <sub>2</sub>	1 hour	0.2 mg/m <sup>3</sup>	-	0.32 mg/m <sup>3</sup>	0.2 mg/m <sup>3</sup>	0.2 mg/m <sup>3</sup>
	24 hours	-	0.07-0.11 mg/m <sup>3</sup>	-	0.1 mg/m <sup>3</sup>	-
	1 year	0.04 mg/m <sup>3</sup>	-	0.057 mg/m <sup>3</sup>	0.04 mg/m <sup>3</sup>	0.04 mg/m <sup>3</sup>
CO	1 hour	-	-	36.3 mg/m <sup>3</sup>	30 mg/m <sup>3</sup>	-
	8 hours	-	22.5 mg/m <sup>3</sup>	-	10 mg/m <sup>3</sup>	-
	24 hours	-	11.3mg/m <sup>3</sup>	10.26 mg/m <sup>3</sup>	-	-
TSP	1 hour	-	-	-	0.3 mg/m <sup>3</sup>	-
	24 hours	-	-	0.33 mg/m <sup>3</sup>	0.2 mg/m <sup>3</sup>	-
	1 year	-	-	0.10 mg/m <sup>3</sup>	0.1 mg/m <sup>3</sup>	-
PM <sub>10</sub>	1 hour	-	0.2 mg/m <sup>3</sup>	-	-	-
	24 hours	0.05 mg/m <sup>3</sup>	0.1 mg/m <sup>3</sup>	0.12 mg/m <sup>3</sup>	0.15 mg/m <sup>3</sup>	0.15 mg/m <sup>3</sup> (Interim Target-1) 0.10 mg/m <sup>3</sup> (Interim Target-2) 0.075 mg/m <sup>3</sup> (Interim Target-3)



						0.05 mg/m <sup>3</sup> (Guideline)
	1 year	0.02 mg/m <sup>3</sup>	-	0.05 mg/m <sup>3</sup>	0.05 mg/m <sup>3</sup>	0.07 mg/m <sup>3</sup> (Interim Target-1) 0.05 mg/m <sup>3</sup> (Interim Target-2) 0.03 mg/m <sup>3</sup> Interim Target-3) 0.02 mg/m <sup>3</sup> (Guideline)
PM <sub>2.5</sub>	24 hours	0.025 mg/m <sup>3</sup>	0.035 mg/m <sup>3</sup>	0.05 mg/m <sup>3</sup>	0.05 mg/m <sup>3</sup>	0.075 mg/m <sup>3</sup> (Interim Target-1)0.05 mg/m <sup>3</sup> (Interim Target-2)0.0375 mg/m <sup>3</sup> Interim Target-3) 0.025 mg/m <sup>3</sup> (Guideline)
	1 year	0.01 mg/m <sup>3</sup>	0.015 mg/m <sup>3</sup>	0.025 mg/m <sup>3</sup>	0.025 mg/m <sup>3</sup>	0.035 mg/m <sup>3</sup> (Interim Target-1) 0.025 mg/m <sup>3</sup> (Interim Target-2) 0.015 mg/m <sup>3</sup> Interim Target-3) 0.01 mg/m <sup>3</sup> (Guideline)
Ozone	1 hour	-	-	0.2 mg/m <sup>3</sup>	0.2 mg/m <sup>3</sup>	-
	8 hours	0.1 mg/m <sup>3</sup>	-	0.14 mg/m <sup>3</sup>	0.12 mg/m <sup>3</sup>	0.16 mg/m <sup>3</sup> (Interim Target-1) 0.1 mg/m <sup>3</sup> (Guideline)
Pb	24 hours	-	-	-	0.0015 mg/m <sup>3</sup>	-
	1 month	-	-	0.0015 mg/m <sup>3</sup>	-	-
	1 year	-	-	-	0.0005 mg/m <sup>3</sup>	-
Photochemical oxidants	1 hour	-	38.7 mg/m <sup>3</sup>	-	-	-

*Note 1:* Photochemical oxidants are oxidizing substances such as ozone and peroxyacetyl nitrate produced by photochemical reactions (only those capable of isolating iodine from neutral potassium iodide excluding nitrogen dioxide)

*Note 2:* The value of SO<sub>2</sub> and NO<sub>2</sub>, CO and Ozone of Vietnam was converted to ppm units from mg/m<sup>3</sup>.

*Source:* Myanmar: National Environmental Quality(Emission)Guidelines. (December, 2015).Japan: National Air Quality Standard in Japan (Circular No.25, 1973, originally), Ministry of Environment, Japan

Thailand: Notifications of National Environmental Board No.10, B.E 2538 (1995), No. 24, B.E. 2547 (2004), No. 28, B.E 2550 (2007), No. 33, B.E 2552 (2009), No. 36, B.E 2553 (2010) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992).

Vietnam: National Technical Regulation on Ambient Air Quality (QCVN 05:2013/BTNMT), Ministry of Science and Technology in Vietnam.

WHO: WHO Air Quality Guidelines 2005.

### Summary of sampling points

The locations of air quality monitoring points in detail are shown below.

**Table 5.3-2: Locations of air quality monitoring station**

Sampling Points	Coordinates	Description of Sampling Point
AQN-1	24°14'55.53"N 96°11'53.08"E	Located at the Naba (Substation) EPC compound , Katha District .
AQN-2	24°10'41.07"N 96°19'15.10"E	Located at the Kyantaw village, Near Naung Hlaing stream, Katha District.
AQN-3	24° 8'31.78"N 96°49'31.05"E	Located at the Tawlan village, near the Yadanar Zaya Theikdi pagoda, Shwe Gu township.
AQN-4	24°13'22.77"N 97°14'55.22"E	Located at the Bhamo (Substation) EPC compound, Bhamo township.



**Figure 5.3-7: Location map of air quality and noise level monitoring points**

#### ***AQN-1***

AQN-1 was measured in the compound of Naba substation EPC compound. The topographic feature is mostly occurred as hilly ground feature and thick vegetation pattern. It is located at northwest of Katha Township, about 18 km away. Naba and Kan Ni villages are situated at northwest and south of AQN-1 respectively.



**Figure 5.3-8: Air quality and noise level monitoring at AQN-1**

#### ***AQN-2***

AQN-2 was located at the Kyantaw village. The topographic feature is mostly hilly and covered by thick vegetation. This station is located near the Naung Hlaing stream. There are some residential houses around the station and Katha Township is distance about 1 km away.



**Figure 5.3-9: Air quality and noise level monitoring at AQN-2**

#### ***AQN-3***

M AQN-3 was monitored at the east of Tawlan village. This station was located in the Dayanara Zaya Theikdi pagoda hill as well as the area of Nan Phar reserved forest. The topographic feature is also hilly and thick vegetation. It is closed to the Mandalay-Myithyina highway road and Shwe Gu Township is located in northwest. The possible emitted pollution sources are might be come from road side.



**Figure 5.3-10: Air quality and noise level monitoring at AQN-3**

#### ***AQN-4***

AQN-4 was monitored in the compound of Bhamo EPC. This station is located in the open space area and the topographic feature is generally plain and thin vegetation around this station. It is closed to EPC service quarters and Bhamo township is located in the northwest. Mandalay-Myitkyina highway road is distanced about 180 m from AQN-4. The possible emitted pollution sources are residential activities and road site by passing vehicles.



**Figure 5.3-11: Air quality and noise level monitoring at AQN-3**

#### ***Survey Period***

Air quality monitoring was daily conducted from 16<sup>th</sup> – 22<sup>nd</sup> June, 2017. The measurement duration is shown in the following table.

**Table 5.3-3: Sampling duration for air quality survey**

Sampling Point	Period
AQN-1	16 <sup>th</sup> - 17 <sup>th</sup> June, 2017
AQN-2	17 <sup>th</sup> – 18 <sup>th</sup> June, 2017
AQN-3	19 <sup>th</sup> – 20 <sup>th</sup> June, 2017
AQN-4	21 <sup>th</sup> – 22 <sup>st</sup> June, 2017

Source: Resource & Environment Myanmar Co., Ltd.

#### ***Survey Method***

Sampling and analysis of ambient air pollutants was conducted by referring to the recommendation of United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner EPAS (Environmental Perimeter Air Station) was used to collect Ambient Air Monitoring data. The characteristics of the instrument are:

- Portable direct reading and logging
- Configure up to 14 simultaneous air measurements including U.S. EPA criteria air pollutants
- Standard configuration measures PM10 or TSP particulates, NO<sub>2</sub>, CO, temperature, and relative humidity

**Table 5.3-4: Sampling and analysis method for air quality**

No.	Parameter	Analysis Method
1	Sulfur dioxide (SO <sub>2</sub> )	On site reading
2	Carbon monoxide (CO)	On site reading
3	Nitric oxide (NO)	On site reading
4	Nitrogen dioxides (NO <sub>2</sub> )	On site reading
5	Total suspended particles(TSP)	On site reading
6	Particle matter 10 (PM10)	On site reading

Source: Resource & Environment Myanmar Co., Ltd.



**Survey Result****(a) Ambient gases****AQN-1**

Daily average of ambient gases levels at AQN-1 was presented in following table. Most of ambient gases levels are lower than the environmental standard (one day) in WHO guideline and Myanmar National Environmental Quality (Emission) Guidelines (NEQG). SO<sub>2</sub> level is also complied with the both of standards in 24 hours results.

**Table 5.3-5: Ambient gases levels at AQN-1**

No.	Date	Time	CO	NO <sub>2</sub>	NO	PM2.5	PM10	RH	SO <sub>2</sub>	Tmp C
	D.M.Y	hours	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	%	µg/m <sup>3</sup>	°C
1	16-17 June, 2017	24	80	70	10	10	20	68.66	20	29.49
WHO Guideline Value		24	-	150	-	-	50	-	20	-
Myanmar standard		24	-	-	-	-	50	-	20	-
*Environmental, Health, and Safety Guidelines, General EHS Guidelines, WHO guide line & Myanmar National Environmental Quality (Emission) Guidelines on DEC, 2015.										

Source: Resource & Environment Myanmar Co., Ltd.

**AQN-2**

Daily average of ambient gases levels at AQN-2 was presented in following table. Most of ambient gases levels are lower than the environmental standard (one day) in WHO guideline and Myanmar National Environmental Quality (Emission) Guidelines (NEQG). SO<sub>2</sub> level is also complied with the both of standards in 24 hours results.

**Table 5.3-6: Ambient gases levels at AQN-2**

No.	Date	Time	CO	NO <sub>2</sub>	NO	PM2.5	PM10	RH	SO <sub>2</sub>	Tmp C
	D.M.Y	hours	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	%	µg/m <sup>3</sup>	°C
1	17-18 June, 2017	24	90	<10	<10	20	20	63.78	20	32.52
WHO Guideline Value		24	-	150	-	-	50	-	20	-
Myanmar standard		24	-	-	-	-	50	-	20	-
*Environmental, Health, and Safety Guidelines, General EHS Guidelines, WHO guide line & Myanmar National Environmental Quality (Emission) Guidelines on DEC, 2015.										

Source: Resource & Environment Myanmar Co., Ltd.

**AQN-3**

Daily average of ambient gases levels at AQN-3 was presented in following table. Most of ambient gases levels are lower than the environmental standard (one day) in WHO guideline and Myanmar National Environmental Quality (Emission) Guidelines (NEQG). SO<sub>2</sub> level is also complied with the both of standards in 24 hours results.

**Table 5.3-7: Ambient gases levels at AQN-3**

No.	Date	Time	CO	NO <sub>2</sub>	NO	PM2.5	PM10	RH	SO <sub>2</sub>	Tmp C
	D.M.Y	hours	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	%	µg/m <sup>3</sup>	°C
1	19-20 June, 2017	24	80	50	10	10	10	70.14	20	30.33
WHO Guideline Value		24	-	150	-	-	50	-	20	-
Myanmar standard		24	-	-	-	-	50	-	20	-
**Environmental, Health, and Safety Guidelines, General EHS Guidelines, WHO guide line & Myanmar National Environmental Quality (Emission) Guidelines on DEC, 2015.										

Source: Resource & Environment Myanmar Co., Ltd.

**AQN-4**

Daily average of ambient gases levels at AQN-4 was presented in following table. Most of ambient gases levels are lower than the environmental standard (one day) in WHO guideline and Myanmar National Environmental Quality (Emission) Guidelines (NEQG). SO<sub>2</sub> level is also complied with the both of standards in 24 hours results.

**Table 5.3-8: Ambient gases levels at AQN-4**

No.	Date	Time	CO	NO2	NO	TSP	PM10	RH	SO2	Tmp C
	D.M.Y	hours	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	%	µg/m <sup>3</sup>	°C
1	21-22 June, 2017	24	170	40	10	20	20	66.29	20	31.18
WHO Guideline Value		24	-	150	-	-	50	-	20	-
Myanmar standard		24	-	-	-	-	50	-	2	-
**Environmental, Health, and Safety Guidelines, General EHS Guidelines, WHO guide line & Myanmar National Environmental Quality (Emission) Guidelines on DEC, 2015.										

Source: Resource & Environment Myanmar Co., Ltd.

**(b) Wind Speed and Direction**

The average wind speed and direction were collected for 24 hours (1 day) continuous in each location. According to the wind rose diagram, average wind speed of varies from 0.05 to 0.18 m/s in all stations. Prevailing wind direction of AQN-1 is N, AQN-2 is SE, AQN-3 is nearly SSE and AQN-4 is SE, respectively.

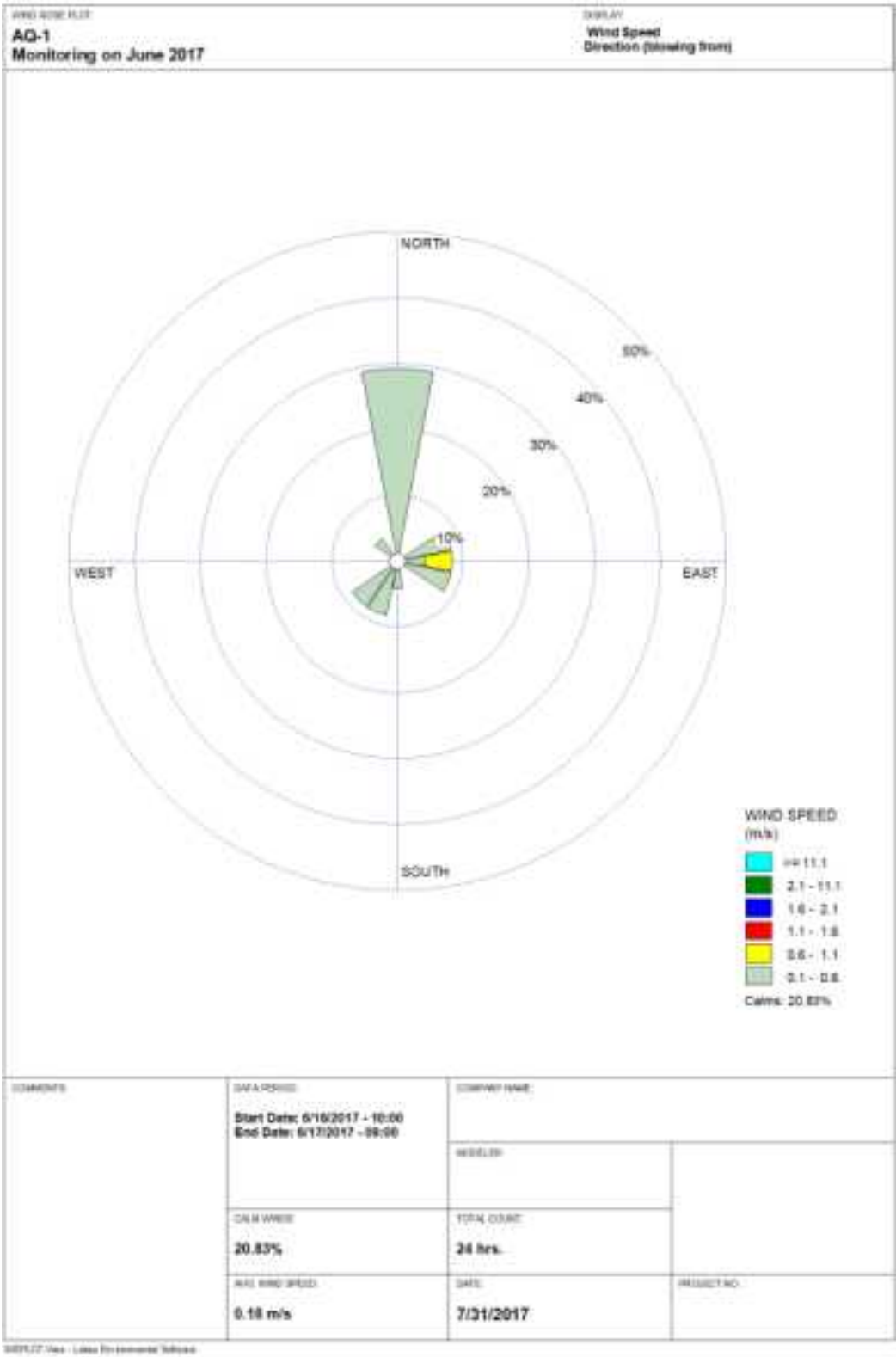


Figure 5.3-12: Wind rose diagram of AQN-1



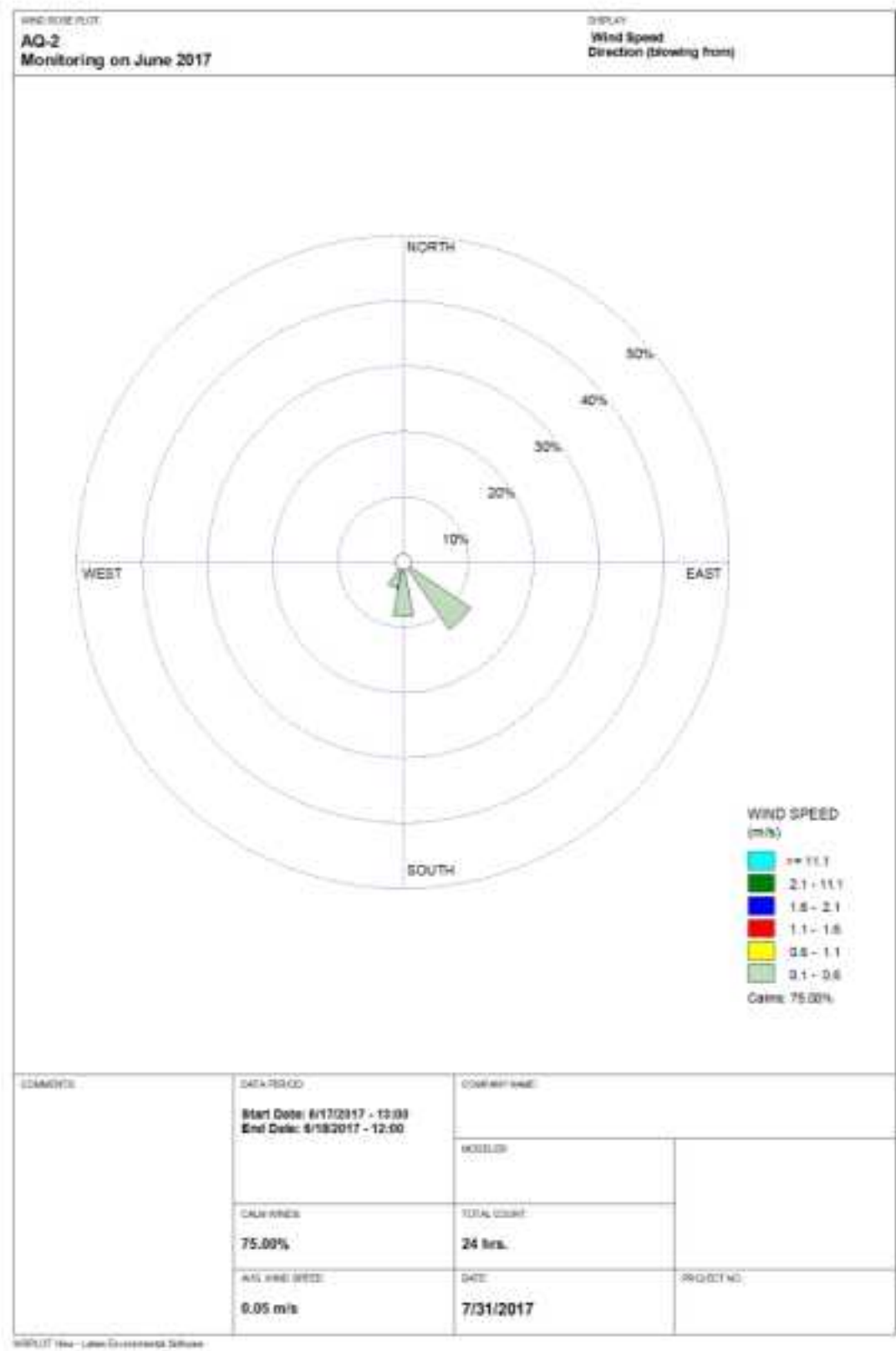


Figure 5.3-13: Wind rose diagram of AQN-2

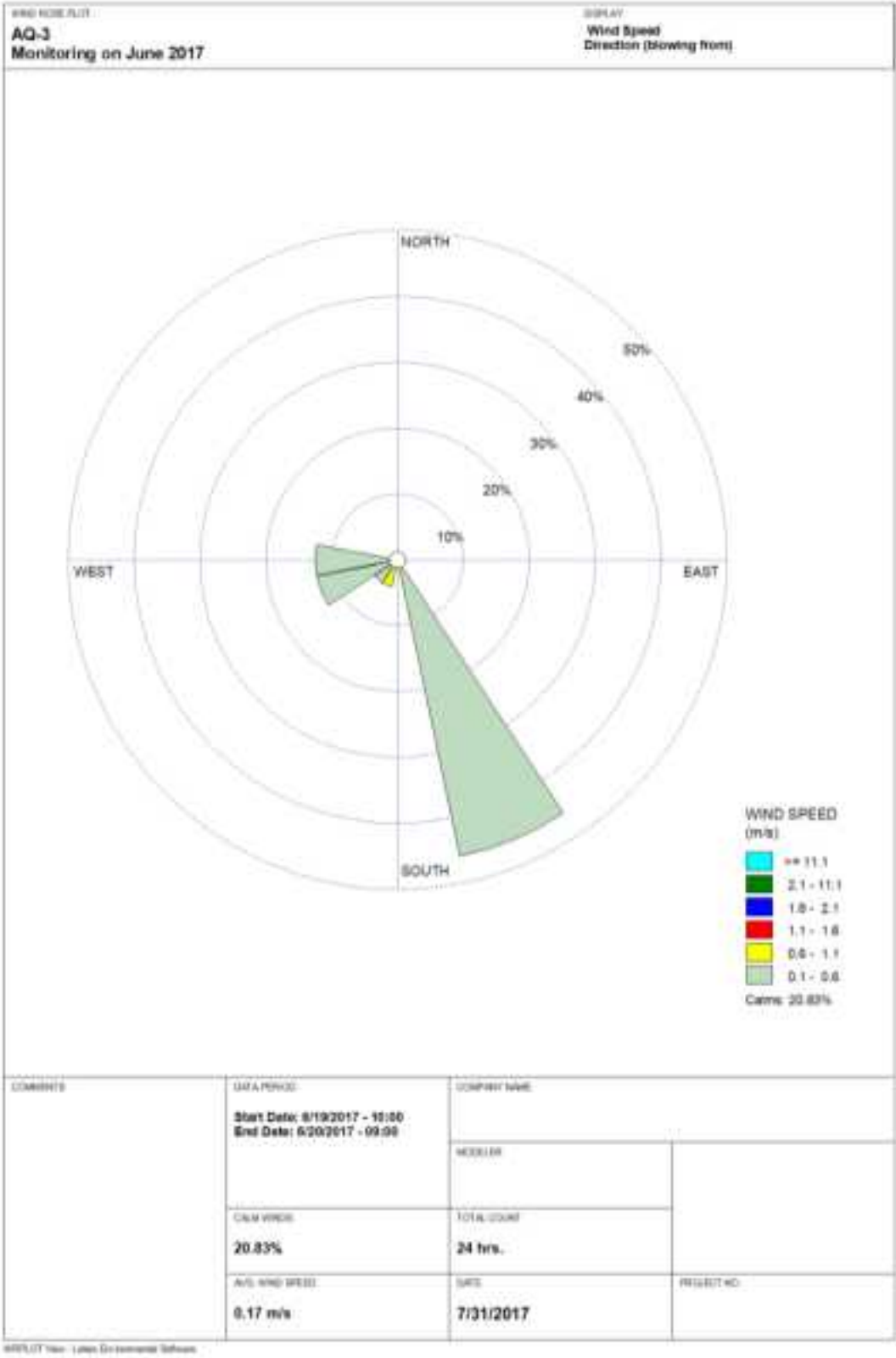


Figure 5.3-14: Wind rose diagram of AQN-3

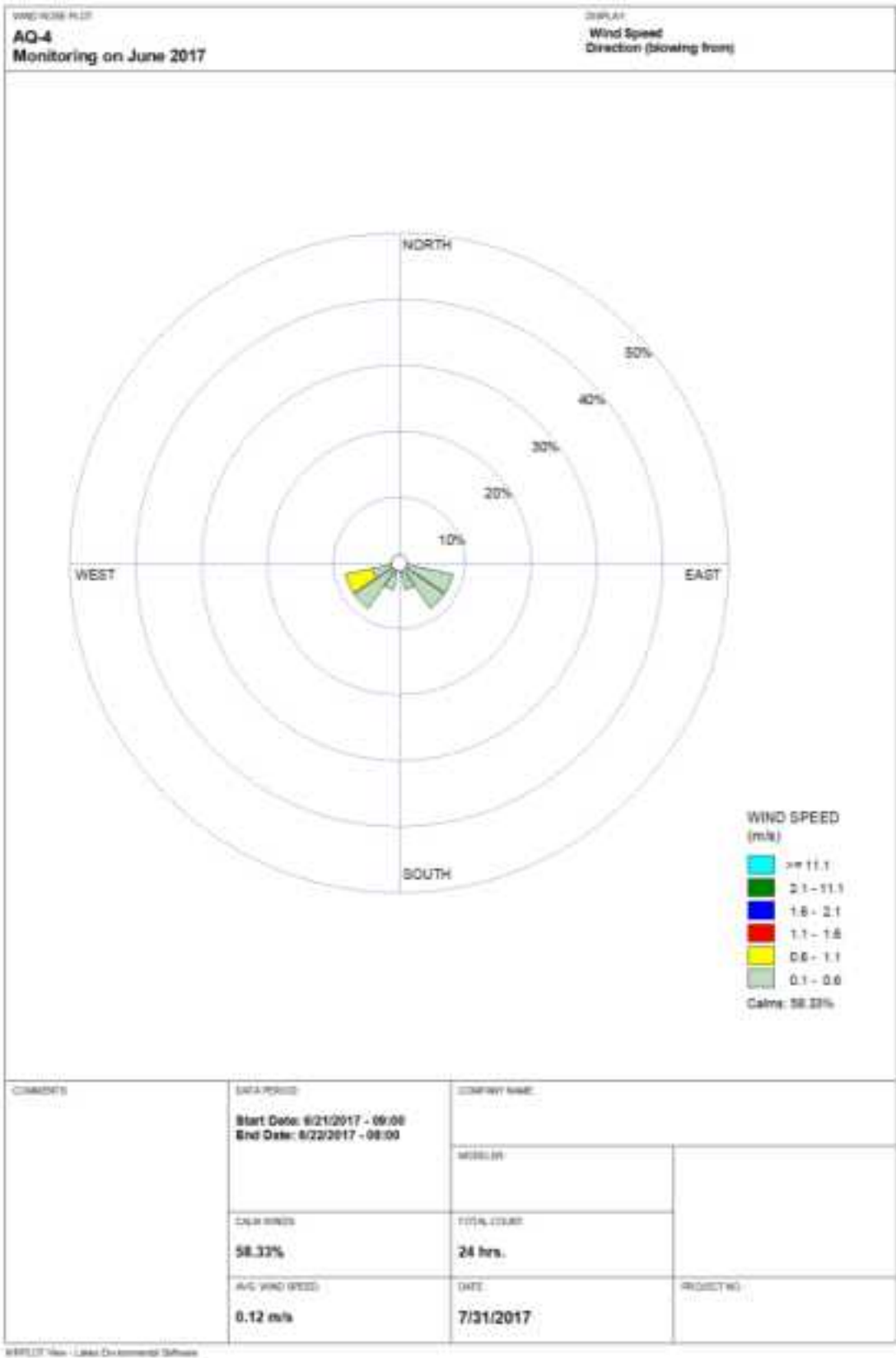


Figure 5.3-15: Wind rose diagram of AQ-4

### 5.3.5 Noise

#### *Survey Item*

Parameter for noise level survey was determined by referring the Myanmar standards as shown in following table.

**Table 5.3-9: Ambient noise standard at operation stage in South-East Asia countries**

Items		Day time (Leq)	Night time (Leq)
Myanmar standard	Residential, institutional, educational	55 dB (7am – 10pm, 15hrs)	45 dB (10pm – 7am, 9hrs)
	Industrial, commercial	70 dB (7am – 10pm, 15hrs)	70 dB (10pm – 7am, 9hrs)

#### *Summary of sampling points*

The locations of noise monitoring points are as same as air quality monitoring locations.

#### *Survey Period*

Air quality monitoring was daily conducted from 16<sup>th</sup> – 22<sup>nd</sup> June, 2017. The measurement duration is as same as air quality monitoring schedule.

#### *Survey Method*

Sampling and monitoring of surrounding sound were conducted by using following instrument for 24 hours/1-day measurement.

Instrument	Brand	Model	Measurement unit
Sound Level Meter	Lutron	SL-0423SD	dB

#### *Survey Result*

Noise levels (LAeq) of the monitoring points were presented in table 5.3-10. One day LAeq was calculated by using the following array formula in the excel sheet. This formula is firstly used for hourly LAeq and then for the 24 hours LAeq.

$10 \cdot \text{LOG}_{10} (\text{AVERAGE} (10^{((\text{RANGE})/10)}))$

By means of the calculated results, though most of daily noise levels are complied with the standard, some night Leq at N-2 and N-3 are fairly high than the standard referred by the Myanmar Standard “Residential, Institutional & Educational”. It is may be release from unusual noise recording such as dogs bark, local people speaking, motorcycle, religious songs nearby.

**Table 5.3-10: Hourly LAeq value in noise monitoring stations** **Unit: dBA**

Time	N-1 (Naba) 16 <sup>th</sup> -17 <sup>th</sup> June 2017	N-2 (Kyan Taw) 17 <sup>th</sup> -18 <sup>th</sup> June 2017	N-3(Taw Lan) 19 <sup>th</sup> -20 <sup>th</sup> June 2017	N-4 (Bhamo) 21 <sup>st</sup> - 22 <sup>nd</sup> June 2017
7:00-8:00	47	48	57	39
8:00-9:00	48	43	56	37
9:00-10:00	46	47	51	46
10:00-11:00	43	43	82	42
11:00-12:00	39	45	60	42
12:00-13:00	40	60	53	78
13:00-14:00	67	77	52	61
14:00-15:00	54	42	84	65

15:00-16:00	62	44	30	54
16:00-17:00	53	42	33	53
17:00-18:00	46	39	40	50
18:00-19:00	42	44	56	52
19:00-20:00	36	48	50	83
20:00-21:00	39	52	59	51
21:00-22:00	36	51	50	34
<b>Day LAeq</b>	<b>47</b>	<b>48</b>	<b>54</b>	<b>52</b>
22:00-23:00	36	50	51	64
23:00-24:00	35	50	58	62
24:00-01:00	39	51	52	60
01:00-02:00	36	49	55	33
02:00-03:00	41	47	57	43
03:00-04:00	36	48	63	39
04:00-05:00	43	48	64	33
05:00-06:00	43	53	55	34
06:00-07:00	45	54	53	36
<b>Night LAeq</b>	<b>40</b>	<b>50</b>	<b>56</b>	<b>45</b>

**Table 5.3-11: Comparing of N-1 (Pauktaw) Ambient noise level with Myanmar standard.**

No.	Monitoring Dates	Time (Hours)	Ambient Noise Quality value (dB)		Remarks
			Day Time LAeq	Night Time LAeq	
1	N-1(Naba ) 16 <sup>th</sup> -17 <sup>th</sup> June 2017	24	47	40	
2	N-2(Kyan Taw) 17 <sup>th</sup> -18 <sup>th</sup> June 2017	24	48	50	
3	N-3(Taw Lan) 19 <sup>th</sup> -20 <sup>th</sup> June 2017	24	54	56	
4	N-4(Bhamo) 21 <sup>st</sup> - 22 <sup>nd</sup> June 2017		52	45	
Target noise levels of (Residential, Institutional & Educational)		24	55 dB (Myanmar standard)	45 dB (Myanmar standard)	

Source: Resource &Environment Myanmar Co., Ltd.

### 5.3.6 Water Quality

There are three locations for surface water quality as well as two for ground water quality, were collected during the field survey.

#### *Survey Item*

Parameters for water quality survey are determined so as to cover the parameters of existing environmental standards.

#### *Summary of sampling points*

The locations of sampling points are described as below.

**Table 5.3-12: Sampling points of water quality survey**

Category	Sampling Point	Coordinates	Description of Sampling Point
Surface Water	SW-1	24° 9'37.80"N 96°20'23.96"E	At the left embankment of Ayeyarwady river Katha Township.
Surface Water	SW-2	24° 8'53.91"N 96°48'4.22"E	At the Nan Pa stream, near Kaing village, Shwe Gu Township.
Surface Water	SW-3	24° 7'9.71"N 96°56'9.19"E	At the Ayeyarwady river, near Zinbone village, Beside of Mandalay-Myitkyina highway road.
Ground Water	GW-1	24°14'51.15"N 96°11'59.61"E	At the Naba Substation, Katha Township.
Ground Water	GW-2	24°13'22.94"N 97°14'59.92"E	At the Bhamo Substation, Bhamo Township.

**Figure 5.3-16: Location map of water sampling points****SW-1**

SW-1 was sampled and measured near left-embankment of Ayeyarwady River, Katha district. Water in this river mainly used for all domestic usage surrounding areas. Katha Town is located about 2 km from sampling point. There has some residential area beside of the SW-1.





**Figure 5.3-17: Surface water sampling at SW-1**

**SW-2**

It was collected from the Nanpa Stream near Kaing village, Shwe Gu Township. Water is mainly used for agricultural purposes of surrounding areas.



**Figure 5.3-18: Surface water sampling at SW-2**

**SW-3**

It was near the southern bank of Ayeyarwady River, located about 1 km east of Zinbon village. Water is mainly used for agricultural purposes of surrounding areas.



**Figure 5.3-19: Surface water sampling at SW-3**



### ***GW-1***

GW-1 was collected at the handed well in the compound of Naba substation, Katha Township. The surrounding are the staff's houses. The water level is 10 m in depth and it is moderately transparent. Water is domestically used such as washing, cooking, and pouring the plant.



**Figure 5.3-20: Ground water sampling at GW-1**

### ***GW-2***

It was located at the compound of Bhamo substation. The water level is 35m in depth and it is domestically used such as washing, cooking, and pouring the plant. Topological nature, vegetation pattern and surrounding condition are same as the AQN-4. Water transparency is medium to high.



**Figure 5.3-21: Ground water sampling at GW-2**

### ***Survey Period***

Surface water quality survey was conducted during 16<sup>th</sup> - 22<sup>nd</sup> June, 2017.

### ***Survey Method***

Water samples were taken by Alpha horizontal water sampler and collected in sterilized sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters as pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), and turbidity were measured at each site concurrently with sample

collection. All samples were kept in iced boxes and were transported to the laboratory and stored at 2-4 °C refrigerators.

**Table 5.3-13: Field equipment for surface water quality survey**

No.	Equipment	Manufacturer	Country of Origin	Model
1	Multiparameter (water quality)	HANNA	USA	HI7609829 (with 3 sensors) 
2	SmarTROLL multi-parameter	In-situ Inc.	USA	
3	pH meter	HANNA	USA	HI 98129
4	Alpha Bottle (Water Sampler)	Wildlife Supply Company®	Indonesia	-
5	DO meter	HANNA	USA	

**Table 5.3-14: Container and preservation method for water samples**

No.	Parameter	Container	Preservation
1	Oil and Grease	1000 ml glass bottle	Sulfuric acid(H <sub>2</sub> SO <sub>4</sub> ), Refrigerate
2	BOD <sub>5</sub> , COD	1000 ml HDPE bottle	Refrigerate
3	Bacteria	1000 ml glass bottle (Sterilize)	Refrigerate

### ***Survey Result***

Water samples were sent to REM-UAE Laboratory in Myanmar and UAE Laboratory in Thailand.

Water quality results are shown in following table. The detailed laboratory result for water is attached in Appendix-7.

**Table 5.3-15: In-Situ measurement and laboratory analysis of water quality**

No.	Item/Sample Name	SW-1	SW-2	SW-3	GW-1	GW-2
1	Date /Time	18.6.2017 10:42 AM	20.6.2017 10:40 AM	20.6.2017 1:32 PM	17.6.2017 10:15 AM	21.6.2017 10:14 AM
2	Weather	Cloudy	Partly cloud	Cloudy and Rainy	Cloudy	Partly cloud
3	Transparency	Low to medium	Low	Low to medium	Medium to moderately high	Medium to high
4	Temperature _Water (C)	24.24	30.19	22.38	27.52	26.9
5	pH	6.97	8.19	7.11	6.1	7.67
6	DO (mg/l)	7.80	7.57	8.03	4.53	7.7
7	EC (µs)	50.9	377.1	45.8	27.7	374.8
8	Turbidity (FNU)	404	589	268	16.4	2.5
9	TDS (ppm)	33.68	222.84	31.38	17.35	234.76
10	ORP (mv)	444.0	244.4	455.0	343.6	373.9
11	Salinity (psu)	0.0	0.2	0.0	0.0	0.2
12	Suspended solid (mg/l)	100	332	102	126	10.2
13	BOD (mg/l)	8.1	8.1	4.5	3.7	3.5
14	COD(mg/l)	38.3	25.6	47.9	26.7	16.0
15	Total Nitrogen (mg/l)	17.8	1.55	2.88	12.5	9.85
16	Total Phosphorus (mg/l)	0.29	0.14	0.05	0.04	0.57
17	Total Coliform Bacteria (MPN/100ml)	17000	92000	43000	4900	6.8
18	Oil & Grease (mg/l)	5	4	6	2	2

### 5.3.7 Soil Quality

There are five locations for soil quality survey during field survey.

#### *Survey Item*

Soil sample were collected in situ and the following parameter are analyzed in laboratory.

- 1) Moisture (%)
- 2) SO<sub>4</sub>
- 3) Na
- 4) K
- 5) Ca

- 6) NO<sub>3</sub>N (%)
- 7) Mg
- 8) Total Nitrogen (%)
- 9) O.M (%) (organic matter)
- 10) P (Total phosphorous)

### ***Summary of sampling points***

The locations of sampling points are as shown in the table. The detail of each sampling point is described below.

**Table 5.3-16: Points for soil quality survey**

Category	Sampling Point	Coordinates	Description of Sampling Point
Soil	S-01	24°14'58.39"N, 96°11'48.49"E	<ul style="list-style-type: none"> <li>• Within the compound of Naba substation, located at the northwest of AQN-1 station.</li> <li>• Clayey soil with minor soil, reddish brown in colored, fine to medium texture.</li> <li>• It was collected in the construction area.</li> </ul>
Soil	S-02	24°9'35.73"N, 96°20'7.47"E	<ul style="list-style-type: none"> <li>• At the left embankment of Ayeyarwady river, Katha Township. it was located at beside of Naung Hlaing creek.</li> <li>• Silty sandy clayey soil, yellowish brown in colored, fine to medium texture.</li> <li>• It was collected in the paddy fields.</li> </ul>
Soil	S-03	24° 8'46.83"N, 96°21'24.47"E	<ul style="list-style-type: none"> <li>• At the right embankment of Ayeyarwady river, located near Poesarkone village, Katha Township.</li> <li>• It was collected in the crops land.</li> <li>• Silty Sand (River sand), pale yellow in colored, fine to medium texture.</li> </ul>
Soil	S-04	24° 8'55.18"N, 96°49'17.09"E	<ul style="list-style-type: none"> <li>• At the Tawlan village, Shwe Gu Township.</li> <li>• It was located near the Mandalay-Myitkyina highway road about 190 m.</li> <li>• It was collected in the paddy fields.</li> <li>• Clayey soil, yellowish to browned in colour. Fine to medium texture.</li> </ul>
Soil	S-05	24°13'22.07"N, 97°14'51.12"E	<ul style="list-style-type: none"> <li>• At the compound of Bhamo substation, Bhamo Township.</li> <li>• It was located 250m away from Mandalay-Myitkyina highway road and northwest is the Bhamo Township.</li> <li>• Same as the S-01 soil type.</li> </ul>





**Figure 5.3-22: Location map of soil sampling points**



**Figure 5.3-23: Soil sampling**

**Survey Period**

Soil survey was conducted during 16<sup>th</sup> – 22<sup>nd</sup> June, 2017.

**Survey Method**

In the course of survey, sampling procedure, sample preservation and sample analysis recommended in standard operating procedure of U.S. EPA (SOP-2013, SOP2016, and SOP 2003) were referred. In soil sampling, the standard agricultural sampler (Soil Auger) was applied. The sampler is a stainless-steel tube that is sharpened on one end and fitted with a long, T-shaped handle. This tube is approximately three inches inside diameter. In order to refrain from contamination, about 20~30 cm of top soil was removed by the sampler before sampling. Then sample was taken and collected in cleaned plastic bag. Chemical preservation of samples was not applied because it is generally not recommended by standard method. Samples were cooled in an ice box which temperature was under 4°C. Samples were protected from sunlight to minimize any potential reaction. Field equipment used on site is also shown in the table.

**Table 5.3-17: Field equipment for sediment and Soil quality survey**

No.	Equipment	Originate Country	Model
1	Soil Auger (for soil sampling)	Italy	Matest

**Survey Result**

Chemical properties for soil were analyzed in Land Use Department's laboratory.

The result of soil quality analysis is presented as follow. The detailed result of soil quality is attached in Appendix-8.

**Table 5.3-18: Soil quality**

No.	Parameter	Results					Unit
		S-01	S-02	S-03	S-04	S-05	
1	Moisture (%)	1.51	7.02	2.28	1.88	0.81	%
2	SO <sub>4</sub>	0.08	0.12	0.76	0.16	0.04	mg/kg
3	Na	0.29	0.65	0.67	0.09	0.40	mg/kg
4	K	0.22	0.12	0.14	0.12	0.14	mg/kg
5	Ca	2.03	7.89	10.23	5.44	2.69	mg/kg
6	NO <sub>3</sub> N(%)	0.06	0.07	0.04	0.05	0.04	%
7	Mg	1.35	0.72	2.05	1.36	0.67	mg/kg
8	Total N(%)	0.09	0.15	0.13	0.16	0.09	%
9	O.M(%)	1.66	3.12	2.11	1.58	1.56	%
10	P	5.71	8.80	10.42	1.92	3.09	mg/kg

Source: Resource & Environment Myanmar Co., Ltd.

**5.4 Biological Environment****Biodiversity**

The Convention of Biological Diversity country profile for Myanmar provides a fundamental brief description of the main biodiversity features of the country ([www.cbd.int](http://www.cbd.int)).

With reference to the Project area, the main ecosystems expected in the area are:

- Forests considered to be integral to the stability of the environment;
- Freshwater ecosystems ranging from fast-flowing mountain streams to wide;
- Slow-flowing lowland rivers; and
- Lakes and other non-flowing wetlands.

Overall, the country counts approximately 11,800 species of vascular plants of gymnosperms and angiosperms, 251 mammals, 1,056 bird species, 279 reptiles, 82 amphibians, 841 medicinal plants, 96 bamboos and many tropical crop species.

The Dry Zone is well known for the production of oil seeds and cotton, especially under developed irrigation systems and the Taninthayi region is suitable for cultivating rubber and fruit crops. Myanmar is also rich with diverse inland water and freshwater diversity, with over 350 freshwater fish species (a significant portion of which may be endemic).

The country counts 144 globally threatened species, among which there are four critically endangered species of mammals, birds and reptiles, respectively, and 13 critically endangered plant species. In addition, 39 endangered species have been reported (including 12 plant species and 10 reptiles) and 80 vulnerable species (among which are 33 birds and 26 mammals). Trends are declining for large mammals, like tigers and elephants that are highly vulnerable to local extinction due to improper sex ratio and reduction of home ranges by human activities. The same negative trend is observed in various natural environments, such as forest and inland water habitats. While FAO's Global Forest Resources Assessment (2005) indicated that about 50% of the total land area of the country is covered with forests, this area decreased by 7% between 1990 and 2005 as a result of human pressure and forest cover changes. Likewise, decline of inland water biodiversity is common due to increased demand on freshwater resources and drainage of wetlands for agriculture and urbanization.

Myanmar relies largely on ecosystem services and biodiversity for the livelihood of its population and economic growth. A particularly salient example of this dependency is the agricultural sector, which represents 36% of the GDP and 13.3% of the country's total export earnings, and employs 61.2% of the total labor force. Forests are also fundamental to the socio-economic well-being of the people of Myanmar, providing local villagers not only numerous forest products to fulfill their basic needs but also contributing substantial foreign exchange earnings to the State economy, notably through timber trade.

#### 5.4.1 Protected Areas in Myanmar/World Database on Protected Areas

According to the World Database on Protected Areas (WDPA, <http://www.protectedplanet.net/country/MM>) the Country hosts 57 Protected Areas including as reported in the following Table.

**Table 5.4-1: World database on protected areas – Myanmar**

Type	Number
National Park	4
Nature Reserve	3
Wildlife Sanctuary	23
National Park and ASEAN Heritage Park	3
Not Reported	4
Bird Sanctuary	4
Other Area	3
Protected Area	2
Reserved Forest	1



Type	Number
Game Sanctuary	1
Wildlife Park	1
Wildlife Sanctuary and ASEAN Heritage Park	2
Bird Sanctuary and ASEAN Heritage Park	1
Tiger Reserve	1
Mountain Park	1
Elephant Range	1
Botanical Garden	1
Ramsar Site, Wetland of International Importance	1

The project is located at more than 100 km far from the nearest protected area named “Indawgyi Lake” to the north and “Chatthin Protected Area” to the south.



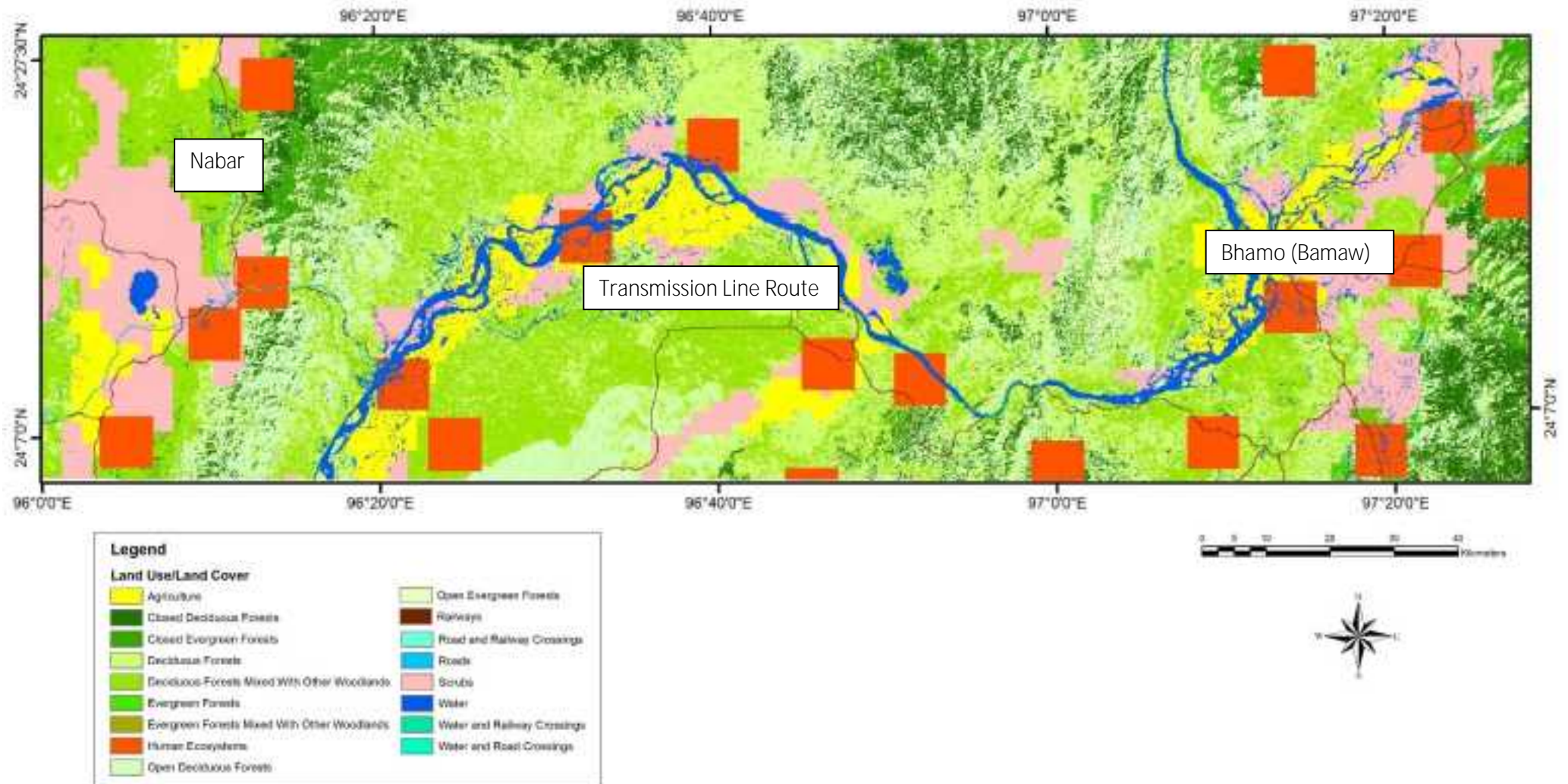


Figure 5.4-2: Land use and habitat map of the area between Bamaw and Nabar

## 5.4.2 Terrestrial and Aquatic Environment

The substations and 230 kV transmission line area is mainly degraded deciduous forest with patches of agricultural area. The Ayeyarwaddy River is the main habitat for aquatic life in the area. Biodiversity survey of the local terrestrial and aquatic flora and fauna was not carried out during the study and secondary information specifically for the Project area is not available.

A general description of the terrestrial and aquatic environment of the present study, which the Project area is part of, is provided here. Three major habitat types were observed namely (1) mixed vegetation with scattered trees, (2) rice field and rubber plantation and (3) aquatic habitat. According to the literature survey followed by field survey, there is no threatened plant and animal species in the proposed substations and along the 230 kV transmission line areas and the overall habitat value is assumed to be moderate. Figure 5.4-1 and Figure 5.4-2 shows the relationship of protected areas and proposed 230 kV Transmission route area. There is no protected area within immediate distance from TL route and substations.

The following IUCN listed Threatened Species were found near the transmission line RoW. The location and name of the Threatened Species are shown in the following tables.

### Mammal Species

No.	Common Name	Scientific Name	IUCN/Status	location
1	Sunda Pangolin	<i>Manis javanica</i>	CR(Critically Endangered)	This Species was found between Bamaw and Shwegu Township area.
2	Chinese Pangolin	<i>Manis pentadactyla</i>	CR(Critically Endangered)	This Species was found between Bamaw and Shwegu Township area.
3	Bengal Slow Loris	<i>Nycticebus bengalensis</i>	VU(Vulnerable)	This Species was found between Bamaw and Shwegu Township area.
4	Hoolock Gibbon	<i>Hoolock hoolock</i>	EN(Endangered)	This Species was found between Bamaw and Shwegu Township area.
5	Dhole	<i>Cuon alpinus</i>	EN(Endangered)	This Species was found between Bamaw and Shwegu Township area.
6	Sun Bear	<i>Helarctos malayanus</i>	VU(Vulnerable)	This Species was found between Bamaw and Shwegu Township area.
7	Asiatic Black Bear	<i>Ursus thibetanus</i>	VU(Vulnerable)	This Species was found between Bamaw and Shwegu Township area.
8	Sambar	<i>Rusa unicolor</i>	VU(Vulnerable)	This Species was found between Bamaw and Shwegu Township area.
9	Irrawaddy Dolphin	<i>Orcaella brevirostris</i>	VU(Vulnerable)	This Species was the Irrawaddy river near Katha township.
10	Chinese Serow	<i>Capricornis milneedwardsi</i>	NT(Near Threatened)	This Species was found between Bamaw and Shwegu Township area.

### Bird Species

No.	Common Name	Scientific Name	IUCN/Status	location
1	Oriental Darter	<i>Anhinga melanogaster</i>	NT(Near Threatened)	This Species was found nearly the Katha township
2	Grey-headed Parakeet	<i>Psittacula finschii</i>	NT(Near Threatened)	This Species were found Katha and Nabar Station.

### Fish Species

No.	Common Name	Scientific Name	IUCN/Status	location
1	Manipur Osterobrama	<i>Osteobrama belangeri</i>	NT(Near Threatened)	This Species was found in the Irrawaddy river of the Katha township and Bamaw Township.
2	Indian butter catfish	Ompok bimaculatus	NT(Near Threatened)	This Species was found in the Irrawaddy river between Katha township and Bamaw Township.



3	Pabo catfish	Ompok pabo	NT(Near Threatened)	This Species was found in the Irrawaddy river between Katha township and Bamaw Township.
4	Boal	Wallago attu	NT(Near Threatened)	This Species was found in the Irrawaddy river between Katha township and Bamaw Township.
5	Gangetic goonch	Bagarius bagarius	NT(Near Threatened)	This Species was found in the Irrawaddy river between Katha township and Bamaw Township.

The biodiversity survey report is presented in Appendix-9.

## 5.5 Social Environment

### 5.5.1 Social Setting

The proposed transmission line will pass through four townships namely Bamw (Bhamo), Shwegu, Kathar and Indaw which occupy one state and one region, namely Kachin and Sagaing.

#### 1. Kachin State

##### Population of Myanmar and Kachin State

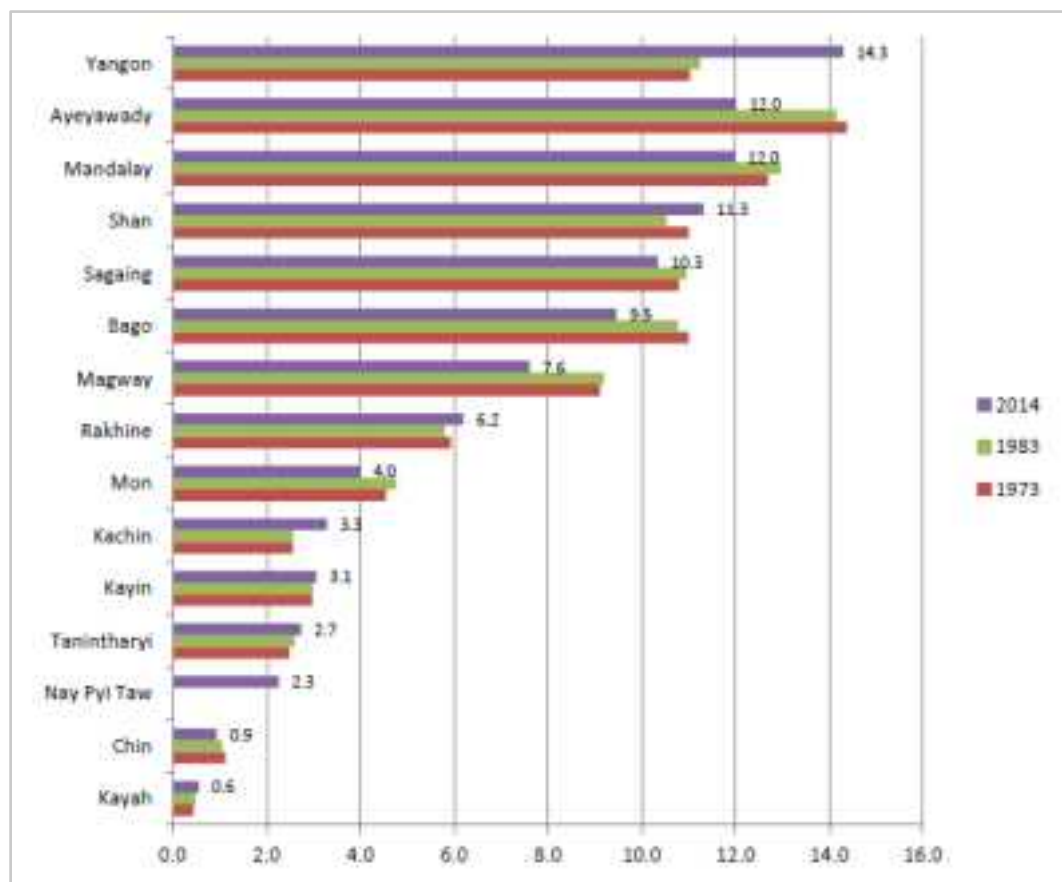
Kachin has Myanmar's highest mountain ranges. Whereas the south-western parts of the State (Myitkyina, Bhamo and Mohnyin districts and parts of Putao District) extend to flatter hills and river plains (Hukawng basin, Myitkyina plain, Bhamo basin and the Putao basin), its northern and eastern limits (most of Putao District) reach up to 5,889 metres.

Hkakabo Razi features as Myanmar's highest mountain, belonging to the eastern stretches of the Himalaya range and the greater Tibetan plateau. The Myanmar Population and Housing Census (MPHC) 2014 shows that Myanmar had a total population of 51,486,253 persons as of 29 March 2014. Of these, 24,824,586 were males and 26,661,667 were females. Kachin's capital Myitkyina lies on the west bank of the Ayeyarwady River. It is the northernmost river port and railway terminus in Myanmar. Other main towns are Bamaw (Bhamo), Mogaung, Mohnyin, Putao and Shwegu. The people living in Kachin State belong to various ethnic groups, primarily Kachins, Bamars and Shans.

The total population for Kachin State as of 29 March 2014 was 1,689,441 persons. Of these, 1,642,841 were enumerated in the census, while 46,600 were estimated not to have been counted during the census. Of the total population of Kachin State, 878,384 were males and 811,057 were females. The total population of Kachin State represents 3.3 percent of the total population of Myanmar.

##### Size and Change of Population in Kachin State

Since 1973, the population of Kachin State has increased from 737,939 to 904,794 in the 1983 census and to 1,689,441 in the Census of 2014. This means the population of Kachin State has increased by about 86 percent between the 1983 and the 2014 Censuses. The population of Kachin State ranks tenth in size when compared with other States and Regions in the country. It is only higher than the population sizes of Kayin, Tanintharyi, Nay Pyi Taw, Chin and Kayah. In terms of the proportion of the total population, the population of Kachin State has increased from 2.6 percent in 1983 to 3.3 percent in 2014. Figure 5.5-1 shows the proportion of each state and region to the total population in the country.



**Figure 5.5-1: Proportion of the population of each State/Region as a percent of the country**

### Population Density

The population density of Kachin State in March 2014 was 19 persons per square kilometre. This is much less than the Union level population density of 76 persons per square kilometre, and it is the second least densely populated State/Region in the country, surpassing only Chin State which has 13 persons per square kilometre. The population density of Kachin State has increased from 8 persons per square kilometre in 1973 to 10 persons per square kilometre in 1983 and to 19 persons per square kilometre in 2014.

### Population by Urban and Rural area

The Census results show that for every 100 persons in Kachin State, 64 persons live in rural areas while 36 persons live in areas that are classified as urban by GAD. At the Union level, 70 percent live in rural areas while 30 percent live in urban areas. Kachin State has the second highest proportion of urban population compared to other States/Regions, surpassed only by Yangon Region with 70 percent of the population living in urban areas. Kachin State is closely followed by Mandalay Region, where 35 percent of the population lives in urban areas.

Total population of the Bhamo is about 135,877 and male is about 66,718 and female is about 69,159. Total population of Shwegu is about 90,691 and male is 45,062 and female is about 45,629.

## Economy

The economy of Kachin State is predominantly agricultural. Kachin's agriculture is much less intensively developed than in the Regions of the Ayeyarwady basin to its South. Nevertheless, Kachin produces considerable quantities of rice, corn, groundnuts, pulses and beans, sugarcane and vegetables. A number of eradication programmes has helped to replace opium-poppy as an important crop. There are also good conditions for freshwater fisheries and livestock, common in many areas. The forests produce teak and hardwood, as well as charcoal, bamboo and resin. A number of industries are associated with these products, such as sugar mills and rice mills. Weaving and blacksmithing are important cottage industries.

## Transportation

Kachin State is served by the following airports:

- Bhamo Airport
- Myitkyina Airport
- Putao Airport

There is a railroad between Myitkyina and Mandalay (through Sagaing). The train will takes 24–30 hours from Mandalay to Myitkyina.

## Education

The Education system in Myanmar does not emphasis learning but rather memorization facts. in 1990's the Education minister asked all the states and division Education Chiefs to pass all the students who failed the mathematics examination with a score of at least 30 points though the normal passing score was actually 40. Educational opportunities in Myanmar are extremely limited outside the main cities of Yangon and Mandalay. It is especially a problem in Kachin State where over 60 years of fighting between the government and insurgents has displaced thousands of people. The following is a summary of the education system in the state.

AY 2002-2003	Primary	Middle	High
Schools	1183	86	41
Teachers	3700	1500	600
Students	168,000	80,000	24,100

## Health

The general state of health care in Myanmar is poor. The military government spends anywhere from 0.5% to 3% of the country's GDP on health care, consistently ranking among the lowest in the world. Although health care is nominally free, in reality, patients have to pay for medicine and treatment, even in public clinics and hospitals. Public hospitals lack many of the basic facilities and equipment. In general, the health care infrastructure outside of Yangon and Mandalay is extremely poor but is especially worse in remote areas like Kachin State. The following is a summary of the public health care system in the state.

2002–2003	# Hospitals	# Beds
Specialist hospitals	2	125
General hospitals with specialist services	2	500
General hospitals	17	553



2002–2003	# Hospitals	# Beds
Health clinics	22	352
Total	43	1530

## 2. Sagaing Region

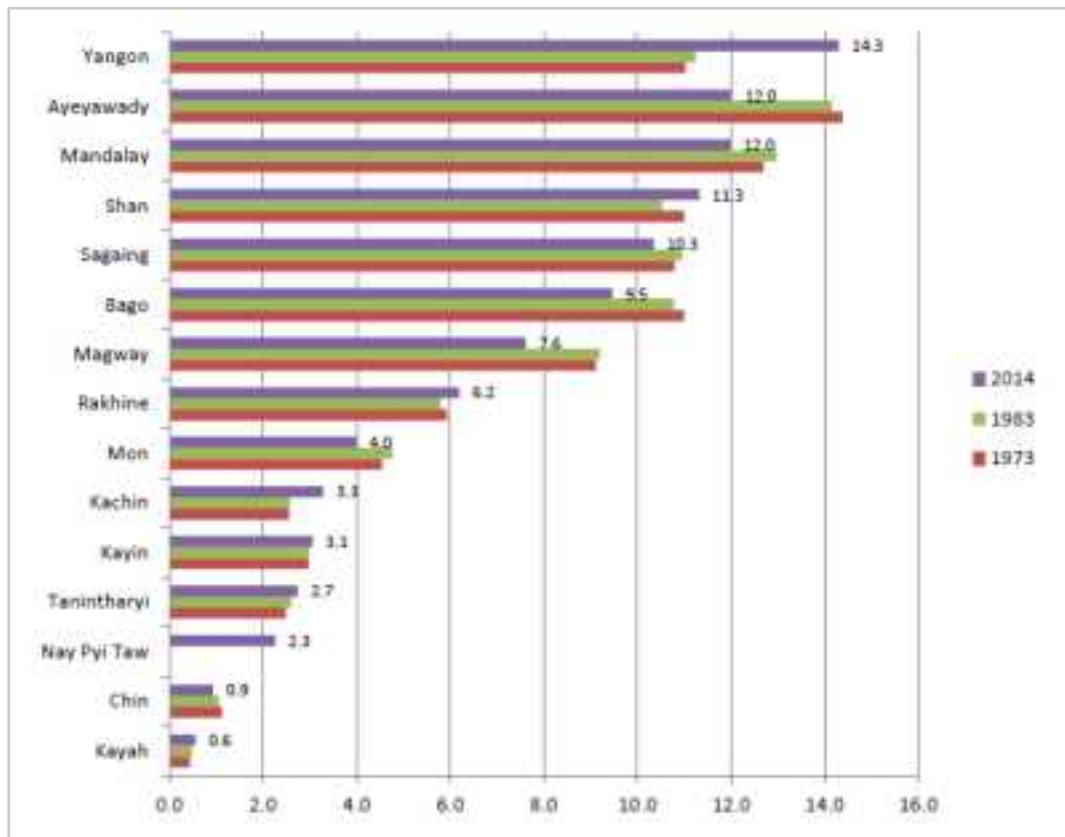
### Population of Myanmar and Sagaing Region

The 2014 MPHC shows that Myanmar had a total population of 51,486,253 persons as of 29 March 2014. Of these, 24,824,586 were males and 26,661,667 were females.

The total population for Sagaing Region as of 29 March 2014 was 5,325,347 persons. Of these, 2,516,949 were males and 2,808,398 were females. The total population of Sagaing Region represents 10.3 percent of the total population of Myanmar.

### Size and Change of Population in Sagaing Region

Since the 1973 census, the population of Sagaing Region has increased from 3,119,054 to 3,862,172 in the 1983 census and to 5,325,347 in the census of 2014. This means that the population of Sagaing Region has increased by about 38 percent between the 1983 and the 2014 censuses. It ranks fifth in size when compared with other States and Regions in the country, behind Yangon Region, Ayeyawady Region, Mandalay Region and Shan State. However, in terms of the proportion of the total population, the population of Sagaing Region has slightly declined from 10.9 percent in 1983 to 10.3 percent in 2014. Figure 5.5-2 shows the proportion of each State and Region to the total population in the country.



**Figure 5.5-2: Proportion of the population of each State/Region as a percent of the country**

### Population Density

The population density of Sagaing Region in March 2014 was 56.8 persons per square kilometre. This is lower than the Union level population density of 76 persons per square kilometre, and it means Sagaing ranks ninth in population density when compared with other States/Regions. The population density has increased from 33 persons per square kilometre in 1973 to 41 persons per square kilometre in 1983, to 56.8 persons per square kilometre in 2014.

### Population by Urban and Rural Area

The Census results show that for every 100 persons in Sagaing Region, 83 persons live in rural areas while 17 persons live in areas that are classified as urban by GAD. At the Union level, 70% of the total populations live in rural areas while 30 % live in urban areas.

There are total population of 167,734 in Kathar Township including about 82,325 of male and 85,409 of female. In Indaw Township, total population is 120,266 including 56,814 of male and 63,452 of female.

**Katha District** is the northeastern-most district in Sagaing Region of Myanmar. Its administrative center is the town of Katahr. The district consists of the townships of Banmauk, Indaw, Kathar, Kawlain, Pinlebu, Tigyaing, and Wuntho.

### Economy

The area is supported by rice farming, fisheries and timbering.

## 5.6 Socio-economic Profile of Affected Villages

The proposed project is the construction of 230kv transmission line between Bamaw and Nabar with the length of about 121 km, two newly -built 230kV/66kV substations and one extended substation aiming at power supply for area along the Northern Mandalay to Kachin State. There are about 42 villages around the transmission line. Name of villages and locations are as shown in Table 5.6-1. The installation of towers along the RoW will affect some farmland and agricultural land that owned by the 42 villages in five townships. Any houses are not found in the 150 feet wide transmission line RoW (75 ft. from centre of TL route). Farmland, plantation, forest and reserved forests are involved along the proposed transmission line route.

**Table 5.6-1: Names of villages along the transmission line**

State/Division	District	Township	Latitude	Longitude	Name of Village
Kachin	Bamaw	Bamaw	24°12'13.22"N	97°12'56.77"E	Kan Thar
			24° 7'33.35"N	97° 4'45.29"E	Mya Le
			24° 7'57.35"N	97° 0'52.95"E	Sin Kan
			24° 8'30.38"N	97° 7'55.11"E	Supote Kone
			24° 9'26.55"N	97° 9'26.46"E	Sar Wady
			97° 4'45.29"E	97° 6'18.90"E	Kaung Tone
			24°11'7.26"N	97°15'14.36"E	Thein Lin
			24°12'16.47"N	97°15'10.13"E	Kabar Ni
			24°12'28.41"N	97°14'4.63"E	Kan Kyi
			24°12'29.09"N	97°13'6.54"E	Nyaung Pin Thar
			24°13'30.95"N	97°14'30.42"E	Kone Ma Hat
			24°13'31.04"N	97°14'43.25"E	Han Te
			24°13'19.44"N	97°15'6.58"E	Phan Khar Kone
			24°13'14.86"N	97°14'42.80"E	Phoe Day War
		Shwegu	24° 8'11.38"N	96°43'13.86"E	Si Maw

			24° 9'41.92"N	96° 43'20.72"E	Naung Latt Kyi
					Hein Kaung
			24° 9'23.41"N	96° 43'13.79"E	Nant Lann
			24° 8'8.81"N	96° 45'9.51"E	Tone Kauk
			24° 9'5.74"N	96° 43'59.28"E	Si Mu Lay
			24° 8'48.58"N	96° 45'34.58"E	Hnget Ta Tar
			24° 9'12.83"N	96° 44'23.06"E	Si Mu Kyie
			24° 8'15.47"N	96° 44'16.37"E	Man Wain
			24° 9'19.54"N	96° 47'19.45"E	Myaing Thar
			24° 9'40.43"N	96° 47'13.05"E	Pann Tin
			24° 8'35.24"N	96° 49'19.36"E	Taw Lon
			24° 8'56.35"N	96° 48'34.32"E	Kaing Yar
			24° 7'4.21"N	96° 55'32.09"E	Zin Bon
			24° 8'34.01"N	96° 47'47.65"E	Lanku
Sagaing	Katha	Katha	24° 8'48.73"N	96° 19'41.37"E	Tone Paw
					Bo Kone
			24° 10'38.16"N	96° 19'31.99"E	Kyan Taw (Pyi Taw Thar)
			24° 14'6.91"N	96° 17'39.85"E	Pin Ma Lut
			24° 12'20.35"N	96° 17'46.74"E	Nat Yay Twin
			24° 9'24.35"N	96° 19'8.63"E	Thein Inn
			24° 14'3.23"N	96° 17'48.98"E	Lann Khwa
			24° 9'4.39"N	96° 22'13.18"E	Kyaung Kone (Pa Lway Shwe)
					Poe Zar Kone
			24° 8'54.35"N	96° 23'20.96"E	Inn Dayant
		Indaw	24° 14'36.33"N	96° 11'55.69"E	Kan Ni
			24° 14'55.84"N	96° 11'51.19"E	Na Bar
			24° 14'10.23"N	96° 11'20.29"E	Na Ya Gaung

### 5.6.1 Demography of Affected Villages

Population is the one of the important socio-economic conditions of township. Total population of four Townships in 2014 was as shown in Table 5.6-2.

**Table 5.6-2: Total population of four townships**

No.	Township	Male	Female	Total
1	Bamaw	66718	69159	135877
2	Shwegu	47174	47610	94784
3	Kathar	417710	443573	861283
4	Indaw	56814	63452	120266

Source: 2014 population census data

**Table 5.6-3: Total population of affected village**

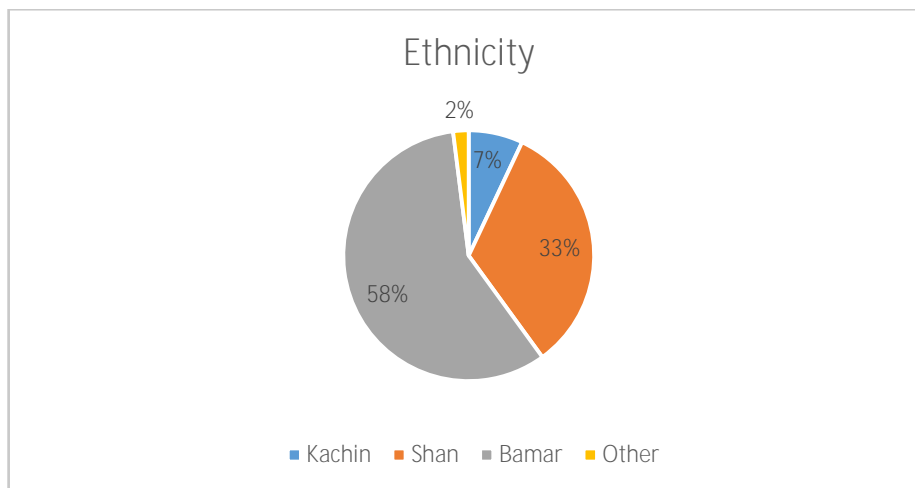
No.	Township	Village Name	Population				Total Population
			House	Household	Female	Male	
1	Bamaw	Kan Thar	77	77	239	203	442
2		Mya Le	275	275	675	733	1408
3		Sin Kan	697	697	1920	1700	3620
4		Supote Kone	72	72	160	175	335

5		Sar Wady	293	293	883	751	1634
6		Kaung Tone	332	332	993	770	1763
7		Thein Lin	450	450	1137	1082	2219
8		Kabar Ni	105	105	500	250	750
9		Kan Kyi	143	143	600	400	1000
10		Nyaung Pin Thar	261	261	669	660	1329
11		Kone Ma Hat	330	330	739	715	1454
12		Han Te	560	560	1405	1246	2651
13		Phan Khar Kone	95	95	225	188	413
14		Phoe Day War	152	152	376	259	635
15	Shwegu	Si Maw	214	230	844	362	1206
16		Naung Latt Kyi	150	150	-	-	-
17		Hein Kaung	40	40	70	100	170
18		Nant Lann	168	168	413	455	868
19		Tone Kauk	66	66	138	148	286
20		Si Mu Lay	91	92	252	222	474
21		Hnget Ta Tar	77	77	300	176	476
22		Si Mu Kyie	65	67	191	178	369
23		Man Wain	172	172	392	476	868
24		Myaing Thar	69	69	185	172	357
25		Pann Tin	134	134	403	383	786
26		Taw Lon	58	68	166	188	354
27		Kaing Yar	55	55	146	159	305
28		Zin Bon	92	92	185	100	285
29	Katha	Tone Paw	243	250	600	583	1183
30		Bo Kone	30	30	80	70	150
31		Kyan Taw (Pyi Taw Thar)	485	500	1301	1172	2473
32		Pin Ma Lut	214	224	506	450	956
33		Lan Kuu	136	136	383	325	708
34		Nat Yay Twin	152	152	500	326	826
35		Thein Inn	120	120	278	286	564
36		Lann Khwa	128	128	-	-	-
37		Kyaung Kone (Pa Lway Shwe)	68	68	200	145	345
38		Poe Zar Kone	55	55	153	120	273
39		Inn Dayant	246	246	597	584	1181
40	Indaw	Nabar	586	620	1300	1000	2300
41		Kan Ni	110	110	340	236	576
42		Nar Ra Khaung	103	103	250	230	480
<b>Total</b>			<b>7969</b>	<b>2834</b>	<b>9507</b>	<b>15134</b>	<b>27434</b>

Source: Village tract leader

## 5.6.2 Ethnicity and Religion of Affected Villages

The major ethnic group are Myanmar and Shan, minority are Kachin, Rakhine, Lesuu, Kadu and Indian. Most of them are Buddhism, others are Christian and Hindi.



Source: village leader

**Figure 5.6-1: Ethnicity of affected villages**

### 5.6.3 Economic Conditions of Affected Villages

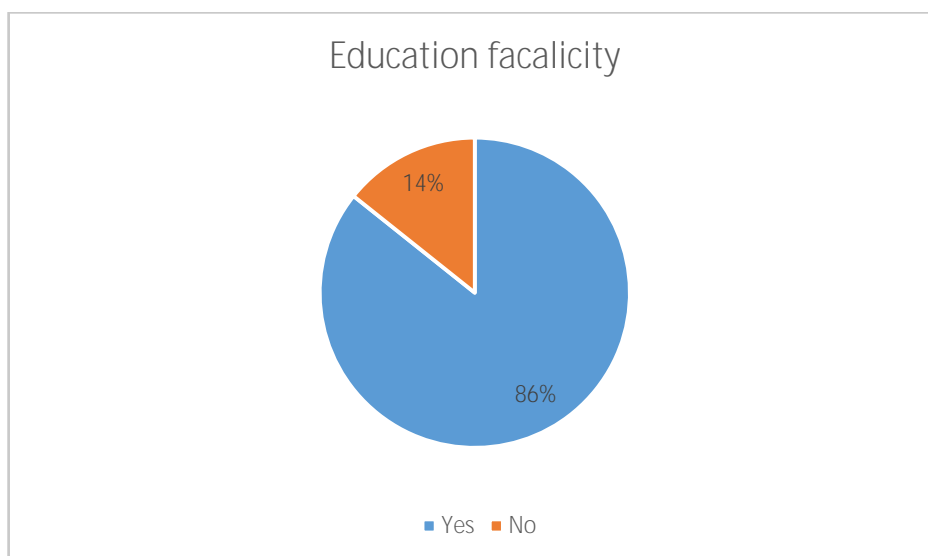
Land use of all affected villages includes cultivated land, virgin land, non-cultivated land and forest land. In our survey 17925 acres of paddy land, 5005 acres of farm land, 206 acres of orchard land, 10 acres of plantation land, 301 acres of community forest and 2105 acres of grazing land. The main crops are paddy, corn, bean and vegetables. Cows and buffalos are mainly used in agricultural works. Chicken, pig and goats are important livestock for home consumption and one of the income sources of their livelihood. Income levels of villages are between 2.5 million and 152 million.

### 5.6.4 Expenditure

Expenditure is between 2.5 million and 110 million per year. Most of the respondents spend about 3 lakh (kyats) for their family monthly expenditure.

### 5.6.5 Education

Most of the villages have primary school, sub-middle school and three villages have high schools. Total number of students in each village is 15 to 894.

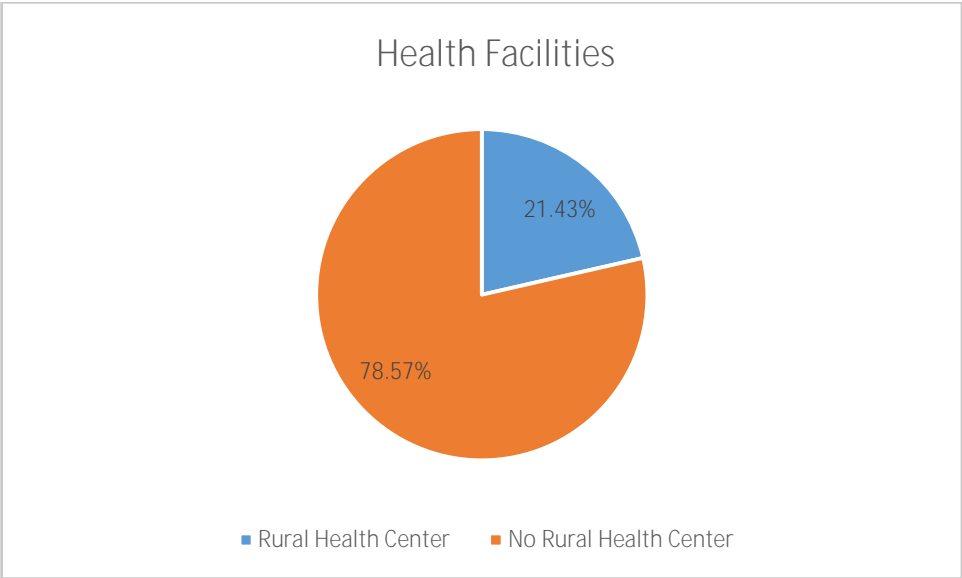


Source: Village Leader

**Figure 5.6-2: Education facility**

5.6.6 Health Facility in Affected Villages

Total of nine villages have rural health center and sub-rural health center. The others 33 villages have no health center and they drive 15minutes to 30 minutes to nearest health center by motorbike.

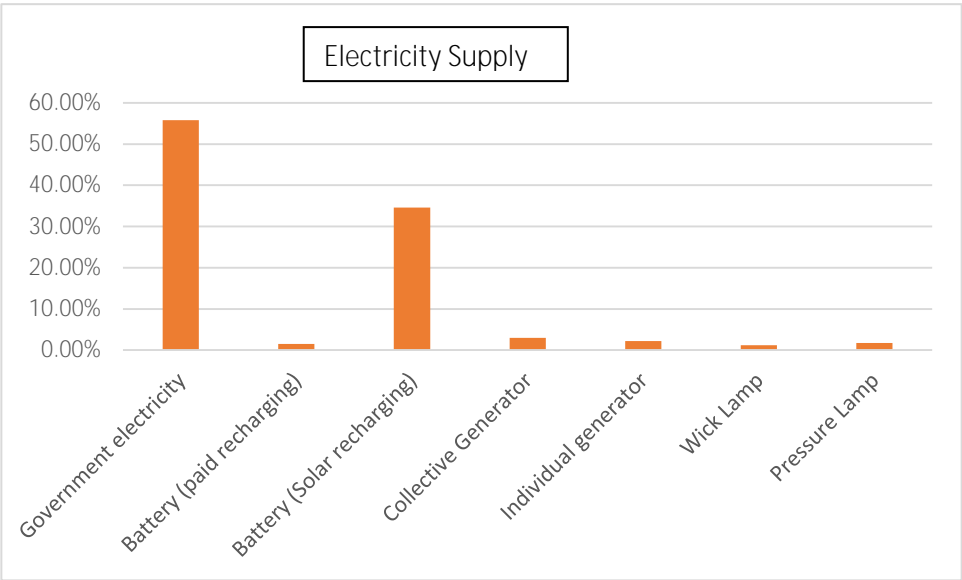


Source: Village Leader

Figure 5.6-3: Health facility

5.6.7 Electricity Supply

Over 50% of household have government electricity, about 30% of house used solar and others are used battery, generator and lamp.



Source: Village Leader

Figure 5.6-4: Electricity supply

### 5.6.8 Possession

All villagers own their houses. Types of houses are brick, wooden and bamboo hut. Most of the respondents own wooden houses with zinc roof. Over 80% of household own motorbike and the others own car and tractor.

**Table 5.6-4: Types of houses of respondents**

Village Name	Wood	Brick	Bamboo hut
Tone Paw	200	2	20
Zin Bon	0	3	15
Bo Kone	30	11	1
Kyan Taw (Pyi Taw Tar)	10	0	20
Pin Ma Lut	193	1	20
Lan Kuu	133	3	30
Nat Yay Twin	130	30	20
Thein Inn	86	4	30
Lann Khwa	80	3	0
Kyaung Kone (Pa Lway Shwe)	34	0	34
Poe Zar Kone	22	0	13
Inn Dayant	140	6	100
Nabar	4	10	5
Kan Ni	6	0	3
Nar Ra Khaung	0	0	0
Si Maw	100	0	114
Naung Latt Kyi	130	5	15
Hein Kaung	30	0	10
Nant Lann	130	10	28
Tone Kauk	0	0	0
Si Mu Lay	80	5	11
Hngat Ta Tar	62	0	15
Si Mu Kyie	61	1	15
Man Wain	100	9	72
Myaing Thar	350	4	6
Pann Tin	114	15	5
Taw Lon	0	1	20
Kaing Yar	35	1	20
Kan Thar	0	0	0
Mya Le	200	15	60
Sin Kan	697	80	0
Supote Kone	52	0	20
Sar Wady	0	11	15
Kaung Tone	282	35	50
Thein Lin	440	100	10
Kabar Ni	100	8	5
Kan Kyi	100	10	0
Nyaung Pin Thar	205	5	56

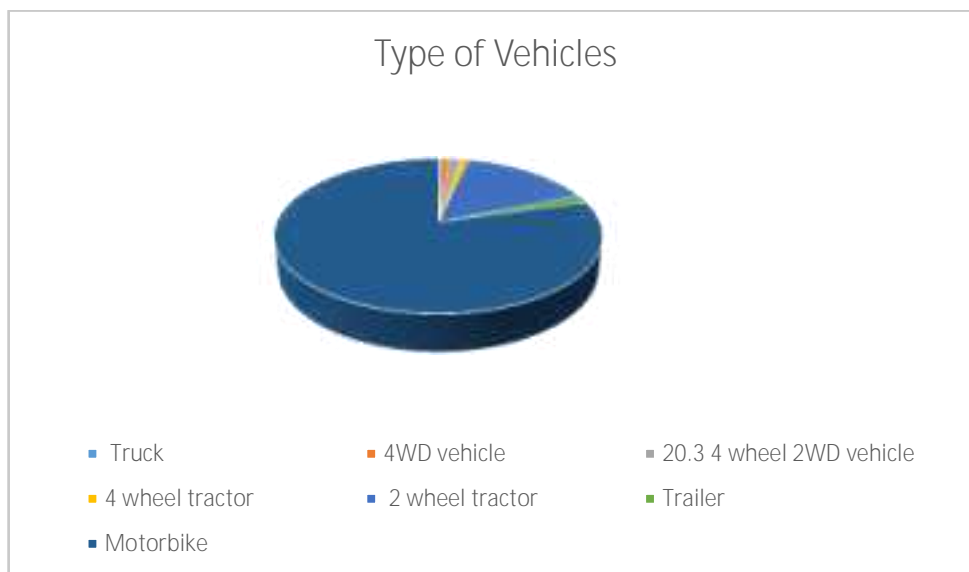


Kone Ma Hat	228	5	97
Han Te	495	50	15
Phan Khar Kone	82	10	3
Phoe Day War	152	15	0

Source: FGD

### 5.6.9 Transportation

All respondents from the villages travel to the town for shopping, medical treatments and others. Most of the respondents from all villages considered that transport is not so bad condition they can use all season, some of the villages facing a problem in rainy season. Type of vehicles were used for traveling are shown in Figure 5.6-5.



Source: FGD

**Figure 5.6-5 : Type of vehicles**

## 5.7 Cultural Features

The International Finance Cooperation and existing Myanmar Law, require that in constructing of Power Transmission Line, Ministry of Electricity and Energy, avoid or minimize of mitigating adverse impacts that the construction may have on cultural heritage in particular with regard to architectural structures, shrines, stupas, temples, monasteries, palaces, excavated buildings, sculpture and paintings along the proposed power transmission line, primarily within 100 meters on either side.

### 5.7.1 Methodology

Preliminary to the field investigation, the team undertook a desk-study employing documentary materials and resource persons specializing in the history, archaeology and culture of the region.

### 5.7.2 Background of the Region

Two substations and 230 kV transmission line are situated between Bhamo District and Katahr District.

### 5.7.2.1 Important Cultural/Historical/Archaeological Sites

The Ministry of Culture (MOC) had designated 46 Cultural Heritage Zones which are classified into three zones, Ancient Monument Zone, Ancient Site Zone, Protected and Preserved Zone, as shown in the following table. The boundaries of zones are delineated by concrete piles. The MOC has not made maps of the Cultural Heritage Zones, but it is going to prepare those maps.

Three zones are stipulated in “The Protection and Preservation of Cultural Heritage Regions Law (1998)” as follows:

- (1) Ancient Monumental Zone means the zone where the ancient monument is situated and which is prescribed under this law.
- (2) Ancient Site Zone means the zone where the ancient site is situated and which is prescribed under this law.
- (3) Protected and Preserved Zone means the zone prescribed under this law for the protection and preservation of the view of the cultural heritage, ancient monument and ancient sites in order that they may not be destroyed.

According to the explanation of Department of Archaeology, National Museum and Library (DANML), “Ancient Monumental Zone” and “Ancient Site Zone” mean core zones that development activities are strictly restricted, and “Protected and Preserved Zone” means the so-called buffer zone where some development activities can be allowed with prior permission from the MOC after the DANML has scrutinized the application submitted by the proponent. (e.g., Hotels and commercial facilities can be built in single story. The proponent submits an application with plan including layout designs to the DANML for prior permission.)

The DANML also explained about land acquisition for the development activities. The lands of cultural monuments are under the jurisdiction of MOC. However, some lands may be owned by other persons even in the Cultural Heritage Zones, In this case, the proponent negotiates with the landowner under the procedures of townships, the Ministry of Home Affairs or the Ministry of Agriculture and Irrigation in case of agricultural lands. Besides, the DANML explained that they have a policy not to relocate the existing residents in the Cultural Heritage Zones and to restrict encroachment into the zones.

**Table 5.7-1: Notified Zones of Cultural Heritage Regions and Buildings**

Sr. No.	Heritage Region	Classification of Zone	Order Record	Issue Date
1	• Bagan, Nyaung U	Ancient Monument Zone Ancient Site Zone Protection and Preservation Zone	1/99	11.2.1999
2	• Kanbawzathadi Palace	Ancient Monument Zone Protection and Preserve Zone	2/99	11.2.1999
3	Mahawaiyan bonthar Bargayar kyaung taw gyi (Aungmyaethazan) Maha atula waiyan atumashi kyaung taw gyi • Shwe Nan Taw Kyaung • Sandar Muni Phaya • Khu tho daw Phaya	Ancient Monument Zone Ancient Site Zone Protection and Preserve Zone	3/99	6.8.1999
4	• Kyaik Htee Yoe Phaya	Protection and Preserve Zone	4/99	11.2.1999
5	• Sri Ksetra and environment	Ancient Monument Zone Ancient Site Zone	1/01	31.1.2001
6	• Mya Thein Tan • Minn Konn bell • Phahtoe Taw Gyi • Two Lion	Ancient Monument Zone	2/01	18.5.2001

	<ul style="list-style-type: none"> <li>Sattawyar Phaya</li> <li>Pontaw Stupa</li> </ul>			
7	<ul style="list-style-type: none"> <li>Beikthano</li> </ul>	Ancient Monument Zone	1/02	29.5.2002
8	<ul style="list-style-type: none"> <li>Tagung</li> </ul>	Ancient Monument Zone Ancient Site Zone Protection and Preservation Zone	1/07	5.6.2007
9	<ul style="list-style-type: none"> <li>Khayone Cave</li> </ul>	Ancient Monument Zone Protection and Preservation Zone	1/08	13.6.2008
10	<ul style="list-style-type: none"> <li>Hanlin</li> </ul>	Ancient Monument Zone Ancient Site Zone Protection and Preservation Zone	1/08	13.6.2008
11	<ul style="list-style-type: none"> <li>Innwa</li> </ul>	Ancient Monument Zone Ancient Site Zone Protection and Preservation Zone	2/08	13.6.2008
12	<ul style="list-style-type: none"> <li>Yathae Pyan Cave</li> </ul>	Ancient Monument Zone Protection and Preservation Zone	2/08	16.6.2008
13	<ul style="list-style-type: none"> <li>Kawgue Cave</li> </ul>	Ancient Monument Zone Protection and Preservation Zone	2/08	16.6.2008
14	<ul style="list-style-type: none"> <li>Sulay Stupa</li> </ul>	Ancient Monument Zone	3/08	4.7.2008
15	<ul style="list-style-type: none"> <li>Maung Tee Stupa</li> </ul>	Ancient Monument Zone	4/08	4.7.2008
16	<ul style="list-style-type: none"> <li>Bo Ta Htaung</li> <li>(Kyaik Day Up) Stupa</li> </ul>	Ancient Monument Zone	5/08	4.7.2008
17	<ul style="list-style-type: none"> <li>Shwe Bone Pwint Stupa</li> </ul>	Ancient Monument Zone	6/08	4.7.2008
18	<ul style="list-style-type: none"> <li>Koe Htut Kyi Pagoda</li> </ul>	Ancient Monument Zone	7/08	4.7.2008
19	<ul style="list-style-type: none"> <li>Kyaik Ca Loet Stupa</li> </ul>	Ancient Monument Zone	8/08	4.7.2008
20	<ul style="list-style-type: none"> <li>Myin Zaing</li> </ul>	Ancient Monument Zone Ancient Site Zone Protection and Preservation Zone	9/08	25.8.2008
21	<ul style="list-style-type: none"> <li>Pinnya</li> </ul>	Ancient Monument Zone Ancient Site Zone Protection and Preservation Zone	10/08	25.8.2008
22	<ul style="list-style-type: none"> <li>Palate</li> <li>Yatana Larba Muni Sutaungpyi (Snake Pagoda)</li> <li>Bamaw Kyaung</li> <li>Kyake Kone Kyaung</li> <li>Partali Kyaung</li> <li>Bawdi Kyaung</li> <li>Lay Htat Kyaung</li> <li>Naught Taw Per Kyaung</li> </ul>	Ancient Monument Zone Ancient Site Zone Protection and Preservation Zone	11/08	25.8.2008
23	<ul style="list-style-type: none"> <li>Myauk Oo</li> </ul>	Ancient Monument Zone	1/09	5.11.2009
24	<ul style="list-style-type: none"> <li>Salay</li> </ul>	Ancient Monument Zone	2/09	5.11.2009
25	<ul style="list-style-type: none"> <li>Shwe Dagon</li> </ul>	Ancient Monument Zone Protection and Preservation Zone	3/09	5.11.2009
26	<ul style="list-style-type: none"> <li>Kyaik Mhaw Won Stupa</li> </ul>	Ancient Monument Zone	4/09	5.11.2009
27	<ul style="list-style-type: none"> <li>Ngar Htat Kyi Pagoda</li> </ul>	Ancient Monument Zone	5/09	5.11.2009
28	<ul style="list-style-type: none"> <li>Chauk Htat Kyi Pagoda</li> </ul>	Ancient Monument Zone	6/09	5.11.2009
29	<ul style="list-style-type: none"> <li>Kyaik Ka Lat Stupa</li> </ul>	Ancient Monument Zone	7/09	5.11.2009
30	<ul style="list-style-type: none"> <li>Kyaik Wine Stupa</li> </ul>	Ancient Monument Zone	8/09	5.11.2009
31	<ul style="list-style-type: none"> <li>Kyaik Ka San Stupa</li> </ul>	Ancient Monument Zone	9/09	5.11.2009
32	<ul style="list-style-type: none"> <li>Shwe San Taw Stupa</li> </ul>	Ancient Monument Zone	10/09	5.11.2009
33	<ul style="list-style-type: none"> <li>Kyaik ParDaKyi San Tae Shin Stupa</li> </ul>	Ancient Monument Zone	11/09	5.11.2009
34	<ul style="list-style-type: none"> <li>Kyaik Khaik Stupa</li> </ul>	Ancient Monument Zone	12/09	5.11.2009

35	• Pale (Kyit Chaung 7)	Ancient Monument Zone	1/10	24.3.2010
36	Primate Region (Kyit Chaung 25)	Ancient Monument Zone	2/10	24.3.2010
37	• Maing Maw	Ancient Site Zone	3/10	5.4.2010
38	• Thargaya	Ancient Site Zone Protection and Preserve Zone	1/2012	2.2.2012
39	• Myaung Mya	Ancient Site Zone Protection and Preserve Zone	1/2012	2.2.2012
40	• Wai Tha Li	Ancient Site Zone Protection and Preserve Zone	3/2012	9.3.2012
41	• Danyawadi	Ancient Site Zone Protection and Preserve Zone	4/2012	9.3.2012
42	A Myint village and thone pan hla (a neint) village	Protection and Preserve Zone	5/2012	2.4.2012
43	• Pyadalin Cave (1) • Pyadalin Cave (2)	Ancient Monument Zone Protection and Preserve Zone	6/2012	3.9.2012
44	• Myae Htoo	Protection and Preserve Zone	7/2012	3.9.2012
45	• Wadi	Ancient Monument Zone Protection and Preserve Zone	8/2012	3.9.2012
46	• Pinle (Maing Maw)	Ancient Monument Zone Protection and Preserve Zone	9/2012	3.9.2012

Source: Department of Archaeology, National Museum and Library, Ministry of Culture

### 5.7.2.2 Sites under Protection of International Treaty

The Myanmar Government has applied to UNESCO regarding the classification of the following eight (8) cultural heritage regions and natural heritages as World Heritage Sites. In the applied cultural heritage regions, the MOC considers Pyu Ancient Cities including Beikthano, Hanlin and Sriksetra as priority sites to be designated as World Heritage Sites.

- (1) Bagan Archaeological Area and Monuments (Mandalay)
- (2) Phy Ancient Cities including Beikthano, Hanlin, and Sriksetra
- (3) Wooden Monasteries of Konbaung Period: Ohn Don, Sala, Pakhangyi, Pakhannage, Legaing, Sagu, Shwe-Kyaung (Mandalay)
- (4) Badah-lin and associated caves (Shan State)
- (5) Ancient cities of Upper Myanmar: Innwa, Amarapura, Sagaing, Mingun (Mandalay)
- (6) Myauk-U Archaeological Areas and Monuments (Rakhine State)
- (7) Inle Lake
- (8) Mon cities: Bago, Hanthawaddy (Bago Region)

### 5.7.3 Assessment

In this assessment, the potential impact of the power transmission line on the cultural heritage, the team focused on the following features of the tangible cultural heritage (a) archaeological sites (2) historic structures (3) historic districts.

There is no archaeological site identified or excavated by the Department of Archaeology line is to be instructed. The main archaeological sites identified, excavated and marked for preservation are in the central Myanmar plain, in Rakhine State in the west, and the Mon State in the southeast where high civilizations developed in historical times. There are a number of limestone caves in Shan State which are of archaeological interest, most notably Byadalin cave which is identified as a site of Hoabinhian culture. However, there are no such sites in the region of the construction of the power transmission line.

The main historic structures in Myanmar are religious structures which are usually built of more durable material than secular structures. Both Buddhist and Christian religious structures, that is, pagodas, monasteries, churches, etc., are of cultural significance in the region of the construction of the power transmission line. Religion plays an important part in the life of local communities and religious structures are the local centres of social as well as religious life. There is a variation in the size and antiquity of these religious

structures, but even the smallest village structure has significance in establishing the identity and sustaining the life of the community. Since these religious structures are located within or in close proximity to human settlements, the construction of the power transmission line in open areas will have no effect on them.

## 6 IDENTIFICATION AND ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS AND ENVIRONMENTAL IMPACT MITIGATION MEASURES

### 6.1 Introduction

The scientific and technical reliability of an Initial Environmental Examination (IEE) study depends on the skills of the IEE practitioners/reviewers, who estimate and review the nature and magnitude of the environmental change that the proposed project may entail. Impact prediction and evaluation is a vital exercise for assessing impacts, deciding alternatives, setting down mitigation measures and developing an environmental management plan. Predicting the magnitude of impacts and evaluating their significance is the core exercise of impact assessment. This process is also known as impact analysis and can be broadly broken down into three overlapping phases:

- **Identification:** To specify the impacts associated with each phase of the project and the activities undertaken
- **Prediction:** To forecast the nature, magnitude, extent and duration of the main impacts; and
- **Evaluation:** To determine the significance of residual impacts after taking into account how mitigation will reduce a predicted impact.

In assessing environmental impacts and their significance, some key concerns have to be kept in mind:

- Identity who or what is affected
- Description of how they are affected
- Evaluation against a set of consistent assessment criteria

#### 6.1.1 Impact Identification

The present transmission line project does not normally require extensive impact identification. However, there are some impacts such as displacement, loss of livelihoods, influence of topography and meteorology on water and air pollution, feasibility with respect to land use, geological characteristics, other sensitive receptors such as forest/biodiversity etc., which are site specific and can only be identified once the data on them is available or generated.

There are various tools that can be used for impact identification, such as questionnaires, checklists, network method, comparison with other similar projects, matrix and ad-hoc methods.

In this IEE report, we used the impact identification methods of questionnaires and comparison with other similar projects to complete the actions.

The summary of potential impacts on environmental, socio- economic, demographic and cultural context will be present in this section. While identifying the above key features, the section also discusses the type and range of impacts likely to result from the different project activities, measuring its extent and severity.

The specific purpose of this section is to;

- Identify and assess the range of potential impacts and extent of their severity;
- Explain the ways in which the project might affect environment, ecology, socio-economic resources, demographics, livelihoods, cultural patterns, as well as access and infrastructure issues;
- Suggest viable mitigation measures for the identified impacts;

- Develop a management plan based on the proposed mitigation measures.

These impacts have been identified through field surveys, onsite measuring, and enquire with the village community. Discussions with project proponents, district officials, and village representatives were undertaken along the study area. A mix of quantitative and qualitative methods i.e. sampling, questionnaires, interviews, oral histories, have been used to derive these impacts. Potential impacts have also been predicted based on experience of working in past similar assignments.

The assessment process is based on available information, including the project description (as provided by Client), and social and environmental baseline data. The assessment considers all relevant social and environmental impact/risks, including issues identified in IFC Performance Standards 2 through 8, and those who will be affected by such risks and impacts.

Although the route for the transmission line has been selected to minimize social or environmental impacts, there will, nevertheless, be some impact along the corridor due to construction, erection of transmission line towers and stringing of overhead transmission line and in setting up associated utilities.

This section presents a summary of the environmental impacts from the activities related to construction and operation of the transmission line and two substations. The impacts are based on the project description provided by the client, existing available data and similar past projects.

The transmission line design will involve approximately 296 towers, based on approved transmission line route by Department of Power Transmission and System Control, Ministry of Electricity and Energy. Land acquisition for Bamaw and Nabar substation have been completed and the land is own by Ministry of Electricity and Energy. Land acquisition and crop compensation for some part of the transmission line route, the ministry will settled out with land owners during construction phase. The potential environmental and social impact assessment for the present project will be assessed only for environmental and social impact without land acquisition. Besides, the evaluation of potential environmental and social impacts arising from the project activities will be assessed during both construction and operation phase only and there is no consideration for decommissioning phase because the source of electric power is come from hydropower which is sustainable and green energy.

The components of the present project will include the Right of Way (RoW), the transmission line, transmission towers, access roads and worker camps. No spoil areas are required as excavated material will be used for back fill and embankments at tower sites. During construction phase, the construction footprint will be confined to within 150ft. (about 50 meter), except for the construction of external roads required in remote parts of the RoW. Vegetation below 3m will be retained within the RoW where land is not required for tower footprints or access. The consideration and selection of the transmission line route was based on engineering principles and environmental factors, such as slope, geological condition for foundations and other obstructions.

The main construction contents in the present transmission line are as follows:

- 230kV double circuit line Bamaw-Nabar with estimated length of 75miles (121km);
- New Bamaw 230/110/66kV substation with 2×100MVA 230/110kV step-up transformers, 1×50MVA 110/66kV transformer, two 230kV line feeders, one 110kV line feeder and three 66kV line feeders.
- New Nabar 230/66kV substation with 2×50MVA transformers, 6×230kV line feeders and three 66kV line feeders.



- Replacement of conductor ACSR“IBIS” with ACCC“LATEDO”on single circuit existing 110kV line Tapein 1-Bamaw with length of 22 miles (35km).

In summary, project activities will include;

#### Construction Phase

- Clearing of vegetation for the RoW
- Earthworks for the installation of the transmission towers
- Construction of towers and stringing
- Rehabilitation of RoW areas not required to be permanently cleared and
- Construction of worker camp

#### Operation

- Vehicle travel within the RoW for maintenance works
- Maintenance of RoW, including repairs to transmission lines and trimming vegetation
- Road maintenance.

The potential environmental impacts can be understood to be in the following areas:

**Table 6.1-1 : Potential Environmental and Social Impacts**

Impact	Construction			Operation	
	Activities	Casting & Foundation	Erection of Tower	Stringing	Power Transmission
Soil		✓	-	✓	-
Waste disposal		✓	-	-	-
Aesthetics		✓	✓	-	-
Surface water quality		✓	-	-	-
Hydrology		✓	-	-	-
Biodiversity (Impacts on Flora and Fauna)		✓	-	✓	✓
Traffic and transport		✓	✓	✓	-
Atmospheric emissions/ dust		✓	-	-	-
Noise and Vibration		✓	-	✓	-
Socioeconomics		✓	-	✓	✓
Land use		✓	-	-	-
Economy and Livelihoods		✓	✓	✓	
Electromagnetic fields		-	-	-	✓
Community Health and Safety		✓	✓	✓	
Occupational Health and Safety		✓	✓	✓	
Hazards due to Natural disasters		-	-	-	✓
Major accident risks		✓	✓	✓	✓

### 6.1.2 Impact Prediction

While there are a number of models for predicting impacts on physical environment (air, water and noise), modeling socio-economic and cultural impacts is difficult and is generally done through qualitative assessment or economic analysis.

### 6.1.3 Impact Evaluation

The criteria for evaluating the significance should be based on local standards wherever possible. Where local standards are not available, acceptable international standards should be used (e.g. IFC, WHO or USEPA standards and guidelines of others countries, etc.). In all cases, the choice of the appropriate standard must be robust, defensible and relevant to the local situation. If there are no appropriate existing standards available, then the criteria

should be developed and their use must be clearly explained in the IEE. As a good practice in impact evaluation, it is better to use established procedures or guidelines, or relevant criteria which are comparable. While doing impact evaluation, it is equally important to understand the nature and characteristics of impacts on potential target areas, such as air, water, land, human beings, etc. to understand the significance, importance and intensity. The criterion that has been used to evaluate impacts on various environmental and social aspects is as following:

***Context***

The context refers to spatial or geographical extent of impact due to proposed linear project. In this study, impacts were classified as per the following context:

- Local (low spread), when an impact is restricted within 17.5 m of either side of the project foot print i.e. within the corridor defined for the project;
- Medium (medium spread) when an impact is spread from 17.5 m to 50 m either side of the project foot print i.e. beyond 17.5 m but within 50m either side of the corridor defined for the project; and
- Regional (high spread) when impact is spread beyond 50m either side of the project foot print i.e. beyond 50 m either side from the corridor defined for the project.

The above context has been selected based on the understanding of the linear project and prevailing environmental and social baseline conditions. The baseline conditions show that the project is free from settlements along the corridor route and no displacement is expected from the project. The project, however, is passing through forest land and will also require periodic maintenance during operation phase when access to forestland as well will require pruning of twigs of trees to restrict it to specific height for safe transmission as well for protection.

***Duration***

The duration of impact considers whether the impact would be short-term, medium-term or long-term and has been assessed based on the time taken to recover back to its pre-project state. For the transmission line project, impacts were classified based on their existence in temporal scale as follows:

- Short term (low duration) when impacting for a duration of six months (other than for ecology); this will result in the recovery of the effected environmental component (other than for ecology) within a year;
- Medium (medium duration) when impacting between six months and three years; this will result in the recovery of the effected environmental component (other than for ecology) within 1 to 10 years; and
- Long term (high duration) when impacting beyond three years (other than for ecology); and will result in recovery of prevailing conditions within 10 years or beyond.

For ecology [faunal species or floral species of ecological significance and trees(of girth size 30 cm or more)], impacts will be short term if limited to less than one generation, while impacts will be medium if limited to one generation and long term if limited to more than one generation.

***Intensity***

Indicators of the intensity of an impact, whether it is insignificant, minor, moderate, or major, was based on the following criteria for impact intensity:

- Insignificant intensity when resulting in changes in the environmental baseline of less than 20% in regional context or 20 to 30% in medium context or up to 30% in local context but for short duration;

- Minor intensity when resulting in changes in the baseline up to 20% in regional context or up to 30% in medium context or more than 30% in local context or for ecology minimal changes in the existing ecology in terms of reproductive capacity, survival or habitat suitability;
- Moderate intensity when resulting in changes in the baseline for up to 30% in regional context or more than 30% in medium context or for ecology changes are expected to be recoverable in terms of medium duration; and
- Major intensity when resulting change in the baseline beyond 30% in regional context or for ecology changes serious impairment to species, productivity or their habitat.

### **Type**

The type of impact refers to whether the effect is considered beneficial or adverse. Beneficial impacts would improve resource conditions. Adverse impacts would deplete or negatively alter resources.

The significance assessment matrix is provided in Table 6.1-2.

**Table 6.1-2: Impact Significance Criteria for Environmental and Social Components (other than for Ecology)**

Significance	Context	Duration	Intensity
Insignificant	Local	Short	Low
Minor	Local	Short	Moderate
	Local	Medium	Low
	Local	Medium	Moderate
	Medium	Short	Low
	Local	Long	Low
Moderate	Local	Medium	High
	Local	Long	Moderate
	Medium	Short	Moderate
	Medium	Medium	Low
	Medium	Medium	Moderate
	Medium	Long	Low
	Medium	Long	Moderate
	Regional	Short	Low
	Regional	Short	Moderate
	Regional	Medium	Low
	Regional	Medium	Moderate
Major	Local	Short	High
	Local	Long	High
	Medium	Short	High
	Medium	Medium	High
	Medium	Long	High
	Regional	Short	High
	Regional	Medium	High
	Regional	Long	Low
	Regional	Long	High
	Regional	Long	High

*Note:* Positive impacts are termed as beneficial while negative ones are adverse

*Source:* International Association for Impact Assessment

## **6.2 Construction Phase Impacts**

### **6.2.1 Soil Quality**

#### ***a) Activities***

Digging of foundation pits for the towers and the cutting of vegetation (for foundation purposes) are the main two activities, which are likely to affect the soil structure and quality. Foundations will be dug up to a depth of 3 m (at least) depending upon the tower type and soil characteristics. At the tower sites, all vegetation within the footprint of the tower base and for a distance of approximately 2 m beyond the base in all directions will be cleared to ground level. There will be some damage to crops and vegetation during stringing operation due dragging and pulling of conductors.

Some loss of vegetation/crop will occur due to movement of construction material and manpower through cultivated areas.

#### ***b) Potential Impacts***

The most significant potential impacts will be due to change to soil structure and soil quality as a result of excavation or compaction. The magnitude and extent of the impacts are likely to vary according to the characteristics of the soil and the types of construction activity. Foundation pits will be backfilled by the excavated soils which will resemble the order of the original soil layers.

Compaction of soil during backfilling might lead to temporary effects on natural infiltration of rainwater, but these impacts are temporary, localized and marginal.

Removal of vegetation and trees during construction of foundation, especially on the slopes would render soil vulnerable to erosion. The socio-economic aspect of crop clearing is discussed in next sub section. Also, stringing activities can cause larger damage to crop if carried out during flowering/fruit bearing season.

Movement of workers through adjoining fields during construction can damage fresh crops. Loose soils and construction material if placed in adjoining fields will lead to damage of existing crop and contamination of soil. The excavated if kept uncovered and unprotected will be rendered vulnerable to loss from erosion.

#### ***c) Mitigations***

The suggested mitigations to minimize impact on vegetation and soil include means to protect excavated soil material from erosion and contamination by placing them away from streams of water along the slope or in direct line of local drainage. Loose soil should be kept covered till the time of backfill and the excess soil should be removed after casting activities are complete. The construction activities shall be planned in non-monsoon months which will minimize any rainwater run-off or any loss due to infiltration.

Construction materials will be stored within the footprint of the site to avoid any kind of damage or contamination of soil/crop of adjoining fields. Movement of material and manpower shall be restricted to existing roads/tracks or as agreed upon with the stakeholders to avoid creation of new roads/tracks.

#### ***d) Impact Significance***

Due to temporary, localized and small size of the nature of impacts, together with proposed mitigation measure, the impacts predicted to occur on soils is minor. The significance of impacts on soil and its reduction with mitigation measures during construction is summarized in Table 6.2-1.

**Table 6.2-1: Impact Significance on Soil for Construction Phase**

Aspect	Scenario	Context			Duration			Intensity			Type		Significance			
Soil		Local	Moderate	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Moderate	Major
	Without mitigation		☑		☑			☑			☑			☑		
	With mitigation	☑			☑			☑			☑		☑			

## 6.2.2 Waste Disposal

### a) Activity

The main type of waste likely to be generated during construction activities is the construction debris resulting from casting for foundations and some steels carp from tower construction. Other wastes that will be generated include waste food/packaging material littered by workers.

### b) Potential Impacts

There is potential for spread of construction debris to areas outside that marked for construction. The debris generated from construction activities can be carried along with small springs, rivulets and rivers flowing in proximity of the tower. Construction debris can also contaminate wells, canals etc. in proximity of the activity.

### c) Mitigations

Any construction debris generated at the site will be removed from the site immediately after the completion of construction activities and the site will be leveled as original. Workers will be strictly instructed about random disposal of any waste generated from the construction activity.

Arrangements will be made to collect and prevent littering by workers on site.

### d) Impact Significance

Given the mitigations in place, insignificant environmental impacts are anticipated due to waste generation from the construction activities if good management and engineering practices are followed. The significance of impacts due to waste disposal and its control with proper mitigation measures is summarized in Table 6.2-2.

**Table 6.2-2: Impact Significance due to Waste Disposal for Construction Phase**

Aspect	Scenario	Context			Duration			Intensity			Type		Significance			
Waste Disposal		Local	Moderate	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Moderate	Major
	Without mitigation		☑		☑			☑			☑			☑		
	With mitigation	☑			☑			☑			☑		☑			

### 6.2.3 Aesthetics and Visual Impact

#### a) Activity

The visual amenity will be disturbed mainly during casting of foundation and leaving the site with stubs of tower. The erection of towers and conductors across the terrain will be an extrinsic element to the existing ambience.

#### b) Potential Impacts

The visual impacts and change of landscape due to construction activity will be for a short period of 15-30 days. However route of towers and transmission line are expected to cross highways/roads, and other transmission line which may lead to change of landscape resource and character due to introduction of manmade features leading to visual intrusion and loss of visual amenity. The cumulative impact due to already existing towers can hamper the aesthetic value of the area.

#### c) Mitigations

The route is planned after a series of survey to avoid habitation and forest areas. The clearing of trees will be kept to minimum and wherever possible, trimming of trees will be adopted *vis-à-vis* felling of trees. The lattice structure of towers provide sufficient see through effect which diminish the visual impact on the aesthetics of the area. The area being hilly terrain with undulations restrict the view of many towers in a single view, moreover the height of tower do not appear to be significant with reference the terrain.

#### d) Impact Significance

The overall landscape and visual impacts of the transmission line is expected to be minor. The impact is summarized in Table 6.2-3.

**Table 6.2-3: Impact Significance on Aesthetics and Visual for Construction Phase**

Aspect	Scenario	Context			Duration			Intensity			Type		Significance			
Aesthetics and Visual		Local	Medium	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Moderate	Major
	Without mitigation		☑				☑		☑		☑			☑		
	With mitigation	☑					☑	☑			☑		☑			

### 6.2.4 Surface Water Quantity and Quality

#### a) Activity

There is only one major river (Ayeyarwaddy) along the route of transmission line besides numerous rivulets and springs. The transmission line will require a minimum 6.4 m<sup>3</sup> of water for casting of foundations for each tower, which will be sourced from nearby water bodies through tankers. The groundwater in the region is shallow especial between Kathar and Nabar due to presence of many perennial rivers.

#### b) Potential Impacts

Water consumption will not have any impact on water requirement of the area as the water availability is in excess however, there is potential for wastage of water at site. There is potential for contamination of surface water bodies due to runoff from construction activities close to them. Also, construction along the slopes can affect small changes in the surface drainage pattern of the area.

Impacts to surface water quality can occur from erosion and sediment run off, discharge of inadequately treated sewage and domestic waste and release of hazardous materials.

The pollution sources are stated as follows:

#### **Erosion and Sediment**

Sources of erosion and sediment run off include:

- Erosion and sediment run off from construction activities that expose or move soil (including clearing of vegetation and earthworks)
- Release of sediment laden effluent during construction, for example soil waste from drilling activities
- Erosion and sediment released from stream bed and river bank disturbance at river course crossings

Erosion has the potential to lead to deposition of sediment and increased turbidity of water which can limit photosynthesis, suffocate benthic fauna and more broadly degrade aquatic habitat.

#### **Hazardous Materials**

Hazardous materials that may be used in the construction work:

- Paints and solvents
- Petroleum products such as oils, fuels and grease
- Concrete curing and repair compounds and
- Contaminated waste material.

There is potential for hazardous materials to be released to the environment, particularly during storage and handling and equipment/vehicle maintenance.

#### ***c) Mitigations***

Optimal use of water will be planned and followed at construction site. Construction activities in proximity of water bodies will ensure prevention of runoffs. At the river crossing the horizontal clearance (the distance between the towers) will be greater than the maximum river width at high flood levels and the vertical clearances will be according to the statutory requirements. The rivers crossings along the route are small and will not affect any change to the span of towers.

Any groundwater encountered during excavation will be pumped out and the source will be prevented from any kind of runoff from the adjoining areas. For impact on water quality, the following general water quality management measures will be implemented.

#### **Erosion and sediment**

- Clearing and earthworks will be undertaken in the dry season wherever possible to minimize erosion and subsequent release of sediment.
- The period of soil exposure will be minimized by phasing clearing and construction activities and covering exposed area by sand bags or canvas sheet. Exposed areas of river banks will be covered immediately and preferably by replanted with locally native tree species like woody vegetation.
- If vegetation clearing is required on river banks, vegetation will be cut near or at ground level to leave root mass in the ground. This helps to reinforce soil stability and reduce erosion.
- Stockpile materials will be located at least 30 meter away from steep slopes, water courses or drainage paths
- Water quality will be monitored regularly.

#### **Hazardous Material**

- All fuel and hazardous material storage will be adequately banded to prevent any spillage problem
- Only minimal chemicals, hazardous substances and fuel will be stored on site works



- Discharge of oil contaminated water into the environment is prohibited.

**d) Impact Significance**

The impacts during the construction activities will be short-lived. The transmission line will have insignificant impact on the surface water quality and quantity. The impact is summarized in Table 6.2-4.

**Table 6.2-4: Impact Significance on Surface Water Quality and Quantity for Construction Phase**

Aspect	Scenario	Context			Duration			Intensity			Type	Significance				
Surface Water Quality and Quantity		Local	Medium	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Moderate	Major
	Without mitigation		☑		☑			☑			☑			☑		
	With mitigation	☑			☑			☑			☑		☑			

## 6.2.5 Hydrology

**a) Activity**

There is only one major river (Ayeyarwaddy) along the route of transmission line besides numerous rivulets and springs. The clearing vegetation, earthworks and construction of access road and crossing river tower construction are the main activity of the project.

**b) Potential Impacts**

Impacts to hydrology may include the following:

- Clearing of vegetation may speed the movement of surface run off
- Earthworks required for tower footprints, access roads, stockpiles areas and other infrastructure may alter the flow of surface run off and
- Construction of access roads may involve in-stream works which may alter water flows.
- Temporary diversion of rivers for in-stream works (potentially required for access road construction) impacting hydrology, aquatic biota, and potentially access of villagers to water resources.

**c) Mitigations**

- Wherever possible, construction will occur during the dry season
- Earthworks will be undertaken to minimize changes to surface water flows and to avoid collecting standing water.
- If river diversion is expected to alter flows to an extent that would lower the downstream water level, local people will be informed of changes to water levels, including expected extent and duration of change.

**d) Impact Significance**

The impacts during the construction activities will be short-lived. The transmission line will have insignificant impact on the hydrology. The impact is summarized in Table 6.2-5.

**Table 6.2-5: Impact Significance on Hydrology for Construction Phase**

Aspect	Scenario	Context			Duration			Intensity			Type	Significance				
Hydrology																
		Local	Medium	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Moderate	Major
	Without mitigation		✓		✓			✓			✓			✓		
	With mitigation	✓			✓			✓			✓		✓			

## 6.2.6 Biodiversity (Flora and Fauna)

### a) Potential Impacts

The scale of land use changes which is approximately 556 ha (1370 acres) including land limited to vegetation below 3 m of land to be cleared. Out of all, 64.4 ha (159 acre) are agricultural land and, are not expected to have a major impact on Biodiversity. Power transmission line rights-of-way often reduce and fragment forests; indirectly, they occasionally facilitate further deforestation by improving physical access.

Anticipated impacts to biodiversity due to construction include:

- Temporary disturbance of habitat in areas required to facilitate construction. Temporary disturbance will mainly be associated with construction areas surrounding tower pads, any required access tracks to tower locations and temporary stockyards, workers camps and mobile offices.
- Disturbance and displacement of resident fauna due to noise, light and /or vibration as a result of construction activities (excavation, drilling, clearing, and vehicle movement).
- Fauna mortality due to vehicle/machinery strike, hunting, poaching and collection for trade due to the creation of access roads within and outside of the RoW.

The biodiversity survey (see in Appendix – 9) assessed the impact of the above items on biodiversity as having minor or negligible significance, however impacts to IUCN listed threatened species and nationally listed restricted species was assessed as having moderate significance.

### Impacts to Threatened Species

The following IUCN listed Threatened Species were found near the transmission line RoW. The location and name of the Threatened Species are shown in the following tables.

#### Mammal Species

No.	Common Name	Scientific Name	IUCN/Status	location
1	Sunda Pangolin	<i>Manis javanica</i>	CR(Critically Endangered)	This Species were found between Bamaw and Shwegu Township area.
2	Chinese Pangolin	<i>Manis pentadactyla</i>	CR(Critically Endangered)	This Species were found between Bamaw and Shwegu Township area.
3	Bengal Slow Loris	<i>Nycticebus bengalensis</i>	VU(Vulnerable)	This Species were found between Bamaw and Shwegu Township area.
4	Hoolock Gibbon	<i>Hoolock hoolock</i>	EN(Endangered)	This Species were found between Bamaw and Shwegu Township area.
5	Dhole	<i>Cuon alpinus</i>	EN(Endangered)	This Species were found between Bamaw and Shwegu Township area.
6	Sun Bear	<i>Helarctos malayanus</i>	VU(Vulnerable)	This Species were found between Bamaw and Shwegu Township area.
7	Asiatic Black Bear	<i>Ursus thibetanus</i>	VU(Vulnerable)	This Species were found between Bamaw and Shwegu Township area.
8	Sambar	<i>Rusa unicolor</i>	VU(Vulnerable)	This Species were found between Bamaw and Shwegu Township area.

9	Irrawaddy Dolphin	<i>Orcaella brevirostris</i>	VU(Vulnerable)	This Species was the Irrawaddy river at Katha township.
10	Chinese Serow	<i>Capricornis milneedwardsi</i>	NT(Near Threatened)	This Species were found between Bamaw and Shwegu Township area.

### Bird Species

No.	Common Name	Scientific Name	IUCN/Status	location
1	Oriental Darter	<i>Anhinga melanogaster</i>	NT(Near Threatened)	This Species was found nearly the Katha township
2	Grey-headed Parakeet	<i>Psittacula finschii</i>	NT(Near Threatened)	This Species were found Katha and Nabar Station.

### Fish Species

No.	Common Name	Scientific Name	IUCN/Status	location
1	Manipur Osterobrama	<i>Osteobrama belangeri</i>	NT(Near Threatened)	This Species was found at Irrawaddy river of the Katha township and Bamaw Township.
2	Indian butter catfish	<i>Ompok bimaculatus</i>	NT(Near Threatened)	This Species was found at Irrawaddy river of the Katha township and Bamaw Township.
3	Pabo catfish	<i>Ompok pabo</i>	NT(Near Threatened)	This Species was found at Irrawaddy river of the Katha township and Bamaw Township.
4	Boal	<i>Wallago attu</i>	NT(Near Threatened)	This Species was found at Irrawaddy river of the Katha township and Bamaw Township.
5	Gangetic goonch	<i>Bagarius bagarius</i>	NT(Near Threatened)	This Species was found at Irrawaddy river of the Katha township and Bamaw Township.

### b) Mitigations

- Implement the mitigation measures proposed in relation to hydrology, water quality, air quality and noise and vibration.
- Follow the law and rules against logging outside the approve construction areas and against wildlife hunting and poaching will be imposed on project staff, workers and all contractors and personnel engaged in or associated with the Project, with penalties levied for anyone caught carrying and using animal snares and traps, including fines and dismissal and prosecution under the Forest Law, 1992 and Protection of Wild Life and Wild Plants and Conservation of Natural Areas Law 1994.
- The project owner shall be directly responsible for dissemination to its staff and workers of all rules, regulations and information concerning these restrictions as well as the punishment that can expected if any staff or workers or other person associated with the Project violate rules and regulations.
- The planned clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing;
- Disturbed areas shall be rehabilitated as soon as possible following construction activities.
- Construction contractor will establish biological resource management program and management plan to manage the construction activities to be conducted and monitor compliance with relevant permits and environmental regulations in order to prevent potential impacts to terrestrial ecology, in particular, vegetation and wildlife.
- Construction and domestic waste will be appropriately stored and disposed of to avoid attracting native and alien species to the construction areas;
- Oil, chemical and solid waste will be stored, and handled and disposed according to local municipal law

- Construction vehicles and machinery will be maintained in accordance with industry standard to minimize unnecessary noise generation.
- Traffic signs will be installed on all roads throughout construction areas depicting speed limits.
- Commitment will be made to raise awareness of values of natural habitat areas to construction work force and make arrangements for restriction of poaching.
- Speed limit to maximum of 40 km/hr for construction vehicles will be enforced to minimize potential for fauna strike.
- Minimizing vegetation clearance of RoW as much as possible and ensuring the clearance not beyond designated area.
- Commitment will be made to raise awareness of values of natural habitat areas to construction work force and make arrangements for restriction of poaching.
- Leaving ground vegetation and shrub within RoW unless disturbance to access.
- Carrying out all vegetation clearance in consultation with Department of Forest.
- Disposing of chopped trees in accordance with guidance of Department of Forest.
- Rehabilitating borrow pits or stockpile areas after completion of construction.
- Prohibiting forest extraction by contractor employees.
- Prohibit using herbicide for clearing vegetation.
- Hunting wild animals will be strictly prohibited to apply all staff.
- In areas with concentrations of vulnerable bird species, the top (grounding) wire should be made more visible with plastic devices. Electrocutation (mainly of large birds of prey) should be avoided through bird-friendly tower design.
- Surveying to identify the exact location of rare plants and animals which are known to be present in the project area.
- Modification of the route, special construction techniques, or limiting construction time to specific seasons.
- Managing transmission line RoWs to provide habitat for endangered/threatened resources, including osprey nesting platforms built on top of transmission poles.

### c) **Impact Significance**

The plant species that listed and recorded in recently study were checked with IUCN red list of threaten species. But no threatened plant species were found in IUCN red list. Forest fragmentation can occur if proper mitigation measures are not taken.

There is no record of threatened and endangered species of fauna along the transmission line RoW but the IUCN listed threatened species were found near RoW.

The impacts during the construction activities will be short-lived. The transmission line will have insignificant impact on the biodiversity. The impact significance is summarized in Table 6.2-6.

**Table 6.2-6: Impact Significance on Biodiversity for Construction Phase**

Aspect	Scenario	Context			Duration			Intensity			Type		Significance			
Biodiversity (Flora and Fauna)		Local	Medium	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Moderate	Major
	Without mitigation			☑	☑				☑		☑				☑	
	With mitigation		☑		☑			☑			☑			☑		

## 6.2.7 Atmospheric Emissions/ Dusts

### a) Activity

The activities that are likely to form part of atmospheric emissions are exhausted gas and dust coming out from construction vehicles on the unpaved road, diesel power -driven earth movers, clearance of ROW, working area, access road construction, conductor string equipment such as crane, and operation of stationary plants such as generator.

### b) Potential Impact

As the construction of transmission line involves limited groundwork, the potential for dust generation is low and short lived. The increase in traffic volumes during the construction of the transmission line is expected to be occasional and negligible. Hence, it is considered that the contribution to pollutant concentrations arising from the construction activities and traffic is small and insufficient to cause any increase in the stipulated air standards or existing concentrations.

### c) Mitigations

Notwithstanding the potential of atmospheric emissions from construction and related activities the environmental impact of the project is low; the following mitigation measures will further reduce the impact of emissions, leading to insignificant impacts:

- Sprinkling of water on dust generating areas;
- Restricting the speed limits of vehicles during movement on unpaved roads; and
- Covering of vehicles carrying loose soil/construction material.
- Applying preventive maintenance system
- Checking vehicle and equipment inspection daily
- Stopping dust generating activities in high wind
- Applying good site practice and house keeping
- Turning off the engine while not in use
- Optimizing construction schedule to minimize time that vehicles are in operation
- Covering load-carrying platform properly when carrying earth/sand

### d) Impact Significance

The potential for dust generation will be short lived and low, the overall impact is expected to be insignificant. The impact is summarized in Table 6.2-7.

**Table 6.2-7: Impact Significance due to Atmospheric Emissions for Construction Phase**

Aspect	Scenario	Context			Duration			Intensity			Type		Significance			
Atmospheric Emissions		Local	Medium	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Moderate	Major
	Without mitigation	☑			☑				☑		☑			☑		
	With mitigation	☑			☑			☑			☑		☑			

## 6.2.8 Noise and Vibration

### a) Activity

The sources of noise during construction activities include:

- Construction traffic and
- Construction activities such as excavation, concreting, tower erection, backfilling, use of pumps (for pumping excess water) and compressors, etc.

### b) Potential Impacts

There is potential for disturbance to habitations, schools, temples in proximity of the towers due to construction related activities.

During erection of tower there can be disturbance from noise of workers.

Also, during stringing there is potential for disturbance from continuous operation of tractors.

### c) Mitigations

Construction activities will be concentrated and done sequentially so that no area is prone to extensive duration of noise impacts. For example though it might take anywhere between 3 to 6 months to complete tower erection and stringing exercise, the actual construction only happens for about 15-30 days.

There will be minimum lag period between laying of foundations and erection of the tower. Most of the work is done manually instead of cranes and other heavy equipment, which will reduce the potential for noise impacts.

Construction activity will be undertaken only during daytime. There will be some noise generated from the movement of tractors and trailers transporting the materials and equipment but the traffic volumes are expected to be occasional and insignificant. The followings are the additional mitigation measures.

- Ensuring all noise emitting activities to be kept distance from the residential area
- Inspecting all noise emitting equipment on a daily basis
- Shutting down all engines while not in use
- Limiting night work including transportation of material
- Maintaining ambient noise level below 55 dBA
- Considering a schedule of on-site activities for reducing the potential for the simultaneous occurrence/overlap of especially noisy activities.

The process of stringing of cables will produce only human voices, which might be audible to residents in very close proximity of the operations. However, again these impacts will be localized and short lived.

### d) Impact Significance

It can be concluded that the noise impacts from construction activity will be low and short-lived. No significant noise impacts from construction activities are predicted and any noise, if generated, will be well within the stipulated standards. The impact significance is summarized in Table 6.2-8.

**Table 6.2-8: Impact Significance due to Noise for Construction Phase**

Aspect	Scenario	Context			Duration			Intensity			Type		Significance		
Noise		Local	Moderate	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Major
	Without mitigation		☑		☑			☑			☑		☑		
	With mitigation	☑			☑			☑			☑		☑		

## 6.2.9 Social Issues and Management

### Involuntary Resettlement (Construction)

The area in which transmission line location is carefully selected with the principle of avoiding relocation as possible as it can be. As a result, there is no household fall within the transmission line corridor as per current proposed transmission line design.

In addition, it is impossible to avoid the use of tower base in private land mainly agricultural land. In addition, it is impossible to avoid ROW clearance which affected natural and commercial trees where the alignment locates in mountainous area. Total of (2.96) hectares of land for tower base construction shall be acquired permanently and commercial or natural trees within ROW shall be cut down at ground level.

Though the community did not raise social economic issues such as objection to access, loss of crop and impacts on agriculture due to project activities, there are expectations to receive power as a side product of the proposed transmission line. Community also had expectations for local benefits and other opportunities from project besides apprehension on potential exposure to electromagnetic fields during operation phase of the project.

To date, the project expresses no intention in process of disbursing compensation through negotiations with the community. The negotiations and agreements on land utilization as well as assets valuations should be on bipartite agreement basis. The project has to be planned to maintain safe distances all along the corridor and ensure mitigations for adverse impacts.

Even until the power provision to local settlement along the project is absent, the developer should consider other appropriate compensation like maintaining construction road to be applicable for local people, other facilities like repairing old local schools, rural health care facilities, and donation for village fund for community needs.

#### ***Land Take/Right of Use***

##### **Impact 1**

Land will be used for permanent facilities like foundation, pylons etc. (Currently the interruptions due to use of land should be compensated. The rates for land are agreed on a negotiated basis.). The project will alter land use by:

- Temporarily removing land uses from areas required for access roads, and other temporary infrastructure
- Permanently converting a small area of land to use for lattice towers
- Permanently limiting the types of land uses allowable within the RoW to those compatible with the transmission line, including:
  - Prohibiting dwellings
  - Prohibiting growth of vegetation greater than 4.5m
  - Allowing growth of low growing crops, except in areas previously consisting of natural habitat and
  - Opening access to additional land through the creation of new roads.

The changes in land use and the effects these changes have on communities will vary throughout the project area. The level of impact will depend on the current level of utilization, availability of alternative resources and diversity of the local economy.

The scale of land use changes approximately 556ha (1370 acres) including land limited to vegetation below 3m of land to be cleared. Out of all, 64.4ha (159 acre) are agricultural land and, are not expected to have a significant impact on the social conditions of the surrounding communities.

After approval of the present transmission line project by the ECD, the project company will recheck the RoW and access road alignments and place signs around affected areas to inform the public and to limit the extent of land intrusion for agriculture purposes.

#### **Suggested Mitigation**

- Ensure that negotiations for compensation are free and fair. Also ensure that the compensation rates are at par with the market rates.



- It also needs to be ensured that the opportunity cost of such land is considered when deciding the compensation amount.

**Monitoring and Awareness**

- Land owner should be adequately informed about compensation package by the MOEE's Liaison Officer.

**Management Responsibility**

- Head of the Administration/Land/RoW
- Liaison Officer
- Local Administration

**Impact 2**

There may be some changes in the alignment to take into account any specific requirement along the route which may result in some deviations from the original route profile.

**Suggested Mitigation**

- Inform landowners about the change in the route. Release land not required after re-routing to the landowners

**Monitoring and Awareness**

- A final check survey need to be conducted just before the time of construction for exact tower spotting.

**Management Responsibility**

- Head Administration/Land/RoW
- Liaison Officer

***Community and Private Property***

**Impact 3**

There may be damages to community and private/individual property during construction activities. The analysis of alternatives has to be done by the project proponents and community or private property resources have at best been avoided in the transmission line corridor. Wherever such private resources have been impacted, the compensation has to be negotiated and included in the compensation amount.

**Suggested Mitigation**

- Ensure that the construction activities are to be so planned that any use of community and individual property is either avoided or prior permission sought before use.
- Any unforeseen use and/or damage to property or structures etc. needs to be immediately compensated.

**Monitoring and Awareness**

- Construction activities should be closely monitored for such incidences. All such commitments should be a part of the contractor agreements.

**Management Responsibility**

- Head Administration/Land/RoW
- Liaison Officer
- Construction Contractor
- Local Administration

***Economy and Livelihoods***

**Impact 4**

Construction of the transmission line and associated infrastructure will provide employment opportunities to local people and may have a positive impact on the local economy and livelihoods. In addition, employment in the project, and associated training,

is expected to improve the skills and experience of local people in construction projects, including an improved working knowledge of health and safety practices.

#### **Mitigation Measures**

The following measures should be implemented to maximize the benefits of the project to the economy and livelihoods:

- UREC will carefully manage labor conditions
- The construction contractor will hire local people during construction where local people have the required skills and experience. It is acknowledged, however, that much of the labour, especially skilled labour, will come from outside the project area and
- Training in health and safety and technical areas will be provided to all personnel.

### **6.2.10 Potential Health Impacts and Proposed Management**

#### **1) Community Health Impacts**

Presence of labour in the area, even for short duration, can create local conflicts (Health impacts including risks of sexually transmitted diseases on the community).

##### ***Suggested Mitigation***

A public health education campaign will be provided, addressing: hygiene, disease prevention (including transmission pathways and symptoms of relevant diseases) and basic health promotion. The program will be designed and implemented in consultation with district and local health authorities.

Commit to meet Electricity Law and other Myanmar regulation requirements as well as international conventions on labour, especially on issues of child and forced labour, working conditions, collective bargaining, non-discrimination and equal opportunity, complaint and grievance mechanism as well as occupation health and safety.

##### ***Monitoring and Awareness***

- Weekly inspection of construction locations

##### ***Management Responsibility***

- Head Administration/Land/RoW
- Liaison Officer
- Construction Contractor
- Local Administration

#### **2) Occupational Health and Safety**

Construction activities present health and safety risks to personnel, including:

- Accident and injury while working
- Spread of transmissible diseases between worker and
- Contraction of disease due to poor sanitation and environmental conditions in work and accommodation areas.

##### ***Mitigation Measures***

The following measures will be implemented:

- Health Awareness Training will be mandatory for all personnel and will address both on-the-job safety and health awareness
- Clean drinking water will be provided to all camps and work areas
- Adequate sewage treatment will be provided
- First aid kits will be readily accessible by workers and first aid teams will be specifically trained and assigned in groups of two to three persons to the different sites and

- Vector control of mosquitoes and other pests will be managed including by minimizing mosquito breeding habitat and providing mosquito nets and other barriers.

### **6.2.11 Archeological, Historic and Cultural Effects**

#### ***Potential Impacts***

Temporary migration of workers may influence local cultural and create social tension.

Along the route of the power transmission line, there are a number of historic districts which are based on a variety of distinctive languages and cultural traditions of ethnic minorities. The nature and scale of the construction is such that it will not have a disturbing, effect on these historic districts. The local peoples express the opinion that the construction and the existence to the power transmission line will not disrupt their way of life and they raised no objection to the construction.

The collection of primary baseline data indicates that the construction of the Proposed Power Transmission Line by MOEE will have minimal adverse impact on the cultural heritage along the construction route. However, as the Kachin State and Sagaing Region is the platform of 15<sup>th</sup> Century Shan History, it is recommended that the developer and its subcontractors to report the cultural materials that find while excavating during the construction of power line facilities.

#### ***Mitigation Measures***

- The contractor will consult with local authorities to learn of any traditional practices and rules that need to be followed and to coordinate in the enforcement of laws and regulations.
- A code of conduct will be established and enforced to reduce the potential for conflict between local residents and migrant workers.
- Any entertainment venues or recreational facilities in the vicinity of the project shall be operated strictly according to the local village values and traditions and
- Local employment will be prioritized.

### **6.2.12 Traffic and Transport**

#### ***a) Potential Impacts***

Power transmission line from Bamaw and Nabar runs cross the Ayeyarwaddy River and pass through low hill mountain that situated no residential areas so impact on traffic system by the project would be low. Moreover, there can be traffic problems in on local roads while vehicles of the construction work move around.

Access can be disrupted during construction, at individual land owner level, and at the community level when village/ link roads are damaged/used beyond capacity for transportation and construction related activities.

(Developer or its subcontractor has wherever possible tried to avoid any access routes to avoid any disruption or inconvenience to the individual/community. Wherever such access is mandatory the negotiations have been done with the affected landowner by the construction contractor).

#### ***b) Suggested Mitigation***

- Avoid using community /village roads for project activities. Alternative roads should be constructed and used. All access roads have to be fully restored after use.
- Transportation schedules will be arranged to avoid peak hours of road usage.
- Traffic signs will be installed for all roads throughout construction areas.
- Relevant traffic regulations will be implemented throughout construction areas.

- In cases where heavy loads are required to be transported, some segments of roads and bridges may be reinforced to withstand the load.
- In the event that stringing conductors present a possible risk to traffic temporary barriers (such as bamboo scaffolds) will be constructed across the roads and rivers to protect the public and property.

***c) Monitoring and Awareness***

- Ensure that the compensation, even not in money and but in other negotiation should be applied between the contractor and the affected person in time.
- In case the land owner's access to his fields is disrupted for longer than what he/she has been compensated for, then the additional loss of crops should be compensated at the existing rates.
- Ensure prior approval and discussion with the local administration (Head of the Village Tract, or Village) and concerned departments for any disruption of traffic/access.
- Supervise construction contractors as well as vehicle operators

***d) Management Responsibility***

- Head Administration/Land/RoW
- Liaison Officer
- Construction Contractor
- Local Administration

## **6.2.13 Potential Hazards**

IFC Performance standard 2 highlights the need for safe and healthy work environment taking into account inherent risks in its particular sector and specific classes of hazards with respect to the project, including physical, chemical, biological, and radiological hazards. The performance standard highlight the need to prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards.

***a) Activity***

All construction related works.

***b) Potential Impacts***

During construction physical injury can result from workers slipping along the slopes; road accidents, accident to workers during erecting of towers and other occupational hazards.

Stringing activity around low tension/ high tension wires and other electrical units can be a potential hazard if proper planning is not followed. Workers at times are not accustomed to use of Personal Protection Equipment, their attitude to avoid PPE may result in accident/hazard.

Pits dug along roads /tracks close to habitations can lead to potential accidents for people and domestic animals in the proximity.

***c) Mitigations***

The staff of contractors involved in the construction activities will be trained about the mandatory precaution and safety practices prior to commencement of construction activity. All required Personal Protection Equipment will be used by the workers at site and their use will be supervised. Safety harness will be ensured for workers while erection of tower. Vehicle movements to follow the traffic norms and maintain a safe speed while moving through the hilly tracts.

Stringing activities near low tension wires/high tension wires and other electrical utilities will be done after proper shutdown of the line/utilities with prior information and permission.

All excavation activities will be conducted in supervision of the site contractor with prior information to the nearby inhabitants. Proper signage will be provided in places where excavated pits are close to road or hilly tracts.

The design of the towers will adhere to the Proper Standards (i.e. IFC standard and Indian Standard), which will ensure sufficient safety margins to reduce the risk from wind and seismic activities. Extreme weather conditions could affect the transmission line though the very high wind speed is rare. Hence the risk of natural impacts is low.

## **6.3 Operation Phase Impacts**

### **6.3.1 Soils**

No impacts of any significance are predicted on vegetation and soil due to operation of the transmission line. Any spillage of Aluminium oxide paint during operation and maintenance of the transmission line towers may impact soil quality. Low frequency of painting as well as involving experienced personnel with mitigations like prior spread of sheets underneath the tower structure while painting.

### **6.3.2 Waste Disposal**

No significant waste is anticipated to be generated during operation of the transmission line.

### **6.3.3 Aesthetics and Visual Impact**

There will be no additional visual impact due to operation of transmission line as the will only involve transmission of electricity through the established network.

### **6.3.4 Surface Water and Hydrogeology**

Transmission line infrastructure may have the following impacts to water quality during the operational period.

- The presence of hardstand areas (i.e. tower pads) has the potential to impact water quality through the operational phase by reducing infiltration, thereby increasing overland flows carrying pollutants to watercourses. Given the small area of tower pads (about 100 m<sup>2</sup>) this impact is expected to be minor.

#### ***Mitigation Measures***

- Drainage of hardstand areas will be designed and constructed to retain surface runoff and facilitate infiltration to a level similar to pre-construction flows.

### **6.3.5 Biodiversity**

Anticipated impacts to biodiversity during operation include:

- Permanent loss of 2.96ha (73 acres) of habitat and modification of 556ha of habitat within the corridor footprint.
- The RoW may interrupt the continuity of forest habitat (mostly degraded deciduous forest), as vegetation heights will be limited to below 3 meter, however the maintenance of vegetation in the understorey and midstorey is likely to continue to allow arboreal species to move through the landscape.
- Disturbance and displacement of resident fauna due to noise as a result of electricity transmission and noise and light as a result of maintenance activities.
- During operation, mortality of avifauna (birds and bats) may occur due to collision with the transmission line and electrocution. Avian collisions could occur in large

numbers if lines are located in daily flyers, or if avifauna are travelling during low light conditions.

#### **Mitigation Measures**

- Within the RoW, vegetation trimming will be restricted to that required to safely operate the transmission line. Groundcover and midstorey vegetation will be retained wherever practicable.
- The project shall implement landscaping and re-vegetation after completion of construction in suitable areas and
- Vegetation management will be made to raise awareness of values of natural habitat areas to personnel work force and arrangements will be made for restriction of poaching and forest product collection.
- Commitment will be made to raise awareness of values of natural habitat areas to personnel work force and arrangements will be made for restriction of poaching and forest product collection.
- Hunting wild animal will be strictly prohibited and
- Transmission line will be designed to minimize risk of electrocution, including maintain a 1.5 meter spacing between energized components and grounded hardware, or covering energized parts.

#### **Impact Significance**

- It can be concluded that the biodiversity impacts during operation phase will moderate and long-lived. The impact significant on biodiversity will be moderate and the impacts will be mitigated with suitable mitigation measures so the impacts will be minor after doing mitigation. The impact significance is summarized in Table 6.3-1.

**Table 6.3-1 : Impact significance due to Biodiversity for Operation Phase**

Aspect	Scenario	Context			Duration			Intensity			Type		Significance			
Biodiversity		Local	Medium	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Moderate	Major
	Without mitigation		☑				☑	☑			☑				☑	
	With mitigation	☑					☑	☑			☑			☑		

### **6.3.6 Air Quality**

Operation and maintenance can affect air quality by:

- The emission of ozone from transmission lines when in active corona, however ozone emitted from transmission lines not known to carry any health risk and
- Air pollution due to burning of vegetation for RoW management.
- The operation of the transmission line will not contribute to any atmospheric emissions directly and hence the predicted impacts are negligible. Green House Gas emissions from the transmission line operation will be limited to fuel consumption in vehicle used for the maintenance activities. The project on the whole being a hydroelectric power project will potentially prevent the emission of GHG which would have otherwise been generated for power generation of similar capacity. The GHGs generated from the project will be negligible.

**Mitigation Measures**

Vegetation will not be burnt for maintenance. Mechanical method will be used to trim tall and encroaching vegetation.

**Impact Significance**

- It can be concluded that the impacts on ambient air quality during operation phase will be local, long-lived and intensity is low. The impact significant on air quality will be minor and the impacts will be mitigated with suitable mitigation measures so the impacts will be insignificant after doing mitigation. The impact significance is summarized in Table 6.3-2.

**Table 6.3-2: Impact Significance due to Air Quality for Operation Phase**

Aspect	Scenario	Context			Duration			Intensity			Type		Significance			
Air Quality		Local	Medium	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Moderate	Major
	Without mitigation	✓					✓	✓			✓			✓		
	With mitigation	✓					✓	✓			✓		✓			

**6.3.7 Noise****a) Activity**

The likely noise impacts from operation of the transmission line will be due to:

- Maintenance and repair activities;
- ‘Corona discharge’ from the overhead lines;

**b) Potential Impacts**

Once operational, noise from energized overhead lines can be produced by a phenomenon known as ‘Corona Discharge’ (a limited electrical breakdown of the air). Conductors are designed and constructed to minimize corona effects, although, under certain conditions this can be audible as a ‘hissing’ sound, sometimes accompanied by a low frequency hum. However, noise due to Corona Discharge is negligible for transmission line up to 230 kV grade.

Another noise source could be generated during maintenance of the towers, though it will be infrequent and extremely low.

**c) Mitigations**

Conductors designed and constructed to minimize corona effects will be chosen for transmission.

It is highly unlikely that the corona discharge noise will exceed the normal background noise levels in the area and furthermore, such noises are restricted to certain weather conditions.

**d) Impact Significance**

The noise generation from operational phase will be low but consistent for the entire life of transmission line. The impact of noise is considered to be minor.



**Table 6.3-3: Impact significance due to Noise for Operation Phase**

Aspect	Scenario	Context			Duration		Intensity			Type		Significance				
Noise		Local	Moderate	Regional	Short	Medium	Long	Low	Moderate	High	Adverse	Beneficial	Insignificant	Minor	Moderate	Major
	Without mitigation	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
	With mitigation	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			

### 6.3.8 Social Issues and Management

#### Economy and Livelihoods

Ongoing maintenance of the RoW, particularly vegetation management, can provide employment to local residents.

#### Mitigation Measures

- Local people will be employed for suitable roles wherever possible and
- Appropriate health and safety measures will be undertaken to protect all project personnel.

#### Community Health and Safety

Community will have concerns about its safety and possibility of any accidents like electrocution, skin diseases etc.

(The project proponents through select consultations with relevant stakeholders have tried to allay all fears related to health impact.)

Electrocution due to contact with high voltage electricity or items in contact with high voltage electricity (such as tools, vehicles or ladders).

#### Suggested Mitigation

- Evaluate possible risks and ensure that these are addressed and minimized.
- Communicate about the technical aspects of the transmission line construction and operations, and allay fears about accidents or any other health concerns.
- Use simple diagrams and pamphlets in local language for this purpose.
- Train land owners about safety issues and action to be taken in case of risks.
- Demonstrate that MOEE and its contractors are very concerned about health and safety of workers as well as the community.
- Signs and barriers will be installed to prevent access to high voltage areas.
- Grounding conducting objects will be installed near transmission lines.

#### Monitoring and Awareness

- Ensure communication of health and safety risks to villagers near to settlements in batches and explain the various health and safety measures being undertaken.

#### Management Responsibility

- Safety Officer

#### Anxieties of Risks:

The community could be concerned about the risk of overhead wires and pylons located in the agricultural fields. Misgivings and unsubstantiated fears linked to electrocution would be reported by the community at different places. Similarly unfounded rumours of overhead transmission line leading to several health impacts like skin diseases, disability and infertility were expressed especially in the hilly regions of the project area.

These fears mostly arose from the lack of information and proper understanding of the project and its activities and reportedly at times by the activities of vested groups trying to gain mileage and benefits from the project.

***Managing community perception on health:***

The perceptions of the community with regard to the perceived health impact of the project needs to be managed to allay any fears and apprehensions of the community. Proper dissemination of information and consultations with the community and relevant stakeholders will need to be carried out to dispel individual and community concerns regarding health and safety.

The field consultations carried out in connection revealed that the affected communities possess mixed information about the transmission line.

Generally along the transmission line route the awareness with regard to location of towers, overhead lines is high but low with regards to potential community and health impacts such lines do not have. However, select consultations with informed stakeholders revealed that the overall support to the project remains high, providing that:

- The project proponents address the health and safety concerns if any associated with the electricity lines
- Compensation including specific investment in community development programmes.

In some area, flooding that can increase incident of electrocution often occur. Water channels should be cleaned to drain fluently. By this procedure, can not only prevent flood but also against many other infections associate flooding (e.g. gastroenteritis, leptospirosis) so the community will be appreciated the project components.

**Occupational Health and Safety**

Hazards relevant to project personnel include:

- Exposure to EMF at levels higher than those experienced by the general public.
- Electrocution due to contact with high voltage electricity or items in contact with high voltage electricity (such as tools, vehicles or ladders).
- Working at height on towers.

***Mitigation Measures***

**Electromagnetic fields**

- An EMF safety program will be developed prior to operation which: identifies potential levels of exposure; provides training for all workers; delineates zones appropriate for public access and those restricted to appropriately trained workers; defines measures to limit exposure time, such as through work rotation; and provides personal monitoring equipment for workers.
- Ensure compliance of safe practices and implementation of safety manual
- Provide and ensure use of personal protective equipment (PPEs) like, safety goggles, gloves, safety harness, helmets, gumboots etc.
- Securing the workplace, wherein all lines are shut down prior to maintenance work, use of PPE and procedures for emergencies and compensation procedures in case of accidents.
- Prior training of the workers regarding health and safety procedures is essential.

**Electrocution**

- Transmission lines will be deactivated and grounded prior to work on, or near, transmission lines.
- Live work will only be conducted by trained workers.

**Working at heights**

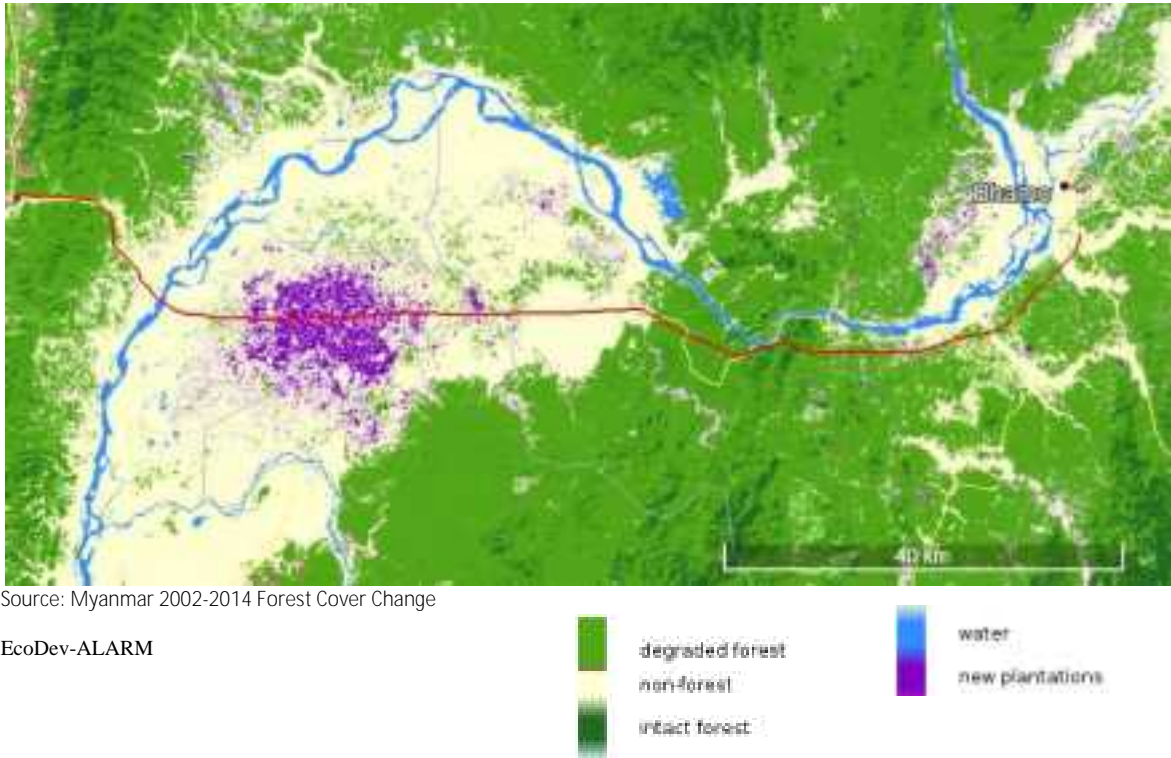
- Fall protection measures will be implemented including provision of appropriate fall protection equipment, training in use of equipment, training in climbing techniques, and rescue of fall-arrested workers.
- All equipment, including hoisting equipment, power tools and tool bags, will be properly rated and maintained.

### **6.3.9 Electricity Hazard caused by forest fire (During Operation)**

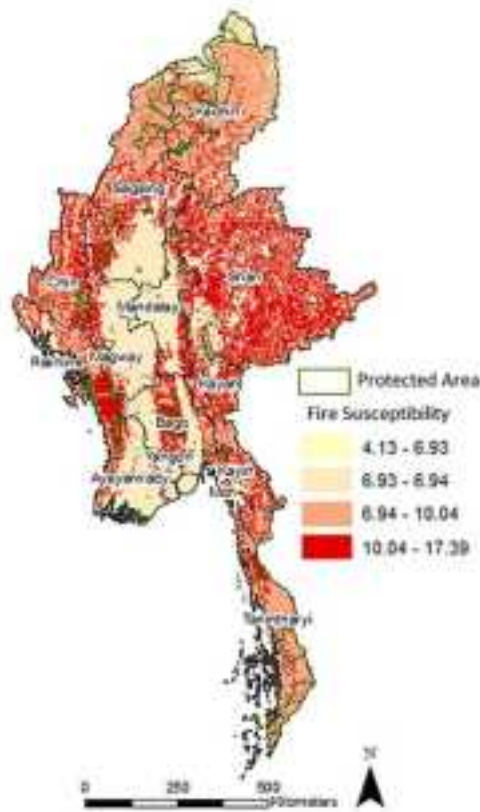
The present Bamaw-Naba 230kV transmission line passes through the degraded dry deciduous forest and agricultural land. The types land use occupied along the transmission line are described in the following table.

Facility	Land Use
Transmission line First Part – Start from Bamaw (50km)	Degraded dry deciduous forest
Second Part (10.5km)	Agricultural Land
Third Part (37km)	Degraded dry deciduous forest
Fourth Part – (3.5km)	Agricultural Land
Fifth Part, towards Nabar (20km)	Degraded dry deciduous forest

The location of the Bamaw - Naba transmission line with respect to the Land Use/Land Cover Map is shown on Figure 1. The transmission line passes through the degraded forest, non-forest area, and new plantation areas. There is no intact forest was observed along the transmission line.

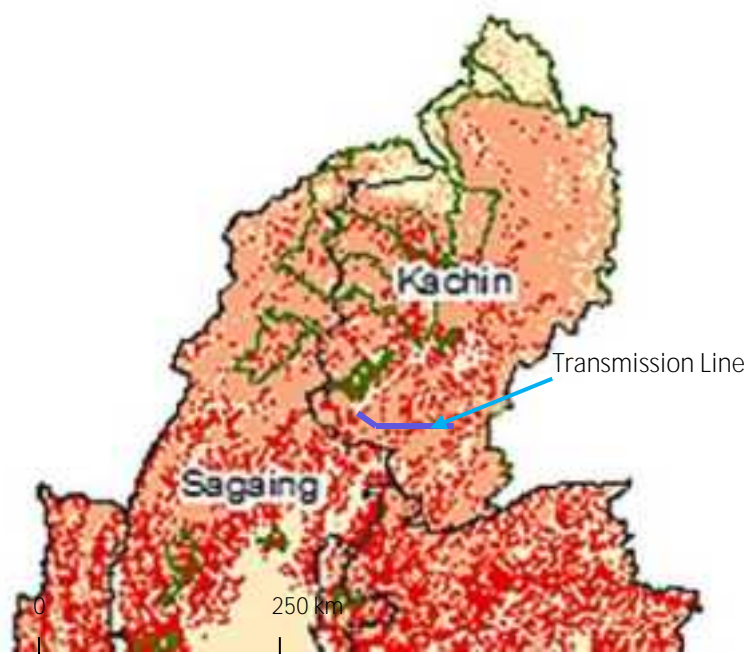


**Figure 6.3-1** Land use/ land cover map along the Bamaw-Naba 230kV transmission line.

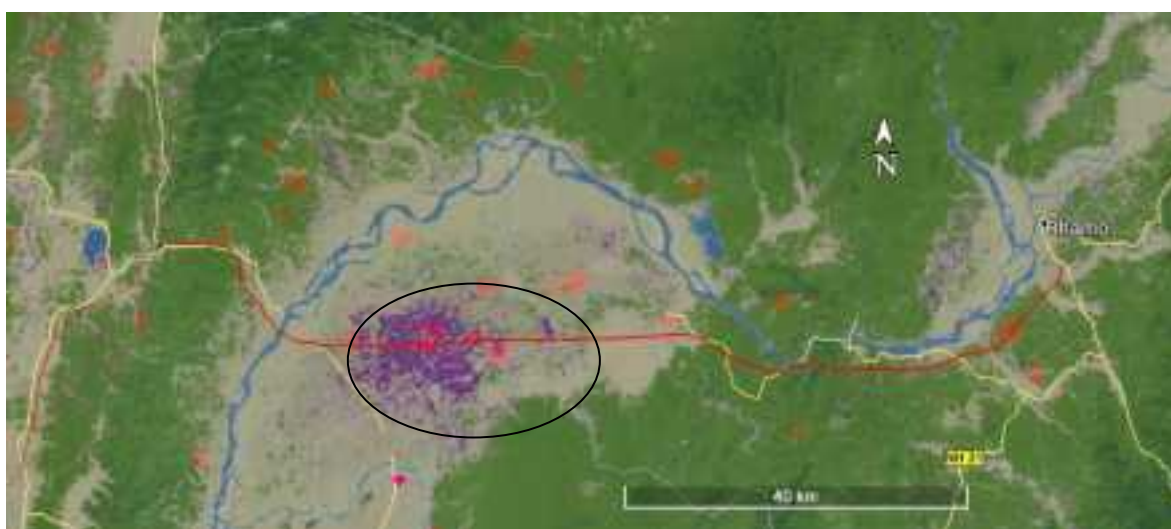


**Figure 6.3-2** Susceptibility of forest fires in Myanmar (Biswas, et al, 2015<sup>1</sup>)

<sup>1</sup> Biswas S, Vadrevu KP, Lwin ZM, Lasko K, Justice CO (2015) "Factors Controlling Vegetation Fires in Protected and Non-Protected Areas of Myanmar". PLoS ONE 10(4): e0124346. doi:10.1371/journal.pone.0124346



**Figure 6.3-3 Susceptibility of forest fires along Bamaw – Naba 230 kV Power Transmission Line**



Source: <https://earthobservatory.nasa.gov/images/18070/fires-in-myanmar>

**Legend**

Red pixel shows Forest Fire on March-April 2007

Red thick line shows Bamaw-Naba 230 kV Transmission Line

**Figure 6.3-4 Pass record of forest fires along the Bamaw-Naba Transmission Line**

In Myanmar, highest fire susceptibility is observed for Shan, Kayah, Kayin, Mon, central Bago, southern Rakhine, southern Kachin, southwestern Sagaing, the borders of Chin, Magway and Sagaing, northern and central Tanintharyi. Distinct clusters of fires with highest frequencies were observed in the following districts; a). Thandwein in Rakhine; b). Bago, Taungoo and Thayarwady



in Bago; c). Lashio, Kyaukme, Loiken and d). Taunggyi in Shan<sup>2</sup>.

If underlying growth is left unchecked, or slash from routine maintenance of the transmission lines is left to accumulate, sufficient fuel can accumulate that may promote forest fires<sup>3</sup>.

Fire susceptibility along the Bamaw - Naba line is shown on Figure 6.3-3. It can be seen that there is low to moderate susceptibility of forest fires along the Bamaw - Naba line.

In Kachin, Sagaing and Tanintharyi fires mostly occurred in cropland-vegetation mosaics and evergreen broadleaf forest classes. In general, the forest fires occurred between March and April in Myanmar. The past occurrences of forest fire along the present transmission line were observed in new plantation areas only. Figure 6.3-3 and 6.3-4 show that the past occurrences of forest fire and the susceptibility of forest fire

Forest fire is common in some locations (new replantation areas) associated with distribution and/or transmission components of the project. Forest fire could damage distribution poles, overhead lines, and other infrastructure. Conversely, the transmission and distribution components of the project could increase the occurrences of wild fire (e.g. if sparks or other failure occurs in dry areas/seasons and acts as a trigger for forest fire in addition to natural triggers (e.g. lightning) and human triggers (e.g. burn the bush, burn in the paddy field etc.).

The recommendation for mitigation measures were made based on International Finance Corporation's EHS Guidelines for Electric Power Transmission and Distribution, April 30, 2007.

- Monitoring right-of-way vegetation according to fire risk;
- Removing blowdown and other high-hazard fuel accumulations;
- Time thinning, slashing, and other maintenance activities to avoid forest fire seasons;
- Disposal of maintenance slash by truck or controlled burning. Controlled burning should adhere to applicable burning regulations, fire suppression equipment requirements, and typically must be monitored by a fire watcher;
- Planting and managing fire resistant species (e.g. hardwoods) within, and adjacent to, rights-of-way;
- Establishing a network of fuel breaks of less flammable materials or cleared land to slow progress of fires and allow fire fighting access.
- cutting gaps in vegetation to act as fire breaks (especially near transmission or distribution components of the project)

The construction of transmission line and substation are mainly responsible for UREC and after completion UREC will transfer to MOEE and DPTSC will responsible for operation phase. Therefore, DPTSC will coordinate with Forest Department to manage above proposed mitigation measures.

The monitoring measures for such kind of electrical hazard have already been proposed in Table 8.3-1: Environmental Monitoring Program, in chapter 8.

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<sup>2</sup> Biswas S, Vadrevu KP, Lwin ZM, Lasko K, Justice CO (2015) "Factors Controlling Vegetation Fires in Protected and Non-Protected Areas of Myanmar". PLoS ONE 10(4): e0124346. doi:10.1371/journal.pone.0124346

<sup>3</sup> IFC. "Environmental, Health, and Safety Guidelines, Electric Power Transmission and Distribution" April 30, 2007

#### **6.3.10 Aircraft Navigation Safety (During Operation)**

According to the International Finance Corporation's EHS Guidelines for Electric Power Transmission and Distribution, April 30, 2007, the power transmission towers, if located near an airport or known flight paths, can impact aircraft safety directly through collision or indirectly through radar interference.

Bamaw-Naba 230 kV transmission line especially Bamaw substation is located about 5 km south of Bamaw airport. Therefore, the impact on aircraft navigation is unexpected.



## 7 RESULT OF THE PUBLIC CONSULTATION AND PUBLIC DISCLOSURE

### 7.1 Objectives of PCM and PD for IEE

Public consultation has played a key role in development of the project and will continue to play an important in its implementation.

The goal has been to ensure opportunities exist for stakeholders to be involved in project design, including potentially affected people. More specifically, the objectives are to:

- Ensure that stakeholders concerns are incorporated in the project design and implementation
- Increase stakeholder awareness and familiarity with the project
- Ensure transparency in the decision-making process and
- Ensure the potential benefits by directly involving relevant stakeholders.

These objectives are being met through a comprehensive public consultation and disclosure process, which has been ongoing for a number of years. This has included:

- Sharing relevant project information at the earliest stages of the project
- Providing on-going opportunities to input to the project; receiving feedback from project stakeholders and
- Utilizing outputs from the consultation process to inform the project design, including proposed management measures and corresponding management plans.

### 7.2 Stakeholder Identification and Stakeholders' Capacity Analysis

An integral component of assessing a project's potential impacts is to identify and prioritize project's stakeholders. Stakeholders are defined as those people, or groups, who are potentially impacted by or interested in the project. It is important to also include in the stakeholder analysis those groups or organizations that are not adversely affected, but whose interests determine them as stakeholders.

STAKEHOLDER MAP

INTEREST	<b>HIGH</b> Local Resident Media NGO's Parliament member <i>Keep informed</i>	Project developer(UREC) Ministry of Electricity and Energy Ministry of Natural Resources and Environmental Conservation <i>Engaged, managed closely</i>
	<i>Monitor</i> Other Related department <b>LOW</b>	<i>Keep satisfied, leverage</i> Electricity Supply Enterprise Environmental Conservation Department Land record Department Agricultural Department <b>HIGH</b>
	INFLUENCE	

Following the initial identification stakeholders, a more in-depth look at stakeholder group interests has been undertaken to consider how they will be affected and to what degree, and what influence they could have on the project.

**Table 7.2-1: Stakeholders Meetings**

State/Division	District	Township	No.	Name of Village
Kachin	Bamaw	Bamaw	1	Bo De Wa
			2	Han Te
			3	Phan Ga Go
			4	Kon Ma Hat
			5	Ka Ba Ni
			6	Kan Gyi
			7	Nyaung Bin Thar
			8	Kan Tha Zu
			9	Thein Lin
			10	Thit Son
			11	Sa Wa Di
			12	Su Bok Kon
			13	Kaung Ton
			14	Mya Le
			15	Sin Kan
		Shwegu	16	Taw Lan
			17	Kaing Ywa
			18	Nam Pa
			19	Myaing Tha
			20	Pan Din
			21	Lan Gu
			22	Hgnet Ta Da
			23	Ton Kauk
			24	Si Mu Gyi
			25	Si Mu Lay
			26	Hein Kaung
			27	Naung Let Kyi
			28	Nan Lan
			29	Si Maw
			30	Si Mae YTK
Sagaing	Katha	Katha	31	Kyun Daw
			32	In Da Yan
			33	Kyaung Go
			34	Po Za Gon
			35	Ton Baw
			36	Thein In
			37	Nat Ye Dwin
			35	Lan Gwa
			36	Pin Me Fot
			37	Na Ba
		In Daw	38	Kan Ni
			39	Na Bar
			40	Na Ya Gaung

### 7.2.1 Project stakeholders

Project stakeholders are identified in order to understand the individuals or organizations that will be affected by or may influence the Project or related activities either positively or negatively. For the purposes of this SEP, a stakeholder is defined as any individual or group who is potentially affected by the proposed Project, or who has an interest in the proposed Project and its potential impacts. It is therefore important to establish which organizations, groups and individuals may be directly or indirectly affected (positively and

negatively) by the proposed Project and which might have an interest in the proposed Project. It should be noted that stakeholder identification is an on-going process, requiring regular review and updating as the IEE progresses.

The proposed project is the construction of 230kv transmission line between Bamaw and Nabar with the length of about 121 km, two newly -built 230kV/66kV substations and one extended substation aiming at power supply for area along the Northern Mandalay to Kachin State. The installation of towers along the ROW and construction of substations will affect land of 40 villages in four townships. Land of 40 villages mean the land use of tower and substations. Any houses are not found in the 150 feet width of transmission line (75 ft from centre of TL route). Farmland, plantation, forest and reserved forests are involved at the land use of towers construction. The following table describes the villages by the transverse of transmission line.

## 7.2.2 Stakeholder Groups

**Table 7.2-2: Focus Group Meetings**

Stakeholder Categories	Stakeholder Groups	Stakeholder
Government	Regional and local government: administrative and technical	<ul style="list-style-type: none"> <li>Ministries ( Ministry of Electricity and Energy, Ministry of Natural Resources and Environmental Conservation and associated offices at the regional and local level)</li> <li>Environmental Conservation Department and associated offices at the regional and local level</li> <li>Administrative Offices and associated offices at the regional and local level</li> <li>Administrators and Officers of respective offices in Bamaw District, and Katha District</li> </ul>
Directly Affected Stakeholders	Customary authorities (per village)	<ul style="list-style-type: none"> <li>Village Leaders</li> <li>Religious Leaders</li> <li>Elders</li> </ul>
	Community Associations (per village)	<ul style="list-style-type: none"> <li>Youth Group</li> <li>Women Group</li> <li>Other associations if there is</li> </ul>
	Community members, including men, women, youth and elders	<ul style="list-style-type: none"> <li>Associated persons by respected villages</li> </ul>
	Business	<ul style="list-style-type: none"> <li>Farmers</li> <li>Gardeners</li> </ul>
Civil Society	National and regional NGOs	<ul style="list-style-type: none"> <li>Women Association</li> <li>Red Cross</li> </ul>
	International NGOs	<ul style="list-style-type: none"> <li>If there is</li> </ul>

## 7.2.3 Stakeholder Engagement Plan

In order to ensure effective engagement and open, frequent and honest dialogue with local communities and other key stakeholders, a stakeholder engagement plan is designed throughout the life of the Project. This plan is to be developed and implemented in order to identify stakeholder and their issues of concern, establishes the methods for consultation, and provides a specific action plan for stakeholder engagement throughout the life of the Project.

**Table 7.2-3: Stakeholder Engagement Activities in Bamaw District, Kyaukme District and Katha District**

Stakeholder Groups	Stakeholders	Approaches and Methods	Material	Issue
The regulatory authorities	-Bamaw District, Kyaukme District, Katha District Provincial Authorities -Department of Forestry -Environmental Conservation Department -Department of Agriculture, Livestock and Irrigation - Land Use Department - Associated Departments -City/ Town Authorities	Informal meeting	Leaflets	-Consult on public participation ( PC1, PC2, attitude survey) and list of participants -Physical and Ecological Assessment Survey
Potentially impacted group	-Headman/ community leaders of 40 villages -Key informants (monks, teachers, gardener, farmers, etc.) and affected persons in 40 villages	- Public Consultation Meeting ( two times PC1 and PC2) -Questionnaire attitude survey	-For PC1 and PC2 = leaflets/ information boards/ mobile exhibition -For attitude survey = questionnaires/ information folders	-PC 1 = Project schedule/ Scope of IEE/ Collect concerns about the project -Attitude Survey = Socio-Economic data/ attitude towards the project -PC 2 = Impact and mitigation measures/ Feedback on mitigation measures
Remark	Subjected to change after meeting with the regulatory authorities	To be conducted by Resource and Environment Myanmar	Prepared by REM	

#### 7.2.4 Stakeholder Lists

1. Representatives of Pyithu Hluttaw
2. Representatives of Amyotha Hluttaw
3. District Administrators, General Administrative Department
4. Township Administrators, General Administrative Department
5. Director of Environmental Conservation Department
6. Representatives of Environmental Conservation Department
7. Representatives of Forest Department
8. Representatives of Electric Power Enterprises

9. Representatives of Agricultural Land Management & Statistics Department
10. Representatives of Agriculture, Livestock and Irrigation Department
11. Representatives of Immigration and National Registration Department
12. Representatives of Fire Service Department
13. Representatives of Development Committee
14. Representatives of Police Force
15. Representatives of Planning Department
16. Representatives of Post and Telecommunication Department
17. Representatives of Information and Public Relation Department
18. Representatives of Road Transport Administration Department
19. Representatives of Planning and Land Administration Department
20. Representatives of Rural Development Department
21. Representatives of Road Transport Administration Department
22. Media
23. CSOs, NGOs and INGOs
24. Village Head and authorities
25. Affected persons

### 7.3 Consultation Strategy and Approach

According to present day policy of the State on development project, information disclosure, public involvement and public participation are necessary before and during implementation tasks. Consultant team applied the following stages of public participation for the successful implementation.

(1) **Focus Group Meetings:** Information disclosure and receiving direct opinion and concern of people

(2) **Stakeholder Meeting:** Information disclosure and project in view of stakeholders.

The Project benefits of a strong endorsement by the Regional level institutional stake holders and regular meetings are held at institutional level. The following stakeholder meetings and focus group meetings have been organized as part of the public consultation requirements foreseen by the national IEE approval process:

In terms of the transmission line corridor, disclosure of the project information, potential impacts and proposed management measures has occurred.

Public Consultation Meeting (PCM) and Public Disclosure (PD) for IEE are planned at two different stages (IEE investigation stage and draft IEE report stage) in order to collect opinions and feedback of the public and to disseminate information on the Project and IEE Study.

#### (1) IEE Investigation Stage

The first stage of the PCM and PD for IEE is conducted at the time of environmental scoping in the initial stage of the IEE study. Information on the Project and scope of the IEE study is disseminated to the public and then comments and opinions are collected to incorporate into the IEE study.

#### (2) Draft IEE Report Stage

The second stage of the PCM and PD for IEE is conducted at the time of preparations of draft IEE report. Information about findings of draft environmental and social impact assessment study and proposed mitigation measures are disseminated to the general public that are directly or indirectly affected by the Project. In addition, their feedback and opinions are obtained which are reflected in the IEE report together with their comments

and request on the environmental and social mitigation measures, environmental management plan (EMP) and environmental monitoring plan (EMoP).

## 7.4 Public Consultation Meeting at IEE investigation Stage

The project proponent prepared the invitation letter together with the notice of the meeting in Myanmar language and announced to the invitees, who are villagers along the transmission line route and relevant governmental organizations, non-governmental organizations (NGOs), community-based organizations (CBOs), and anyone who are interested.

Basically, information on the meeting was announced to the invitees one week in advance before the meeting by sending invitation letters to the respective invitees.

Especially for the villagers, the information on the meeting was announced based on the administrative procedure and local practice. Firstly, the invitation letter was sent to the township offices in order to ask them to provide instructions to each village-tract office under their jurisdiction. And then it was sent from the township offices to each village-tract office one week in advance. Afterwards, the information on the meeting under the village level was requested to be disseminated by 100 household head leaders of the respective villages in accordance with local practice. The 100 household head leaders were informed about the meeting in a convenient way and timing such as verbal announcement or displaying the notice somewhere. Moreover, the dissemination of the information on the meeting below the village level was followed up and reminded over phone.

The presentation and handouts were prepared and explained in Myanmar language. The opinions from the participants were received in the question and answer session. Additionally, feedback forms were provided to the participants so that those who are hesitant to speak out in public could share their views and comments. Special arrangement for the vulnerable group was given; assistant staffs were available to fill out the form in case the participant needs help in writing/reading. Furthermore, female assistants were also available for the female participants who need any help.

The followings are the public consultation meeting held in four Townships shown in Table 7.4-1.

**Table 7.4-1: Public Consultation Meetings**

Stakeholder Group	Date and Place	Consultation Activity
Stakeholders including Township General Administration Department, others related Department, Media, NGO, Parliament Member, UREC, MOEE and REM	14-6-2017 (10:00 am-12:00pm)	Consultation and discussion at Indaw Township's Hall
	14-6-2017 (2:00 pm-4:00pm)	Consultation and discussion at Katha Township's Hall
	22-7-2017 (10:00am-12:00pm)	Consultation and discussion at Shwegu Township's Hall
	27-6-2017 (10:00am-12:00pm)	Consultation and discussion at Bamaw Township's Hall

Focus Group Meetings (between the 14th and 27th June 2017) were held during the IEE investigation of the IEE procedure to introduce to the relevant stakeholders (heads of the villages and the residents) from the 42 villages. The proposed Project, its scope, informs the public about the anticipated impacts and the planned mitigation measures were disclosed and collected their feedback.

The locations of the public hearings are presented in Table 7.4-2.

**Table 7.4-2: Focus Group Meetings**

No.	Date	Name of Village	Participation	Arranged by
1	14-6-2017 to 27-6-2017	Kan Thar	Respondents and REM Co.	Head of Village
2	-	Mya Le	Respondents and REM Co.	Head of Village
3	-	Sin Kan	Respondents and REM Co.	Head of Village
4	-	Supote Kone	Respondents and REM Co.	Head of Village
5	-	Sar Wady	Respondents and REM Co.	Head of Village
6	-	Kaung Tone	Respondents and REM Co.	Head of Village
7	-	Thein Lin	Respondents and REM Co.	Head of Village
8	-	Kabar Ni	Respondents and REM Co.	Head of Village
9	-	Kan Kyi	Respondents and REM Co.	Head of Village
10	-	Nyaung Pin Thar	Respondents and REM Co.	Head of Village
11	-	Kone Ma Hat	Respondents and REM Co.	Head of Village
12	-	Han Te	Respondents and REM Co.	Head of Village
13	-	Phan Khar Kone	Respondents and REM Co.	Head of Village
14	-	Phoe Day War	Respondents and REM Co.	Head of Village
15	-	Si Maw	Respondents and REM Co.	Head of Village
16	-	Naung Latt Kyi	Respondents and REM Co.	Head of Village
17	-	Hein Kaung	Respondents and REM Co.	Head of Village
18	-	Nant Lann	Respondents and REM Co.	Head of Village
19	-	Tone Kauk	Respondents and REM Co.	Head of Village
20	-	Si Mu Lay	Respondents and REM Co.	Head of Village
21	-	Hnget Ta Tar	Respondents and REM Co.	Head of Village
22	-	Si Mu Kyie	Respondents and REM Co.	Head of Village
23	-	Man Wain	Respondents and REM Co.	Head of Village
24	-	Myaing Thar	Respondents and REM Co.	Head of Village
25	-	Pann Tin	Respondents and REM Co.	Head of Village
26	-	Taw Lon	Respondents and REM Co.	Head of Village
27	-	Kaing Yar	Respondents and REM Co.	Head of Village
28	-	Tone Paw	Respondents and REM Co.	Head of Village
29	-	Zin Bon	Respondents and REM Co.	Head of Village
30	-	Bo Kone	Respondents and REM Co.	Head of Village
31	-	Kyan Taw (Pyi Taw Thar)	Respondents and REM Co.	Head of Village
32	-	Pin Ma Lut	Respondents and REM Co.	Head of Village
33	-	Lan Kuu	Respondents and REM Co.	Head of Village
34	-	Nat Yay Twin	Respondents and REM Co.	Head of Village
35	-	Thein Inn	Respondents and REM Co.	Head of Village
36	-	Lann Khwa	Respondents and REM Co.	Head of Village
37	-	Kyaung Kone (Pa Lway Shwe)	Respondents and REM Co.	Head of Village
38	-	Poe Zar Kone	Respondents and REM Co.	Head of Village
39	-	Inn Dayant	Respondents and REM Co.	Head of Village
40	-	Nabar	Respondents and REM Co.	Head of Village
41	-	Kan Ni	Respondents and REM Co.	Head of Village
42	-	Nar Ra Khaung	Respondents and REM Co.	Head of Village

The meetings have been organized in order to present to the stakeholders the Project, the outcomes of the IEE and collect feedback.

The following topics and concerns have been discussed and collected during the meetings: The team leader explained about the objectives of the project, detailed information on the project, plan map of the project, construction system and potential impact. The team Leader



requested to question about the project and suggestions from attendees, Head of Village and villagers. The related department, media, parliament member, NGO, Heads of Villages and villagers gave their suggestions and requested to fulfill the various needs as mentioned below:

- Transmission line pass through the a lots of forest land so , need to negotiate with Forest Department, Ministry of Natural Resources and Environmental Conservation.
  - Compensation plan for damage crops and permanent land occupation for tower base
  - Concerns about the public health and safety risks induced from noise and vibration, atmospheric emissions, fugitive dust emissions and waste management
  - Potential employment opportunities for local people
  - Request to extend and guarantee the access to the electricity network and access of clinic and health care in local area
  - Concerns about the potential electric shock caused by high voltage
  - Concerns about safety distance between electric field and high of tower
  - Positive feedback for the project related to the electricity supply to the Sagaing Region and parts of the Kachin State
  - Request for compensation plan before the project and need to corporate with local affected farmer.
  - Request for explanation in detailed of compensation plan to affected farmer after ground survey has been done
  - Suggest to disclose the project information more widely and transparency
  - Suggest to contractors to inform local authority before entering into the project site for construction
  - Suggest following international best practice and safety plan and avoid the residential area, generally 22feet is safe from electric field.
  - MOEE will compensate for crops damage within the RoW by own budget
- In focus group discussion current facing of their livelihood problem and suggestion from village head and village elder persons;
- Lack of job opportunity and due to loss of their farm
  - Decrease their crop production by Climate change
  - Want to get government electricity
  - Want to get compensation if their farm will damage

The photo record of the meetings and focus group discussion are shown in Appendix-10. The questionnaire survey forms are attached in Appendix-11.

## **7.5 Public Consultation Meeting at the Draft IEE Stage**

PCM at the draft IEE stage was applied same arrangement for the implementation as the scoping stage. Four PCMs were organized on 17 to 21 October 2017 and 10 November 2017. The meetings date and place of meetings are shown in Table 7.5-1.

In the consultation meeting, after the explanation on 1) project outline planned in substations and transmission line 2) the results of baseline survey and 3) the results of impact assessment, 3) proposed mitigation measure and monitoring plan, were explained. At the end, a question and answer session was organized in all the meetings. As a whole, questions were raised from related department, parliament member, village leader and discussed with the project proponent and coordinating organization. Moreover, feedback forms were distributed to the participants in order to collect comments and opinions from them. A total of 7 comment forms were received. The major comments and opinions

written in the collected feedback forms and the responses were summarized in each session.

**Table 7.5-1 : Public Consultation Meetings**

Stakeholder Group	Date and Place	Consultation Activity
Stakeholders including Department, Media, NGO, Parliament Member, UREC, MOEE and REM	17-10-2017 (10:00 Township General Administration Department, others related am-12:00pm)	Consultation and discussion at Shwegu Township's Hall
	20-10-2017 (1:00 pm-3:00pm)	Consultation and discussion at Katha Township's Hall
	21-10-2017 (10:00am-12:00pm)	Consultation and discussion at Naba Village Administrative office's Hall
	10-11-2017 (10:00am-12:00pm)	Consultation and discussion at Bamaw Township's Hall

The public disclosure of the draft IEE at each area will be organized as a part of public consultation as well. The draft IEE will be disclosed as for review and comments, and the final IEE will be prepared. The proposed Project, its scope, informs the public about the anticipated impacts and the planned mitigation measures were disclosed and collected their feedback.

The locations of the public disclosed are presented in Table 7.4-2.

**Table 7.5-2 : Public Disclosure**

No.	Date	Name of Village	Participation	Arranged by
1	16-10-2017 to 31-10-2017	Kan Thar	Head of village and REM Co.	Township GAD
2	-	Mya Le	Head of village and REM Co	Township GAD
3	-	Sin Kan	Head of village and REM Co	Township GAD
4	-	Supote Kone	Head of village and REM Co	Township GAD
5	-	Sar Wady	Head of village and REM Co	Township GAD
6	-	Kaung Tone	Head of village and REM Co	Township GAD
7	-	Thein Lin	Head of village and REM Co	Township GAD
8	-	Kabar Ni	Head of village and REM Co	Township GAD
9	-	Kan Kyi	Head of village and REM Co	Township GAD
10	-	Nyaung Pin Thar	Head of village and REM Co	Township GAD
11	-	Kone Ma Hat	Head of village and REM Co	Township GAD
12	-	Han Te	Head of village and REM Co	Township GAD
13	-	Phan Khar Kone	Head of village and REM Co	Township GAD
14	-	Phoe Day War	Head of village and REM Co	Township GAD
15	-	Si Maw	Head of village and REM Co	Township GAD
16	-	Naung Latt Kyi	Head of village and REM Co	Township GAD
17	-	Hein Kaung	Head of village and REM Co	Township GAD
18	-	Nant Lann	Head of village and REM Co	Township GAD
19	-	Tone Kauk	Head of village and REM Co	Township GAD
20	-	Si Mu Lay	Head of village and REM Co	Township GAD
21	-	Hnget Ta Tar	Head of village and REM Co	Township GAD
22	-	Si Mu Kyie	Head of village and REM Co	Township GAD

No.	Date	Name of Village	Participation	Arranged by
23		Man Wain	Head of village and REM Co	Township GAD
24	-	Myaing Thar	Head of village and REM Co	Township GAD
25		Pann Tin	Head of village and REM Co	Township GAD
26	-	Taw Lon	Head of village and REM Co	Township GAD
27		Kaing Yar	Head of village and REM Co	Township GAD
28	-	Tone Paw	Head of village and REM Co	Township GAD
29		Zin Bon	Head of village and REM Co	Township GAD
30	-	Bo Kone	Head of village and REM Co	Township GAD
31		Kyan Taw (Pyi Taw Thar)	Head of village and REM Co	Township GAD
32	-	Pin Ma Lut	Head of village and REM Co	Township GAD
33		Lan Kuu	Head of village and REM Co	Township GAD
34	-	Nat Yay Twin	Head of village and REM Co	Township GAD
35		Thein Inn	Head of village and REM Co	Township GAD
36	-	Lann Khwa	Head of village and REM Co	Township GAD
37		Kyaung Kone (Pa Lway Shwe)	Head of village and REM Co	Township GAD
38	-	Poe Zar Kone	Head of village and REM Co	Township GAD
39		Inn Dayant	Head of village and REM Co	Township GAD
40	-	Nabar	Head of village and REM Co	Township GAD
41		Kan Ni	Head of village and REM Co	Township GAD
42	-	Nar Ra Khaung	Head of village and REM Co	Township GAD

The public disclosures have been organized in order to present to the stakeholders about the Project, the outcomes of the ESIA and collect feedback.

The following topics and concerns have been discussed and collected during the meetings:

The team leader explained about the objectives of the project, detailed information on the project, plan map of the project, construction system and potential impact. The team Leader requested to question about the project and suggestions from attendees, Head of Village and villagers. The related department, media, parliament member, NGO, Heads of Villages and villagers gave their suggestions, feedback and requested to fulfill the various needs as mentioned below:

- Transmission line pass through how many area of forest land number of plant, should be compensate the kinds of plant given price by Forest Department Ministry of Natural Resources an Environmental Conversation
- Want to know the project Schedule and should be negotiate with farm land owner before the project.
- If the project is constructed by company, will the project be owned by the government after construction finished? Is it possible to rent land area for tower instead of compensation according the way used by Ooredoo and Telenor communication towers?
- Should be obey local tradition and to do medical check-up to avoid infected diseases for the employee. The project needs to interrogate for employee.
  - Suggest that to negotiate with land owners and farmland owners for performing project activities.
  - Suggest that to hold public consultation to share knowledge about transmission line because there are some villages that have less knowledge about electricity.
  - Suggest that damage to agricultural land to be at least, to allow growing low high crops on land except pasture land, to share awareness of way of protecting lightning and thunder.

- Electric poles located in the village need to pile on the foundation with small stones to be resilient from natural disaster.
- Suggest to give a chance for job opportunities and to share electrical skill for local people.
- If there were happen electric pole and cable falling down by natural disaster, the project should have plan not to have negative impact on people, animals and housing structure.
- Suggest to obey cultural rules and to give compensation if there were have accidental damage.
- Suggest that to use qualified materials to prevent falling down towers, poles and consequently forest fires and damage to agricultural land.
- Suggest that to implement local development activities as Corporate Social Responsibility along the project locations.
- Suggest that to do meeting with local leaders and administrators before constructing transmission line.
- Suggest that cable line should be constructed away from residential houses as possible.
- Suggest that to store safely hazardous materials such as petrol and diesel.
- Project proponent and construction company need to meet with local people and farmers directly.
- Need to convey commitments stated in the report.
- Suggest that to follow rules and regulations set by Ministry of Natural Resource and Environmental Conservation.
- Suggest that to give compensation completely for local people grievance.
- Suggest that to do priority for electricity distribution to the villages that the transmission line passed through.
- Suggest that noisy activities should do in the day time and to avoid constriction activities in night time.
- Suggest to follow international best practice and safety plan and avoid the residential area, generally 22 feet is safe from electric field.

The photo record of the meetings and public disclosure are shown in Appendix-10.

## **7.6 Public Disclosure at the Draft IEE Stage**

For the implementation of Public Disclosure (PD) at the draft IEE stage, the additional arrangement was made to implement at the draft IEE stage taking into account the opinion received at the IEE investigation stage as follows;

- 1) Preparation and disclosure of the Executive Summary in Myanmar language in addition to the documents which are officially required (the main part in English, the summary in English and Myanmar language) in accordance with IEE procedure
- 2) Arrangement of PD before the day of holding PCM
- 3) Arrangement for changing PD period to 1 month from 2 weeks
- 4) Distribution of the reports to more places (added 4 disclosure places newly)

The details, such as exact disclosure period and comment submission method, are announced and posted in the respective disclosure places.

Firstly, the executive summary in Myanmar Language has sent before two weeks ahead of public consultation meeting to District Administration Office. After PCM the hard copy

executive summary was delivered to respective head of village and the villagers will read at the village administrative office and response their comments in the comment form.

The public disclosure of the executive summary of draft IEE report was arranged from 16 October 2017 to 31 October 2017. It was disclosed at 46 places as shown in Table 7.6-1.

**Table 7.6-1 : Summary of Public Disclosure for draft ESIA stage**

Disclosure Period	16 October 2017 to 31 October 2017
Disclosure Place	Bamaw, Shwegu, Katha and Inndaw Township General Administrative Offices 42 Villages
Comment submission method	Comments can be submitted with the comment form provided at the disclosure places or by e-mail either in Myanmar or English language.
Language Used	In local language: Myanmar and English language

### Summary of Comments from Public Disclosure at the Draft IEE Stage

Fifty one comments were received from the public. The comments and responses are summarized in table and attached scan copy of comments form.

**Table 7.6.2: Brief Summary of Public Comments and Responses**

Comments
<ul style="list-style-type: none"> <li>▪ Suggest that to negotiate with land owners and farmland owners for performing project activities.</li> <li>▪ Suggest that to hold public consultation to share knowledge about transmission line because there are some villages that have less knowledge about electricity.</li> <li>▪ Suggest that damage to agricultural land to be at least, to allow growing low high crops on land except pasture land, to share awareness of way of protecting lightning and thunder.</li> <li>▪ Suggest that to give safety awareness program for local people.</li> <li>▪ Electric poles located in the village need to pile on the foundation with small stones to be resilient from natural disaster.</li> <li>▪ Suggest to give a chance for job opportunities and to share electrical skill for local people.</li> <li>▪ If there were happen electric pole and cable falling down by natural disaster, the project should have plan not to have negative impact on people, animals and housing structure.</li> <li>▪ Suggest to obey cultural rules and to give compensation if there were have accidental damage.</li> <li>▪ Suggest that to use qualified materials to prevent falling down towers, poles and consequently forest fires and damage to agricultural land.</li> <li>▪ Suggest that to implement local development activities as Corporate Social Responsibility along the project locations.</li> <li>▪ Suggest that to do meeting with local leaders and administrators before constructing transmission line.</li> <li>▪ Suggest that cable line should be constructed away from residential houses as possible.</li> <li>▪ Suggest that to store safely hazardous materials such as petrol and diesel.</li> <li>▪ Project proponent and construction company need to meet with local people and farmers directly.</li> <li>▪ Need to convey commitments stated in the report.</li> <li>▪ Suggest that to follow rules and regulations set by Ministry of Natural Resource and</li> </ul>

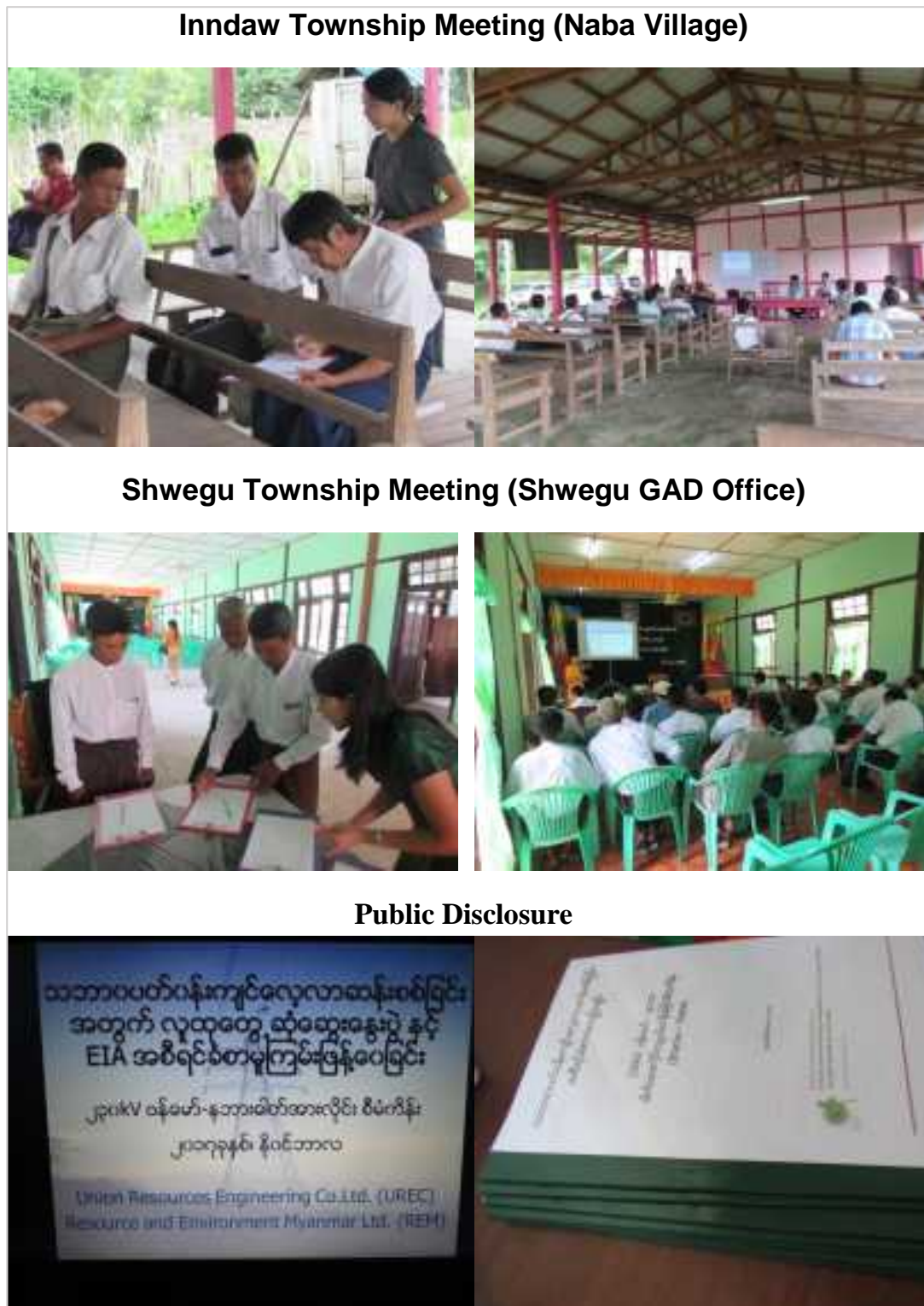


Comments
<p>Environmental Conservation.</p> <ul style="list-style-type: none"><li>▪ Suggest that to give compensation completely for local people grievance.</li><li>▪ Suggest that to do priority for electricity distribution to the villages that the transmission line passed through.</li><li>▪ Suggest that noisy activities should do in the day time and to avoid constriction activities in night time.</li><li>▪ Suggest to follow international best practice and safety plan and avoid the residential area, generally 22 feet is safe from electric field.</li></ul>

Photos of PCM and PD are shown in Figure 7.6-1 and Figure 7.6-2.



**Figure 7.6-1: Public Consultation Meeting in Bamaw and Katha township.**



**Figure 7.6-2: Public Consultation Meeting and Public Disclosure**



## **7.7 GRIEVANCE REDRESS MECHANISM**

The purpose of the grievance mechanism is to ensure that all requests and complaints from individuals, groups and local communities throughout the Project life, from planning and design through construction, operations and decommissioning, are dealt with systematically in a timely manner with appropriate corrective actions being implemented and the complainant being informed of the outcomes.

As aforementioned, UREC will establish several channels for grievance and information to enable the public to register any concern about the Project. Grievance mechanism will be in place throughout all Project stages and presented and discussed with the public during consultations. Channels to raise grievances will include:

- Postal, electronic mail, and local telephone line reaching the administrative office of;
- UREC's main office and local office that located townships nearby the transmission line;
- Written or orally to the transmission line construction site manager; and
- Written or orally during public events and meetings.

All complaints will be logged and processed and addressed within a fixed time, communicated to the complainant, as shown in Figure 7.1-1 by the processing grievances flowchart.

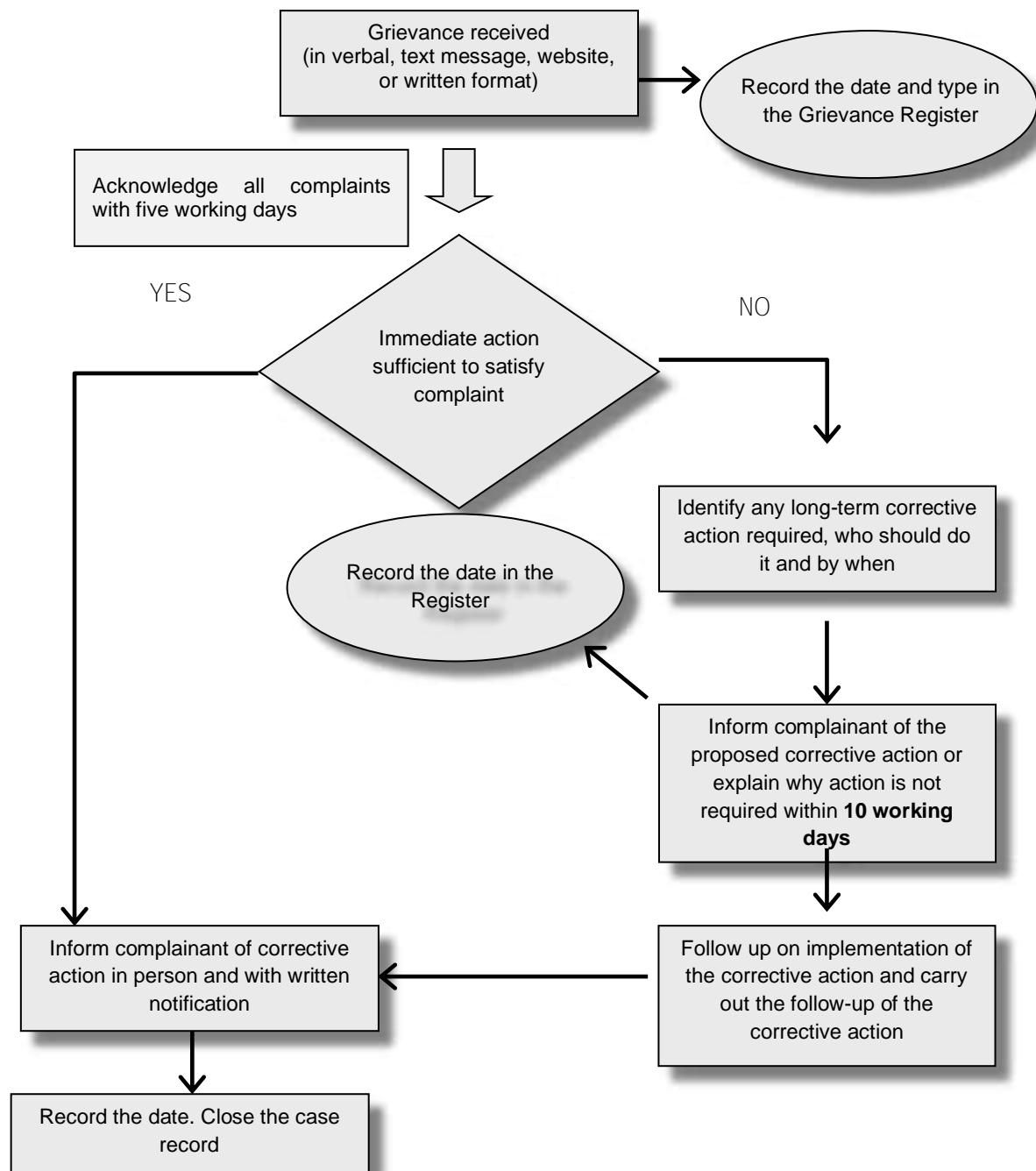


Figure 7.9-1: Flowchart for Processing Grievances

## 7.8 Grievance Redress System

Grievance Redress System is an effective instrument to tackle the various complaints receiving from the PAP and community in such a way that elevate the process of finding solution to reach the satisfaction and mutual agreement in a timely fashion and transparent manner.

The framework for grievance redress mechanism for the projects has been established to address the complaints and concerns that must be raised by PAP about project activities or performance during the construction and operation period .That shall act as a tool for execution within a set time period, purpose and detail out a systematic process against several documents.

The site specific procedure shall be developed for receiving complaints, logging in the GRS log book for recording and registering purpose, investigation, analysis and responding to the PAP.

#### **Grievance Focal Person (GFP)**

Grievance focal person shall be appointed from project Management Unit by MOEE to implement the GRS procedure effectively. The nominated person for role should have sound and broad experience within the social region and acting within such a role previous. He will receive the complaints in verbal or with letter from the PAP through site construction team or village head or PAP himself. The complaint shall be recorded and registered accordingly and deliver the message to Site Grievance Redress Team promptly.

#### **Site/Village Grievance Committee**

Site based grievance redress team shall be established and headed by village administrator, contractor representative and authorities concerns in local and village level. Site /Village Grievance Committee will review the any complaint and concerns and find a solution to cease the degree of complaints which will be agreed and accepted by the PAP. Site /Village Grievance Committee shall address the issue within (14) days. In this stage, many issues shall be resolved as possible locally.

If the case is not addressed to the satisfaction of PAP within the given time frame, Site /Village Grievance Committee shall proceed to submit the issue to Grievance Redress Committee for further review.

#### **Township Grievance Management Committee**

Township Grievance Management Committee is the highest authority to make final decision within project specific Grievance Redress System on the received issues which Site /Village Grievance Committee cannot sort it out alone. Township Grievance Management Committee headed by Township General Administrator with the members of relevant government bodies.

#### **Unsolved Issue**

If the case is still not resolved by Township Grievance Management Committee, PAP can proceed through juridical system such as appealing on court for final resolution starting from township level jurisdiction.

A Public Grievance Sample Form is presented in Appendix-12. The GRM will address all grievances raised by PAPs across the Project, including a grievances raised by stakeholders located along the transmission line corridor.

The GRM, in the first instance, seeks to resolve disagreements or stakeholder concerns before they evolve into grievances. This is done through ongoing engagement with stakeholders throughout the Project, particularly the PAPs.

The resulting informal negotiations and discussions will be conducted in a transparent manner and will be appropriately documented. This includes agreements that are reached, which will be voluntarily signed by all parties involved in the negotiation.

In cases where concerns or conflicts cannot be resolved through consultation and / or discussions, the GRM has established a hierarchy of grievance committees and procedures to receive and resolve grievances. These committees and procedures are summarized below.

**Table 7.8-1: Grievance Redress Committee Members**

Committee	Committee Members
Site/Village Grievance Committee	<ul style="list-style-type: none"> <li>- The village administrator (Chairperson)</li> <li>- Member of village administration office</li> <li>- Representative from the Project Team</li> <li>- Village elders and</li> <li>- Representatives from community organizations</li> </ul>
Township Grievance Management Committee	<ul style="list-style-type: none"> <li>-Township Administrator (Chairperson)</li> <li>- Township Land Record Department</li> <li>- Representative from Township Development Committee</li> <li>- Village Leaders</li> <li>- Representatives from the PAPs</li> <li>- Village elders and local community organization</li> <li>- Representative from the Project Team</li> </ul>

## 8 ENVIRONMENTAL MANAGEMENT PLAN AND MONITORING PLAN

### 8.1 Institutional Arrangement

#### 8.1.1 Project Institutional Arrangement

During the construction stage of the transmission line, a specific project's Environmental and Social Team will be established. It is obligated to entail the appointment of new teams and responsibilities as follows:

- Environmental Management Office (EMO) and
- Social Management Office (SMO)

Both offices would be established as the Environmental and Social Division (ESD) in Safety Department (See in Section 2.3), managed by the ESD Manager who is responsible for the environmental and social implementation of Environmental Management Plan (EMP) on the site during construction stage. The ESD Manager would be supported by a Deputy Quality and Safety Manager, Environment and Coordination. Figure 8.1-1 shows the Project institutional structure of Project Owner. The management responsibilities of the Environment and Social Team are shown in the Table 8.1-1.

**Table 8.1-1: Roles and Responsibilities for implementation of EMP**

Role	Responsibilities
Deputy Quality and Safety Manager (Environment, Coordination)	<ul style="list-style-type: none"> <li>• Guide the development of an Environment and Social Management and Monitoring Plan for the Construction Phase (ESMMP-CP) based on the impacts and mitigation measures defined in the IEE.</li> <li>• Implement the ESMMP-CP.</li> <li>• Confine the construction site to the demarcated area</li> <li>• Provide adequate resources and capabilities to implement and maintain the ESMMP-CP</li> <li>• Verify that sufficient funds are available to properly implement the ESMMP-CP</li> <li>• Submit periodic monitoring reports to MOEE and ECD</li> </ul>
ESD Manager and Environmental and Social Management Officers	<ul style="list-style-type: none"> <li>• Develop the Project ESMMP-CP based on the impacts and mitigation measures defined in the IEE report</li> <li>• Have a working knowledge of the environmental impacts, mitigation measures and recommendations of the ESMMP-CP</li> <li>• Review and improve method statements for environmental aspects prior to work starting</li> <li>• Verify that tender documents and civil works contracts include the Project ESMMP-CP and specify requirement for preparation and implementation of construction ESMMP-CP</li> <li>• Identify environmental and health and safety competence requirements for all staff, including contractor personnel, working on the Project and facilitate delivery of environmental training</li> <li>• Monitor construction performance to verify that appropriate control measures are implemented to comply with ESMMP-CP</li> <li>• Recommend corrective action for any environmental non-compliance incidents on the construction site, and provide advice and liaison with</li> </ul>

	<p>the construction teams to ensure that environmental risks are identified and appropriate controls are developed;</p> <ul style="list-style-type: none"> <li>• Compile a regular report addressing environmental performance progress and any non-compliance issues to relevant parties, including submitting semi-annual monitoring reports to ECD through the MOEE;</li> <li>• Inform affected parties of any changes to the construction program. The contact numbers of the Environmental Officer shall be made available to the affected parties. This will ensure open channels of communication and prompt response to queries and claims;</li> <li>• Establish an environmental grievance redress mechanism that is acceptable to ECD, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance; and</li> <li>• Liaise and cooperate with Local authorities responsible in arranging for adequate meeting and reporting to Local authorities on a regular basis.</li> </ul>
Construction Contractor	<ul style="list-style-type: none"> <li>• Recruit a qualified Environmental Officer on a full-time basis to manage compliance with contractual environmental obligations and implementation of the ESMMP-CP;</li> <li>• Develop and implement the Construction Contractor's Environmental Management Plan (Construction Contractor's EMP) to comply with Project commitments (i.e. Owner's EMP and ESMMP-CP);</li> <li>• Plan and direct construction activities to minimize environmental impacts and comply with environmental management procedures, license and approval requirements;</li> <li>• Verify the implementation of all applicable mitigation measures defined in the ESMMP-CP during construction of road, bridges and culverts, and associated facilities;</li> <li>• Liaise with EMO to facilitate implementation of environmental mitigation measures;</li> <li>• Provide adequate resources to implement the Construction Contractor's ERM and ESMMP-CP;</li> <li>• Implement routine inspection and monitoring program, including undertaking the contractor's weekly environmental monitoring;</li> <li>• Implement a process of corrective and preventive action for noncompliance identified through internal and external inspections and audits;</li> <li>• Implement additional environmental mitigation measures where monitoring or other observations indicate opportunities for improved environmental management;</li> <li>• Submit monthly reports to ESD/EMO on the implementation of environmental mitigation measures and environmental monitoring results;</li> <li>• Maintain an environmental register which keeps a record of all incidents which occur on the site during construction and report environmental incidents to Owner;</li> <li>• Manage safety of construction workers and local people during construction;</li> <li>• Receive and manage complaints from the public in accordance with the Grievance Redress Mechanism;</li> </ul>
All project personnel	<ul style="list-style-type: none"> <li>• Protecting the environment by implementing relevant aspects of the EMP and ESMMP-CP</li> </ul>

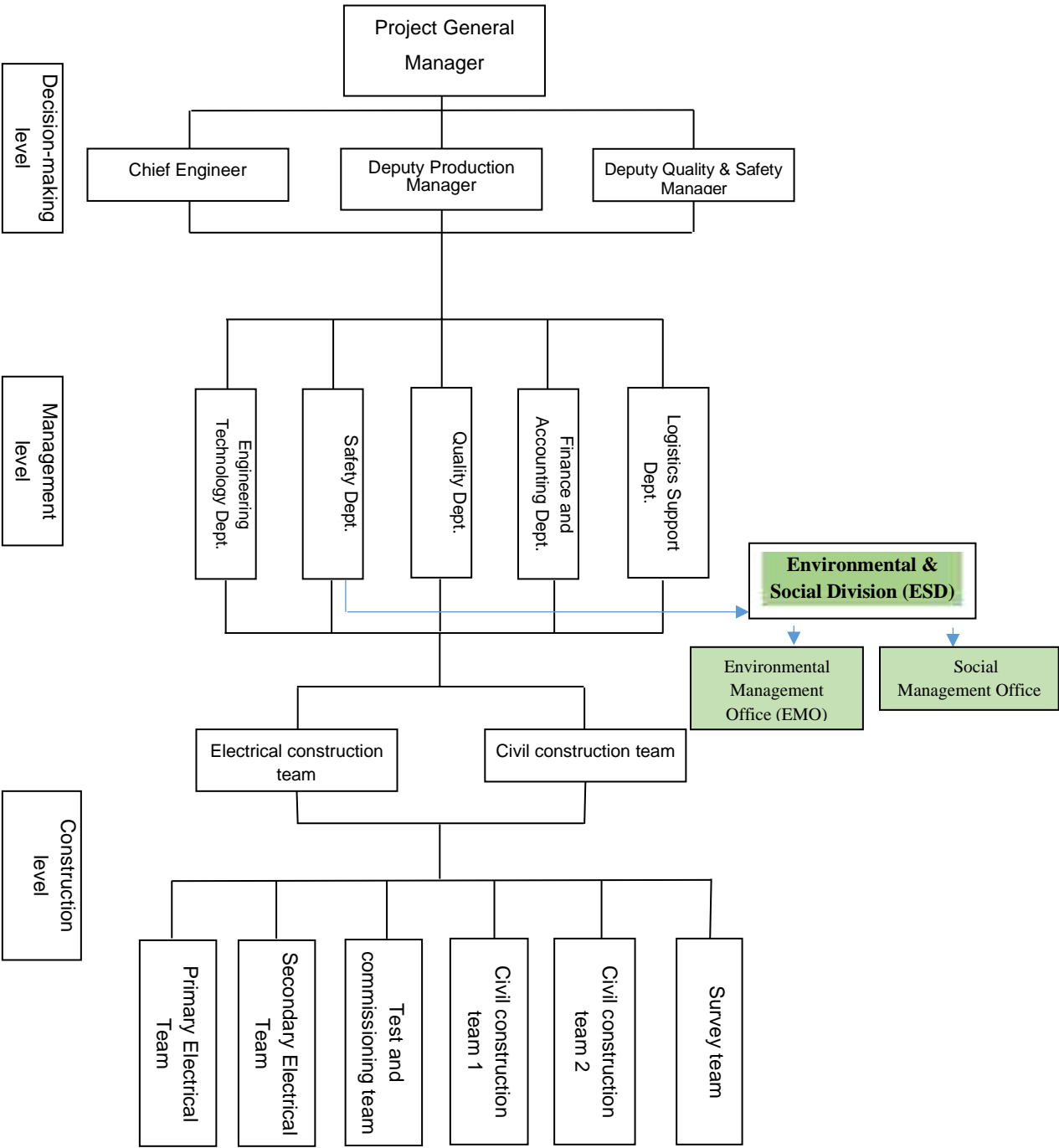


Figure 8.1-1: Project Institutional Structure (Project Owner)

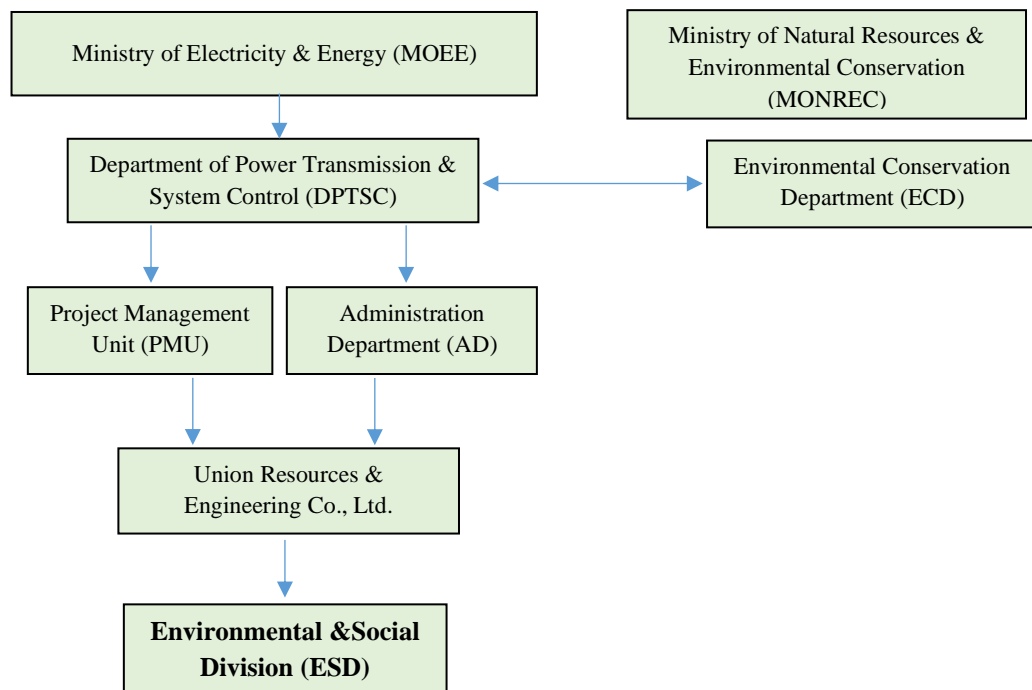


### 8.1.2 Institutional Arrangement (Government of Myanmar)

The Department of Power Transmission and System Control (DPTSC), under Ministry of Electricity and Energy and Environmental conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation (MONREC) are the major responsibility for coordination of EMP and the primary supervisory and monitoring body. A Project Management Unit (PMU) will be established under DPTSC in MOEE to oversee monitoring of the Project.

A Project Management Unit (PMU) and Administration Department (AD) will coordinate the work of the government in resettling the most severely affected people in the Project area, together with the technical assistance, financial support, and related work of the Project developers through the Project's Environment and Social Division.

Figure 8.1-2 shows the relationship between the Project institutional structure and the relevant departments of the concerned ministries.



**Figure 8.1-2: The relationship between the Project institutional structure and the relevant departments of the concerned ministries.**

The roles and responsibilities of institutions concerned for the Project's environmental management in a construction and operation phases are summarized in Table 8.1-2.

**Table 8.1-2: Role and Responsibility for Institutions Concerned**

Institution	Roles and Responsibilities
<b>Pre-Construction/Construction Phase</b>	
Department of Power Transmission & System Control (DPTSC) in MOEE	<ul style="list-style-type: none"> <li>- Supervise tasks implemented by the Project Management Unit (PMU)</li> <li>- Assign a staff dealing with environmental and social issues in Project Management Unit (PMU)</li> </ul>
Project Management Unit, DPTSC (PMU)	<ul style="list-style-type: none"> <li>- Support the environmental staff assigned by the MOEE as appropriate</li> </ul>
Administration	<ul style="list-style-type: none"> <li>- Finalize compensation price with affected people and disburse compensation/assistance to project affected peoples</li> </ul>

Department in MOEE	
Compensation Committee (SLRD, Police officer, Agriculture and Irrigation Department and General Administrated Department at the relevant township and project owner: MOEE)	- Set compensation standards / assistances
Environmental and Social Staff in PMU (Assigned from DPTSC to work for PMU) ECD	<ul style="list-style-type: none"> <li>- Develop the Construction Environmental Management Plan (CEMP) for project contractors.</li> <li>- Supervise the mitigation measured implemented by the construction contractor addressed in the Environmental and Social Management Plan (EMP)</li> <li>- Open windows for project affected peoples</li> </ul>
<b>Operation Phase</b>	
Department of Power Transmission & System Control (DPTSC) in MOEE ECD	<ul style="list-style-type: none"> <li>- Implement operation and maintenance of transmission and substation including environmental management</li> <li>- Review and update EMP in every six months. Review EMMP report and Environmental Audit will be conducted in every year.</li> </ul>

## 8.2 Environmental Measures

Environmental management for the Project aims to minimize the negative impacts of the transmission line construction and at the same time, enhance the positive and beneficial impacts. Table 8.2-1 presents the mitigation measures of transmission line construction. These mitigation measures are an overview only, based on the potential impacts identified in this IEE.

Prior to construction, an Environment and Social Management and Monitoring Plan for the Construction Phase (ESMMP-CP) will be prepared which provides further detail on the implementation of the environmental management. The ESMMP-CP will include a series of sub-plans specific to environmental themes identified in this IEE. The construction contractor will develop a suite of Site- Specific ESMMPs which address specific segments of the RoW, based on site conditions (e.g. proximity to villages, waterways and natural habitats).

**Table 8.2-1: Environmental Management Measures**

Environmental Aspect	Impact	Mitigation Measures	Location	Time Frame	Responsibility to implement	Responsibility to audit
<b>Construction Phase</b>						
Soil	<ul style="list-style-type: none"> <li>- Potential impacts will be due to change to soil structure and soil quality as a result of excavation or compaction.</li> <li>- Compaction of soil during backfilling might lead to temporary effects on natural infiltration of rainwater.</li> <li>- Removal of vegetation and trees during construction of foundation, especially on the slopes would render soil vulnerable to erosion.</li> <li>- Loose soils and construction material if placed in adjoining fields will lead to damage of existing crop and contamination of soil.</li> <li>- The excavated if kept uncovered and unprotected will be rendered vulnerable to loss from erosion.</li> </ul>	<ul style="list-style-type: none"> <li>- To minimize impact on vegetation and soil include means to protect excavated soil material from erosion and contamination by placing them away from streams of water along the slope or in direct line of local drainage.</li> <li>- Loose soil should be kept covered till the time of backfill and the excess soil should be removed after casting activities are complete.</li> <li>- The construction activities shall be planned in non-monsoon months which will minimize any rainwater run-off or any loss due to infiltration.</li> <li>- Construction materials will be stored within the footprint of the site to avoid any kind of damage or contamination of soil/crop of adjoining fields.</li> <li>- Movement of material and manpower shall be restricted to existing roads/tracks or as agreed upon with the stakeholders to avoid creation of new roads/tracks.</li> </ul>	All construction areas	Throughout construction	Construction Contractor	<ul style="list-style-type: none"> <li>- Environment Manager and Environmental Officers</li> <li>- Deputy Quality and Safety Manager (Environment, Coordination)</li> </ul>
Waste disposal	<ul style="list-style-type: none"> <li>- There is potential for spread of construction debris to areas outside</li> </ul>	<ul style="list-style-type: none"> <li>- Any construction debris generated at the site will be removed from the</li> </ul>	All construction areas including worker's	Throughout construction	Construction Contractor	<ul style="list-style-type: none"> <li>- Environment Manager and</li> </ul>

	<p>that marked for construction.</p> <ul style="list-style-type: none"> <li>- The debris generated from construction activities can be carried along with small springs, rivulets and rivers flowing in proximity of the tower.</li> <li>- Construction debris can also contaminate wells, canals etc. in proximity of the activity.</li> </ul>	<p>site immediately after the completion of construction activities and the site will be leveled as original.</p> <ul style="list-style-type: none"> <li>- Workers will be strictly instructed about random disposal of any waste generated from the construction activity.</li> <li>- Arrangements will be made to collect and prevent littering by workers on site.</li> <li>- Excavated spoils shall be reused for vegetation purpose as much as possible</li> <li>- Reinstatement works shall be considered for borrowing pit</li> <li>- Land shall be cleared only needed basis</li> <li>- Designated soil disposal area shall be provided</li> <li>- All wastes are to be collected , handled and transported as per construction waste management procedure</li> <li>- Enough dust bins are to be located in the places where waste generated.</li> <li>- All waste including human waste shall be disposed of properly and environmental friendly manner at local municipal waste disposal area</li> <li>- Burning the solid waste shall be not being permitted.</li> <li>- Waste management practices should be based on the hierarchy of reduces, reuse and recycle principle</li> </ul>	camps			<p>Environmental Officers</p> <ul style="list-style-type: none"> <li>- Deputy Quality and Safety Manager (Environment, Coordination)</li> </ul>
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Aesthetics and Visual Impact	<ul style="list-style-type: none"> <li>- The visual impacts and change of landscape due to construction activity will be for a short period of 15-30 days.</li> <li>- Route of towers and transmission line are expected to cross highways/roads, and other transmission line which may lead to change of landscape resource and character due to introduction of manmade features leading to visual intrusion and loss of visual amenity.</li> <li>- The cumulative impact due to already existing towers can hamper the aesthetic value of the area.</li> </ul>	<ul style="list-style-type: none"> <li>- The route is planned after a series of survey to avoid habitation and forest areas.</li> <li>- The clearing of trees will be kept to minimum and wherever possible, trimming of trees will be adopted <i>vis-à-vis</i> felling of trees.</li> <li>- The lattice structure of towers provide sufficient see through effect which diminish the visual impact on the aesthetics of the area.</li> <li>- The area being hilly terrain with undulations restrict the view of many towers in a single view, moreover the height of tower do not appear to be significant with reference the terrain.</li> </ul>	All construction areas	Throughout construction	Construction Contractor	<ul style="list-style-type: none"> <li>- Environment Manager and Environmental Officers</li> <li>- Deputy Quality and Safety Manager (Environment, Coordination)</li> </ul>
Water quality	<ul style="list-style-type: none"> <li>- Erosion and sediment run off from construction activities that expose or move soil (including clearing of vegetation and earthworks)</li> <li>- Release of sediment laden effluent during construction, for example soil waste from drilling activities</li> <li>- Erosion and sediment released from stream bed and river bank disturbance at river course crossings</li> </ul>	<ul style="list-style-type: none"> <li>- Optimal use of water will be planned and followed at construction site.</li> <li>- Construction activities in proximity of water bodies will ensure prevention of runoffs.</li> <li>- At the river crossing the horizontal clearance (the distance between the towers) will be greater than the maximum river width at high flood levels and the vertical clearances will be according to the statutory requirements.</li> <li>- The rivers crossings along the route are small and will not affect any change to the span of towers.</li> </ul>	All construction areas	Throughout construction	Construction Contractor	<ul style="list-style-type: none"> <li>- Environment Manager and Environmental Officers</li> <li>- Deputy Quality and Safety Manager (Environment, Coordination)</li> </ul>

		<ul style="list-style-type: none"> <li>- Any groundwater encountered during excavation will be pumped out and the source will be prevented from any kind of runoff from the adjoining areas.</li> <li>- Clearing and earthworks will be undertaken in the dry season wherever possible to minimize erosion and subsequent release of sediment.</li> <li>- The period of soil exposure will be minimized by phasing clearing and construction activities and covering exposed area by sand bags or canvas sheet. Exposed areas of river banks will be covered immediately and preferably by replanted with locally native tree species like woody vegetation.</li> <li>- If vegetation clearing is required on river banks, vegetation will be cut near or at ground level to leave root mass in the ground. This helps to reinforce soil stability and reduce erosion.</li> <li>- Stockpile materials will be located at least 30 meter away from steep slopes, water courses or drainage paths</li> <li>- Water quality will be monitored regularly.</li> </ul>				
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Water Quality (Hazardous Materials)	<ul style="list-style-type: none"> <li>- Hazardous materials that may be used in the construction work: <ul style="list-style-type: none"> <li>• Paints and solvents</li> <li>• Petroleum products such as oils, fuels and grease</li> <li>• Concrete curing and repair compounds and</li> <li>• Contaminated waste material.</li> </ul> </li> <li>- There is potential for hazardous materials to be released to the environment, particularly during storage and handling and equipment/vehicle maintenance.</li> </ul>	<ul style="list-style-type: none"> <li>- All fuel and hazardous material storage will be adequately banded to prevent any spillage problem</li> <li>- Only minimal chemicals, hazardous substances and fuel will be stored on site works</li> <li>- Discharge of oil contaminated water into the environment is prohibited.</li> </ul>	All construction areas	Throughout construction	Construction Contractor	<ul style="list-style-type: none"> <li>- Environment Manager and Environmental Officers</li> <li>- Deputy Quality and Safety Manager (Environment, Coordination)</li> </ul>
Hydrology	<p>Impacts to hydrology may include the following:</p> <ul style="list-style-type: none"> <li>- Clearing of vegetation may speed the movement of surface run off</li> <li>- Earthworks required for tower footprints, access roads, stockpiles areas and other infrastructure may alter the flow of surface run off and</li> <li>- Construction of access roads may involve in-stream works which may alter water flows.</li> <li>- Temporary diversion of rivers for in-stream works (potentially required for access road construction) impacting hydrology, aquatic biota, and potentially access of villagers to water resources.</li> </ul>	<ul style="list-style-type: none"> <li>- Wherever possible, construction will occur during the dry season</li> <li>- Earthworks will be undertaken to minimize changes to surface water flows and to avoid collecting standing water.</li> <li>- If river diversion is expected to alter flows to an extent that would lower the downstream water level, local people will be informed of changes to water levels, including expected extent and duration of change.</li> </ul>	<ul style="list-style-type: none"> <li>- Construction site - Watercourses</li> <li>- All earthwork sites</li> </ul>	<ul style="list-style-type: none"> <li>- Prior to river diversion</li> <li>- Prior to and During earthworks</li> </ul>	Construction Contractor	<ul style="list-style-type: none"> <li>- Environment Manager and Environmental Officers</li> <li>- Deputy Quality and Safety Manager (Environment, Coordination)</li> </ul>
Biodiversity (Flora)	- Loss of natural and modified	- Follow the law and rules against	All construction areas	Before	Civil engineers,	Deputy Quality



and Fauna)	habitat due to vegetation clearing	<p>logging outside the approve construction areas and against wildlife hunting and poaching will be imposed on project staff, workers and all contractors and personnel engaged in or associated with the Project, with penalties levied for anyone caught carrying and using animal snares and traps, including fines and dismissal and prosecution under the Forest Law, 1992 and Protection of Wild Life and Wild Plants and Conservation of Natural Areas Law 1994.</p> <p>- The project owner shall be directly responsible for dissemination to its staff and workers of all rules, regulations and information concerning these restrictions as well as the punishment that can expected if any staff or workers or other person associated with the Project violate rules and regulations.</p> <p>- The planned clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing;</p> <p>- Disturbed areas shall be rehabilitated as soon as possible following construction activities.</p> <p>- Construction contractor will establish biological resource management program and</p>		construction	Deputy Quality and Safety Manager (Environment, Coordination)	and Safety Manager (Environment, Coordination)
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		management plan to manage the construction activities to be conducted and monitor compliance with relevant permits and environmental regulations in order to prevent potential impacts to terrestrial ecology, in particular, vegetation and wildlife.				
Terrestrial biodiversity	- Degradation of habitat	<ul style="list-style-type: none"> <li>- The measures outlined in this document relating to hydrology, water quality, air quality and noise and vibration, will be implemented.</li> <li>- Construction and domestic waste will be appropriately stored and disposed of to avoid attracting native and alien species to the construction areas;</li> <li>- Oil, chemical and solid waste will be stored, and handled and disposed according to local municipal law.</li> </ul>	All construction areas	Throughout construction period	Construction Contractor, Environment Manager and Environmental Officers	Environment Manager and Environmental Officers
Terrestrial biodiversity	- Faunal mortality	<ul style="list-style-type: none"> <li>- Speed limit to maximum of 40 km/hr for construction vehicles will be enforced to minimize potential for fauna strike.</li> <li>- Commitment will be made to raise awareness of values of natural habitat areas to personnel and arrangements will be made for restriction of poaching and forest product collection;</li> <li>- Hunting wild animals will be strictly prohibited to apply for all staff;</li> </ul>	<ul style="list-style-type: none"> <li>- Rules apply to all personnel in any location while working for the Project.</li> </ul>	Throughout construction period	Construction Contractor, Environment Manager and Environmental Officers	Deputy Quality and Safety Manager (Environment, Coordination)
Terrestrial	- Disturbance to fauna behaviour	- Construction vehicles and	All construction areas	Throughout	Construction	Environment

biodiversity		<p>machinery will be maintained in accordance with industry standard to minimize unnecessary noise generation.</p> <ul style="list-style-type: none"> <li>- Traffic signs will be installed on all roads throughout construction areas depicting speed limits.</li> <li>- Commitment will be made to raise awareness of values of natural habitat areas to construction work force and make arrangements for restriction of poaching.</li> </ul>		construction period	Contractor, Environment Manager and Environmental Officers	Manager and Environmental Officers
Terrestrial biodiversity	Impacts to threatened species	<ul style="list-style-type: none"> <li>- General biodiversity measures contribute to the conservation of threatened species. In addition:</li> <li>- If threatened flora species are identified within the Project Area (RoW), these will be specifically managed within the Biodiversity Action Plan and replanting or propagation may be appropriate.</li> <li>- The training and awareness program will highlight the threatened species with potential to occur in the Project Area (RoW) to further discourage hunting.</li> </ul>	All construction areas	Throughout construction period	Construction Contractor, Environment Manager and Environmental Officers	Environment Manager and Environmental Officers
Aquatic Biodiversity	<p>Degradation of habitat</p> <p>Mortality</p>	<ul style="list-style-type: none"> <li>- Water quality and hydrology measures will be implemented.</li> <li>- Fishing and using of illegal fishing gear anywhere along the river will be prohibited.</li> </ul>	All construction areas and specific measures for Ayeyarwady River Crossing area Rules apply to all personnel in any location while working for the Project.	Throughout construction period	Environment Manager and Environmental Officers	Deputy Quality and Safety Manager (Environment, Coordination)

Atmospheric emission/dust	Dust emissions from exposed soils, transport of materials and increased traffic.	<ul style="list-style-type: none"> <li>- Sprinkling of water on dust generating areas;</li> <li>- Restricting the speed limits of vehicles during movement on unpaved roads; and</li> <li>- Covering of vehicles carrying loose soil/construction material.</li> <li>- Applying preventive maintenance system</li> <li>- Checking vehicle and equipment inspection daily</li> <li>- Stopping dust generating activities in high wind</li> <li>- Applying good site practice and house keeping</li> <li>- Turning off the engine while not in use</li> <li>- Optimizing construction schedule to minimize time that vehicles are in operation</li> <li>- Covering load-carrying platform properly when carrying earth/sand</li> </ul>	All construction areas	Throughout construction period	Environment Manager and Environmental Officers	Deputy Quality and Safety Manager (Environment, Coordination)
Noise and Vibration	Increased noise and vibration levels may disturb local residents and fauna, and can present a risk to personnel.	<ul style="list-style-type: none"> <li>- All noise and vibration generating construction equipment shall be operated with appropriate sound dampening equipment.</li> <li>- Construction equipment and vehicles will be subjected to regular inspections to check noise emissions and noise control equipment.</li> <li>- Stationary noise sources will be positioned to avoid impacts to sensitive receptors.</li> <li>- Hearing protection will be made</li> </ul>	All construction areas	Throughout construction period	Environment Manager and Environmental Officers	Deputy Quality and Safety Manager (Environment, Coordination)

		<p>available for all construction personnel and required for personnel working in areas with noise above 80dB.</p> <ul style="list-style-type: none"> <li>- High noise activities, such as blasting, will be carried out only within the hours of 6am to 7pm, and residents should be informed of these activities.</li> <li>- The contractor will maintain communication with any schools within 3 km of the Project area, and will avoid high noise activities during school hours.</li> </ul>				
Land Use	Removal of productive land (temporary and permanent)	<ul style="list-style-type: none"> <li>- Livestock in affected areas will be relocated, where necessary; Land acquisition and compensation for crops issues will be settled out before construction and will be reviewed by the MOEE.</li> <li>- Ensure that negotiations for compensation are free and fair.</li> <li>- Also ensure that the compensation rates are at par with the market rates.</li> <li>- It also needs to be ensured that the opportunity cost of such land is considered when deciding the compensation amount.</li> </ul>	Agricultural land and private land	Prior to construction	Environment Manager and Environmental Officers	Deputy Quality and Safety Manager (Environment, Coordination)
Economy and Livelihoods	Construction of the transmission line and associated infrastructure will provide employment opportunities to local people	<ul style="list-style-type: none"> <li>- UREC will carefully manage labor conditions</li> <li>- The construction contractor will hire local people during construction where local people have the required</li> </ul>	All construction areas	Prior to and during construction	Construction contractor	Environment Manager and Environmental Officers

		<p>skills and experience.</p> <ul style="list-style-type: none"> <li>- It is acknowledged, however, that much of the labour, especially skilled labour, will come from outside the project area and</li> <li>- Training in health and safety and technical areas will be provided to all personnel.</li> </ul>				
Damages to community and private/individual property during construction activities.	- Potential disturbance of/damage to property and community facilities.	<ul style="list-style-type: none"> <li>- Ensure that the construction activities are to be so planned that any use of community and individual property is either avoided or prior permission sought before use.</li> <li>- Any unforeseen use and/or damage to property or structures etc. needs to be immediately compensated.</li> </ul>	All construction areas	As required	Construction contractor	Environment Manager and Environmental Officers
Community Health and Safety (Disease)	Possible increase in disease transmission.	<ul style="list-style-type: none"> <li>- A public health education campaign will be provided, addressing: hygiene, disease prevention (including transmission pathways and symptoms of relevant diseases) and basic health promotion. The program will be designed and implemented in consultation with district and local health authorities.</li> <li>- Commit to meet Electricity Law and other Myanmar regulation requirements as well as international conventions on labour, especially on issues of child and forced labour, working conditions, collective</li> </ul>	Villages and households	Prior to and during construction phase	Deputy Quality and Safety Manager (Environment, Coordination)	Deputy Quality and Safety Manager (Environment, Coordination)

		bargaining, non-discrimination and equal opportunity, complaint and grievance mechanism as well as occupation health and safety.				
Occupational Health and Safety (Accident and Injury)	<p>Potential for accident and injury during construction.</p> <ul style="list-style-type: none"> <li>- Accident and injury while working</li> <li>- Spread of transmissible diseases between worker and</li> <li>- Contraction of disease due to poor sanitation and environmental conditions in work and accommodation areas.</li> </ul>	<ul style="list-style-type: none"> <li>- Health Awareness Training will be mandatory for all personnel and will address both on-the-job safety and health awareness</li> <li>- Clean drinking water will be provided to all camps and work areas</li> <li>- Adequate sewage treatment will be provided</li> <li>- First aid kits will be readily accessible by workers and first aid teams will be specifically trained and assigned in groups of two to three persons to the different sites and</li> <li>- Vector control of mosquitoes and other pests will be managed including by minimizing mosquito breeding habitat and providing mosquito nets and other barriers.</li> </ul>	All construction areas	Throughout the construction period	Construction contractor	Environment Manager and Environmental Officers
Archeological, Historic and Cultural Effects	Temporary migration of workers may influence local cultural and create social tension.	<ul style="list-style-type: none"> <li>- The contractor will consult with local authorities to learn of any traditional practices and rules that need to be followed and to coordinate in the enforcement of laws and regulations</li> <li>- A code of conduct will be established and enforced to reduce the potential for conflict between</li> </ul>	Applicable to all personnel while at worker camp and in villages	Throughout construction period	Construction contractor	Environment Manager and Environmental Officers



		<p>local residents and migrant workers.</p> <ul style="list-style-type: none"> <li>- Any entertainment venues or recreational facilities in the vicinity of the Project shall be operated strictly according to the local village values and traditions and</li> <li>- Local employment will be prioritized.</li> </ul>				
Traffic and transport	<p>Hazards associated with the traffic movement in working areas during construction phase leading to property/equipment damage and injury to workers or nearby villagers.</p>	<ul style="list-style-type: none"> <li>- Avoid using community /village roads for project activities. Alternative roads should be constructed and used. All access roads have to be fully restored after use.</li> <li>- Transportation schedules will be arranged to avoid peak hours of road usage.</li> <li>- Traffic signs will be installed for all roads throughout construction areas.</li> </ul> <p>Relevant traffic regulations will be implemented throughout construction areas.</p> <ul style="list-style-type: none"> <li>- In cases where heavy loads are required to be transported, some segments of roads and bridges may be reinforced to withstand the load.</li> <li>- In the event that stringing conductors present a possible risk to traffic temporary barriers (such as bamboo scaffolds) will be constructed across the roads and rivers to protect the public and</li> </ul>	All project roads and public roads	Throughout construction	Construction contractor	Environment Manager and Environmental Officers

Potential Hazards	<ul style="list-style-type: none"> <li>- Physical injury can result from workers slipping along the slopes; road accidents, accident to workers during erecting of towers and other occupational hazards.</li> <li>- Stringing activity around low tension/ high tension wires and other electrical units can be a potential hazard if proper planning is not followed. Workers at times are not accustomed to use of Personal Protection Equipment, their attitude to avoid PPE may result in accident/hazard.</li> <li>- Pits dug along roads /tracks close to habitations can lead to potential accidents for people and domestic animals in the proximity.</li> </ul>	<p>property.</p> <ul style="list-style-type: none"> <li>- The staff of contractors involved in the construction activities will be trained about the mandatory precaution and safety practices prior to commencement of construction activity.</li> <li>- All required Personal Protection Equipment will be used by the workers at site and their use will be supervised. Safety harness will be ensured for workers while erection of tower.</li> <li>- Vehicle movements to follow the traffic norms and maintain a safe speed while moving through the hilly tracts.</li> <li>- Stringing activities near low tension wires/high tension wires and other electrical utilities will be done after proper shutdown of the line/utilities with prior information and permission.</li> <li>- All excavation activities will be conducted in supervision of the site contractor with prior information to the nearby inhabitants. Proper signage will be provided in places where excavated pits are close to road or hilly tracts.</li> <li>- The design of the towers will adhere to the Proper Standards (i.e. IFC standard and Indian Standard),</li> </ul>	All construction areas	Throughout construction	Construction contractor	Environment Manager and Environmental Officers
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		which will ensure sufficient safety margins to reduce the risk from wind and seismic activities. Extreme weather conditions could affect the transmission line though the very high wind speed is rare. Hence the risk of natural impacts is low.				
<b>Operation Phase</b>						
Water Quality	The presence of hardstand areas (i.e. tower pads) has the potential to impact water quality through the operational phase by reducing infiltration, thereby increasing overland flows carrying pollutants to watercourses.	Drainage of hardstand areas will be designed and constructed to retain surface runoff and facilitate infiltration to a level similar to pre-construction flows.	Transmission line RoW	Throughout maintenance period	Maintenance contractor	Environment Manager and Environmental Officers
Biodiversity	<ul style="list-style-type: none"> <li>- The RoW may interrupt the continuity of forest habitat (mostly degraded deciduous forest), as vegetation heights will be limited to below 3 meter, however the maintenance of vegetation in the understorey and midstorey is likely to continue to allow arboreal species to move through the landscape.</li> <li>- Disturbance and displacement of resident fauna due to noise as a result of electricity transmission and noise and light as a result of maintenance activities</li> <li>- During operation, mortality of avifauna (birds and bats) may occur due to collision with the</li> </ul>	<ul style="list-style-type: none"> <li>- Within the RoW, vegetation trimming will be restricted to that required to safely operate the transmission line.</li> <li>- Groundcover and midstorey vegetation will be retained wherever practicable.</li> </ul> <p>The Project shall implement landscaping and re-vegetation after completion of construction in suitable areas and</p> <ul style="list-style-type: none"> <li>- Vegetation management will be made to raise awareness of values of natural habitat areas to personnel work force and arrangements will be made for restriction of poaching and forest product collection.</li> </ul>	Transmission line RoW	Throughout maintenance period	Maintenance contractor	Environment Manager and Environmental Officers

	<p>transmission line and electrocution.</p> <ul style="list-style-type: none"> <li>- Avian collisions could occur in large numbers if lines are located in daily flyers, or if avifauna are travelling during low light conditions.</li> </ul>	<ul style="list-style-type: none"> <li>- Commitment will be made to raise awareness of values of natural habitat areas to personnel work force and arrangements will be made for restriction of poaching and forest product collection.</li> <li>- Hunting wild animal will be strictly prohibited and</li> <li>- Transmission line will be designed to minimize risk of electrocution, including maintain a 1.5 meter spacing between energized components and grounded hardware, or covering energized parts.</li> </ul>				
Air Quality	<ul style="list-style-type: none"> <li>- The emission of ozone from transmission lines when in active corona, however ozone emitted from transmission lines not known to carry any health risk and</li> <li>- Air pollution due to burning of vegetation for RoW management.</li> <li>- Green House Gas emissions from the transmission line operation will be limited to fuel consumption in vehicle used for the maintenance activities.</li> </ul>	<ul style="list-style-type: none"> <li>- Vegetation will not be burnt for maintenance.</li> <li>- Mechanical method will be used to trim tall and encroaching vegetation.</li> </ul>	All roads in project site	Throughout operation period	Maintenance contractor	Environment Manager and Environmental Officers
Noise	Noise pollution from transmission lines may disturb local residents and fauna	<ul style="list-style-type: none"> <li>- Conductors designed and constructed to minimize corona effects will be chosen for transmission.</li> </ul>	Transmission line within 1 km of natural habitat or villages.	Prior to operation	Maintenance contractor	Environment Manager and Environmental Officers
Economy and	Ongoing maintenance of the RoW,	- Local people will be employed for	Transmission line	Throughout	Maintenance	Environment

livelihoods	particularly vegetation management, can provide employment to local residents.	suitable roles wherever possible and - Appropriate health and safety measures will be undertaken to protect all project personnel.	RoW	maintenance period	contractor	Manager and Environmental Officers
Community health and safety	<ul style="list-style-type: none"> <li>- Community will have concerns about its safety and possibility of any accidents like electrocution, skin diseases etc.</li> <li>- Electrocution due to contact with high voltage electricity or items in contact with high voltage electricity (such as tools, vehicles or ladders).</li> </ul>	<ul style="list-style-type: none"> <li>- Evaluate possible risks and ensure that these are addressed and minimized.</li> <li>- Communicate about the technical aspects of the transmission line construction and operations, and allay fears about accidents or any other health concerns.</li> <li>- Use simple diagrams and pamphlets in local language for this purpose.</li> <li>- Train land owners about safety issues and action to be taken in case of risks.</li> <li>- Demonstrate that MOEE and its contractors are very concerned about health and safety of workers as well as the community.</li> <li>- Signs and barriers will be installed to prevent access to high voltage areas.</li> <li>- Grounding conducting objects will be installed near transmission lines.</li> </ul>	Transmission line RoW	Throughout maintenance period	Maintenance contractor	Environment Manager and Environmental Officers
Occupational Health and Safety	- Exposure to EMF at levels higher than those experienced by the general public.	- An EMF safety program will be developed prior to operation which: identifies potential levels of exposure; provides training for all workers; delineates zones appropriate for public access and	Transmission Line	Throughout Operation Period	Operator	Environment Manager and Environmental Officers

	<p>those restricted to appropriately trained workers; defines measures to limit exposure time, such as through work rotation; and provides personal monitoring equipment for workers.</p> <ul style="list-style-type: none"> <li>- Ensure compliance of safe practices and implementation of safety manual</li> </ul> <p>Provide and ensure use of personal protective equipment (PPEs) like, safety goggles, gloves, safety harness, helmets, gumboots etc.</p> <ul style="list-style-type: none"> <li>- Securing the workplace, wherein all lines are shut down prior to maintenance work, use of PPE and procedures for emergencies and compensation procedures in case of accidents.</li> <li>- Prior training of the workers regarding health and safety procedures is essential.</li> <li>- Transmission lines will be deactivated and grounded prior to work on, or near, transmission lines.</li> <li>- Live work will only be conducted by trained workers.</li> <li>- Fall protection measures will be implemented including provision of appropriate fall protection equipment, training in use of equipment, training in climbing techniques, and rescue of fall-arrested workers.</li> </ul>				
	<ul style="list-style-type: none"> <li>- Electrocution due to contact with high voltage electricity or items in contact with high voltage electricity (such as tools, vehicles or ladders).</li> <li>- Working at height on towers.</li> </ul>				

		- All equipment, including hoisting equipment, power tools and tool bags, will be properly rated and maintained.				
<b>Rehabilitation Phase</b>						
Hydrology	Changes to topography required for the construction phase can affect hydrology.	<ul style="list-style-type: none"> <li>- Construction areas not required for operation or maintenance of the transmission line will be rehabilitated.</li> <li>- Rehabilitation areas will be graded to provide proper drainage and blend with natural contour with the land.</li> </ul>	All construction areas	Areas are to be rehabilitated as soon as they are no longer required for construction or operation.	Construction contractor, Environment Manager and Environmental Officers	Deputy Quality and Safety Manager (Environment, Coordination)
Terrestrial Biodiversity	Loss of degradation of habitat	<ul style="list-style-type: none"> <li>- Landscaping and re-vegetation will be undertaken after completion of construction using native species where possible, and based on advice provided by a suitably qualified botanist/ecologist;</li> <li>- Following grading, rehabilitation areas will be vegetated using plants native to the area, suitable for the site condition, and beneficial to wildlife.</li> <li>- Following abandonment, all yards, offices, and construction buildings, including concrete footings and slabs, will be removed from the site.</li> <li>- Where applicable, the following agencies will be consulted to determine the recommended plant species composition, seeding rates, and planting dates: Environmental</li> </ul>	All construction areas no longer required	Areas are to be rehabilitated as soon as they are no longer required for construction or operation.	Construction contractor, Environment Manager and Environmental Officers	Deputy Quality and Safety Manager (Environment, Coordination)



		<p>Conservation Department, Ministry of Natural Resources and Environmental Conservation.</p> <ul style="list-style-type: none"><li>- Grasses, forbs, shrubs, and trees appropriate for site conditions and surrounding vegetation will be included in the plant list.</li><li>- Species chosen for a site will be matched for site drainage, climate, shading, resistance to erosion, soil type, slope, aspect, and vegetation management goals.</li><li>- Wetland and riparian species will be used in re-vegetating disturbed wetlands.</li><li>- Upland re-vegetation shall match the plant list to the site's soil type, topographic position, elevation, and surrounding natural communities.</li></ul>				
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### 8.3 Environmental Monitoring

Successful implementation of Environmental Monitoring Plan depends on regular monitoring, documenting and reporting. The Environment Manager and Environmental Officers should monitor the environmental measures and submit a quarterly report to the concerned department. Additionally, another yearly monitoring report with quarterly monitoring data should be submitted to the Environmental Conservation Department for renewing the Environmental Clearance Certificate. The institutional arrangement for implementation of EMP and Monitoring Plan is described in Section 8.1. The initial monitoring program based on the impacts and mitigation measures defined in this IEE is provided in Table 8.3-1.

Monitoring in the construction period can be categorized in the following:

- At Contractor level, monitoring to ensure on a day to day basis that mitigation measures are fully implemented with construction activities and that results observed comply with the contractual obligations.
- At Owner level, routine inspections to ensure that monitoring results provided by the Construction Contractor are corrected, to provide the necessary environmental coordination and interface with the Contractors, and to provide a comprehensive picture of the current environmental situation and efforts at site level.

#### 8.3.1 Monitoring and Inspection by Construction Contractor

The Construction Contractor will employ suitably qualified inspectors, who will conduct routine inspections to evaluate compliance with commitments defined in the Construction Contractor's SSESMP-CP.

Results of field observations, including documenting compliance or noncompliance, will be reported on standard forms to enable observations to be recorded in a consistent manner. The information can be entered into the database that will be used to track the status of and allow analysis of noncompliance situations.

Monitoring activities will include verification of implementation of mitigation measures defined in the SS-ESMMP, as well as water quality, air quality, noise and vibration and biological monitoring. For ambient air, noise and water quality, sampling and analysis shall be carried out relying on certified equipment and/or laboratory.

#### 8.3.2 Monitoring and Inspection by Owner

The Inspector or Environmental Management Officer (EMO) and Social Management Officer (SMO) of the Owner will visit and inspect each of the construction sites at the frequency defined in the monitoring plan below.

Information collected during each visit will be reported on a standard form, which provides a checklist of issues to control, depending on the degree of compliance or non-compliance observed. The Inspector or EMO and SMO of the Owner may join inspection with Construction Contractor and relevant agencies e.g. PMU, and as agreed in order to observe and follow up any event or significant issues that have been reported. Visits to a site will be increased if the site presents a higher environmental risk potential.

Monitoring activities will include verification of implementation of mitigation measures defined in the ESMMP-CP, as well as water quality, air quality, noise and vibration and biological monitoring. For ambient air, noise and water quality, sampling and analysis shall be carried out relying on certified equipment and/or laboratory.

**Table 8.3-1: Environmental Monitoring Program**

Environmental Aspect/Area to be concerned	Mitigation measures	Monitoring method	Monitoring frequency	Institutional Responsibility		Location
				Implementing Unit	Monitoring Unit	
<b>Construction Phase</b>						
Capacity of personnel	Provision of training and education	Review, training, register to verify mandatory training has been attended.	Monthly	Mitigation measures implemented by Contractor	Monitored by Environmental and Social Officer (ESD), PMU	Human Resources Office
Air Quality	Daily monitoring of dust levels	Visual assessment of dust level and implementation of further dust suppression	Daily	Mitigation measures implemented by Contractor	Monitored by Environmental and Social Officer (ESD), PMU	All cleared/exposed work areas.
Air Quality	Dust suppression, including restricting vehicle movement to designated access routes; covering all loads; watering exposed surfaces during windy conditions; vehicle speed limits; cleaning of vehicles;	Visual verification that mitigation measures are implemented.	Weekly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	All cleared/exposed work areas.
Air Quality	Vehicles switched off when stopped. PPE for emission protection provided to all workers working in activities generating emissions.	Verification of sample of vehicles and work areas.	Weekly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	Throughout construction areas

Air quality and Noise and Vibration	Regular maintenance of vehicles and equipment	Review of vehicle and equipment log books to verify maintenance	Quarterly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	Throughout construction area
Noise and vibration	High noise activities carried out between 6am and 7pm, and not during schools days.	Verify monthly based on daily reports.	Monthly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	Throughout construction area
Water Quality	<ul style="list-style-type: none"> <li>- Undertake clearing and earthworks in dry season.</li> <li>- Minimize period of soil exposure.</li> <li>- Stockpile management measures, including stabilization, drainage, righting and sediment traps.</li> <li>- Water quality monitoring</li> </ul>	<ul style="list-style-type: none"> <li>- Verification of construction schedule.</li> <li>- Verification of construction schedule.</li> <li>- Visual verification of stockpile stabilization, distance from watercourses and drainage paths and installation of sediment traps.</li> <li>- Measurement of parameters are same as baseline data collection</li> </ul>	Monthly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	Water quality monitoring locations (to be defined before construction stage)
Water Quality	Appropriate location of stockpile materials.	Visual verification.	Weekly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	All construction area
Hydrology	Construction materials and equipment	Visual verification that materials and equipment are secured.	Weekly during rainy season	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	All construction area
Terrestrial Biodiversity	Vegetation clearing areas clearly marked.	Visual verification of demarcation of clearing areas,	Weekly	Contractor	Monitored by Environmental	All construction area

	Microhabitat features relocated. Weed and pest management measures.	and restriction of clearing to within defined area. Visual verification of relocation of microhabitat features, and implementation of weed and pest management measures.			and Social Officer (ESD), PMU	
Terrestrial Biodiversity	Delivery of training and awareness.	Discussion with sample of personnel to determine level of understanding of biodiversity values and management measures.	Monthly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	All construction area
Economy and Livelihoods	Employment of local people.	Verification of the number of local people employed, and identification of additional local employment opportunities.	Quarterly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	NA
Community Health and Safety (Disease)	- Delivery of public health campaign. - Provision of mosquito nets, latrines and malaria treatment programs.	Review of implementation of public health program	Monthly	ESD	ESD	Villages
Occupational Health and Safety (Accident and Injury)	A Health and Safety program will be developed and implemented which includes an initial safety induction for all employees, on-going safety awareness and an incident reporting system.	Verify implementation of Health and Safety program.	Monthly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	All project areas
Occupational Health and Safety (Accident and Injury)	First aid kits will be readily accessible by workers and trained first aid teams will be assigned to work sites.	Visual verification of availability of first aid kits.	Monthly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	All project areas
Occupational Health and safety (Disease)	Clean drinking water will be provided.	Monitor drinking water quality.	Monthly	ESD	ESD	Worker Camps
Occupational	Education and awareness	Verification of delivery of	Monthly	ESD	ESD	Worker Camps

Health and safety (Disease)	programs will be provided addressing disease prevention and treatment.	education and awareness program.				
Culture and Customs	code of conduct will be established and enforced to reduce the potential for conflict between local residents and migrant workers.	Supervisors to monitor employee behavior throughout construction period.	Ongoing	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	All project areas
Physical Heritage	Cease work if previously unidentified artifacts are identified.	Review cases of artifact detection and verify that action was taken in accordance with chance finds procedure.	Quarterly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	All construction areas
Traffic and access	Abide by traffic rules; appropriate road barriers applied to separate public traffic from construction areas.	Visual verification of driver behavior and road safety devices.	Monthly	Contractor	Monitored by Environmental and Social Officer (ESD), PMU	All construction areas
<b>Operation Phase</b>						
Noise	Where locating the RoW near human receptors and areas of natural habitat for noise-sensitive species is unavoidable, the use of noise barriers and noise cancelling acoustic devices will be investigated.	Monitoring of noise level at nearest residences, and a sample of natural habitat areas.	Quarterly.	Monitored by Environmental and Social Officer (ESD), PMU	Monitored by Environmental and Social Officer (ESD), PMU	Villages and natural habitat monitoring locations.
Biodiversity	- Vegetation trimming will be restricted to that required to safely operate the transmission line. - Use of herbicides minimized. Speed limits of 40 km/hr enforced.	Verify that mechanical and manual methods of vegetation management are being utilized where practicable, and that vegetation trimming is minimized.	At each vegetation management event.	Monitored by Environmental and Social Officer (ESD), PMU	Monitored by Environmental and Social Officer (ESD), PMU	RoW
Biodiversity	Training and awareness program delivered.	Discussion with a sample of personnel to determine level of understanding.	Quarterly	Monitored by Environmental and Social Officer (ESD), PMU	Monitored by Environmental and Social Officer (ESD),	RoW

					PMU	
Community Health and Safety	Management of vegetation to limit fire risk.	Visual verification that: - Vegetation is not encroaching RoW and does not exceed 4.5 m height; - Fuel breaks are maintained; - Vegetative debris is disposed of in a location/manner that does not increase fire risk.	Quarterly	Monitored by Environmental and Social Officer (ESD), PMU	Monitored by Environmental and Social Officer (ESD), PMU	RoW
Community Health and Safety	- Signs and barriers will be installed to prevent access to high voltage areas. - Grounding conducting objects will be installed near transmission lines.	Visual verification of installation of signs and barriers, and grounding conducting objects.	Quarterly	Monitored by Environmental and Social Officer (ESD), PMU	Monitored by Environmental and Social Officer (ESD), PMU	RoW
Occupational Health and Safety	Implementation of fall protection measures.	Visual verification of the use of fall protection measures, and use of properly rated and maintained equipment.	Quarterly	Monitored by Environmental and Social Officer (ESD), PMU	Monitored by Environmental and Social Officer (ESD), PMU	RoW
<b>Rehabilitation Phase</b>						
Hydrology	Rehabilitation areas will be graded to provide proper drainage and blend with natural contour with the land	Visual verification of proper contouring and drainage.	Once, following completion of rehabilitation.	Monitored by Environmental and Social Officer (ESD), PMU	Monitored by Environmental and Social Officer (ESD), PMU	RoW
Biodiversity	Re-vegetation after completion of construction using locally native species.	Visual verification of tower sites following construction.	Once, or weekly Until achieved, at each tower site following construction.	Monitored by Environmental and Social Officer (ESD), PMU	Monitored by Environmental and Social Officer (ESD), PMU	Tower sites



## 8.4 Indicative Budget for Implementation of the EMP

The budget provided in Table 8.4-1 covers the implementation of, and compliance with, UREC's environmental obligations for transmission line construction and operation. The budget includes environmental monitoring undertaken by UREC (both internally and outsourced). The budget is indicative only, and UREC may fund any additional measures required from changes to the ECC, EMP, ESMMP-CP and ESMMP-OP; or other measures required to prevent or mitigate impacts to the environment which for any reason were not included in the initial budget.

Implementation of environmental controls during construction is the responsibility of the construction contractor. A budget for environmental measures implemented by the construction contractor will be provided in the contractor's EMP.

**Table 8.4-1: Indicative EMP Budget (Figures in US\$)**

Items	Tasks	Expenses (USD)
<b>Implementation of EMP</b>		
<b>Construction Phase</b>		
Capacity of Personnel	Environmental Induction Training Preparation of Posters and Leaflets Provision of PPE	5,000
Water Quality and Erosion	- Sediment and Erosion Control - Controls for preventing spillage and clean-up of hazardous materials - Septic Tank installation - Design for Management of rubbish and waste	25,000
Air quality	- Watering of exposed soil surfaces - Washing and clearing of vehicles	30,000
Noise and Vibration	- Inspections of vehicles - Provision of PPE	7,500
Terrestrial Biodiversity	- Training and Awareness - Inspection of vehicles - Wildlife protection procedure - Speed signage - Marking of habitats for retention	28,000
Cultural heritage and Archaeology	- Training and Awareness - Employment of Head of Village - Inspections for artifacts	11,500
Health and safety	- Construction of toilet facilities - Sewage Treatment - Awareness Program - Mosquito Control - Drinking Water - First Aid equipment	55,000
Traffic and access	- Education and Awareness - Traffic signs	15,000
<b>Operation Phase</b>		
Air Quality	Road watering	25,000
Terrestrial Biodiversity	- Education and awareness on fauna strike - Inspection of vehicles for fauna trafficking	11,500
<b>Rehabilitation Phase</b>		

Topography and Hydrology	- Rehabilitation of disturbed areas - Removal of all equipment and buildings	250,000
Terrestrial Biodiversity	Replanting of disturbed areas with native species	45,000
<b>Environmental Monitoring Program (Calculated over the life of the Project)</b>		
<b>Construction Phase</b>		
Capacity of Personnel	Review training register during weekly site audit	15,000
Water Quality	- Audit of planning documentation - Water quality monitoring - Audit of sediment and erosion control measures	23,000
Air quality	Audit of dust control measures during weekly site audit	12,500
Noise and Vibration	Noise control monitoring	15,000
Terrestrial & Aquatic Biodiversity	- Audit of clearance works - Confirm vehicle inspections	15,000
Health and safety	Audit hygiene and PPE adherence by all personnel	15,000
Traffic and access	Audit use of signage and traffic controls	15,000
<b>Operation</b>		
Air Quality	Daily dust audit	25,000
Terrestrial and aquatic Biodiversity	- Audit of clearance works - Confirm vehicle inspections	25,000
Topography and Hydrology	Audit of slope stability by geologist/engineer	5,000
Terrestrial Biodiversity	Audit of vegetation establishment and removal of plant and equipment/buildings/waste	20,000
PMU Manager		54,000
ESD Manager		54,000
EM Officer		36,000
SM Officer		36,000
Supporting staff and logistic cost		21,600
<b>Total</b>		<b>895,600</b>

## 9 CONCLUSION AND RECOMMENDATION

This IEE report was prepared based on preliminary route alignment that provided by the project company with approval of MOEE and assessment of potential impacts, and has been assessed using information collected during biodiversity and social assessment for the present 230 kV transmission Line Project as well as other desktop sources.

This document provides a description of the baseline social and environmental conditions, a discussion of potential impacts and measures to minimize and mitigate those impacts. The document also introduces the Grievance Redress Mechanism and Consultation Process.

This IEE identified risks to the environment and local communities, including impacts to biodiversity, water quality, traffic and community health and safety. Management actions outlined in this document will be refined and developed further into the appropriate ESMMP-CP documentation that will be implemented to avoid and minimize the identified impacts.

The proposed transmission line project has been categorized as a Category B project (as per the IFC criteria: Category B - Applies to projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures;) due to the following reasons:

- The transmission line project is a linear project that runs for about 121km requiring land as “right of way” of about 24.8m either side of the center of the proposed transmission line;
- The Project during operation phase will have low potential of pollution;
- There is no displacement of families due to the Project;
- The Project will have some adverse social and environmental impacts; however, they are few in number, restricted to the corridors of right of way;
- Impacts caused during construction phase are mostly reversible except that of revenue and forest lands that are taken as right of way for the transmission line.

## List of References

SN	Document/Book	Web Link
1	State of Environment –Himachal Pradesh	<a href="http://www.hpenvis.nic.in">http://www.hpenvis.nic.in</a>
2	International Finance Corporation's Performance Standards on Social & Environmental Sustainability	<a href="http://www.ifc.org">http://www.ifc.org</a>
3	Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution: IFC	<a href="http://www.ifc.org">http://www.ifc.org</a>
4	International Finance Corporation's Guidance Notes: Performance Standards on Social & International Finance Corporation's Environmental Sustainability	<a href="http://www.ifc.org">http://www.ifc.org</a>