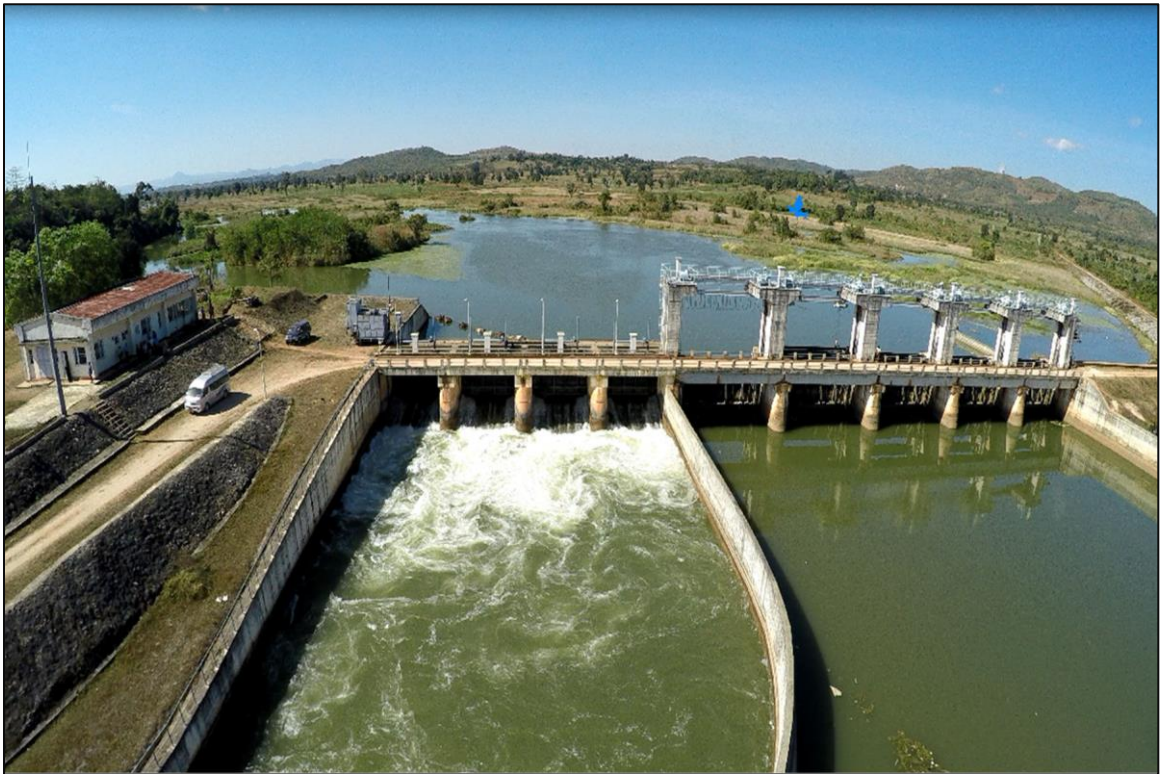


**Environmental Management Plan (EMP)**  
**for**  
**Rehabilitation works**  
**of**  
**Baluchaung No.1 Hydropower Plant**  
**October 2019**



JOINT VENTURE OF  
**NEWJEC**  
**NIPPON KOEI**

**JV of NEWJEC Inc. and NIPPON KOEI Co., Ltd**

**JAPAN**

ဘီလူးချောင်း အမှတ် (၁) ရေအားလျှပ်စစ်စက်ရုံအား

အကြီးစားပြန်လည်ပြုပြင်မွမ်းမံခြင်းလုပ်ငန်းအတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်

**အစီရင်ခံစာအကျဉ်းချုပ်**

**၁။ စီမံကိန်းအကျဉ်းချုပ်**

မြန်မာနိုင်ငံ၏တည်ရှိပြီးဖြစ်သော ရေအားလျှပ်စစ်စက်ရုံ (၂၄) ရုံအနက်မှ (၁၈) ရုံသည်မြစ်ရေစီးကြောင်းမှ တိုက်ရိုက်စီးဆင်းသောရေအားဖြင့်လည်ပတ်နေပါသည်။၎င်းရေအားလျှပ်စစ်စက်ရုံ(၁၈) ရုံ၏စုစုပေါင်း မောင်းနှင်စက်အင်အားသည် (၁၀၈၂) မဂ္ဂါဝပ်ဖြစ်ပြီး တစ်နိုင်ငံလုံးရှိရေအားလျှပ်စစ်စက်ရုံများ၏ (၃၆ %) ရှိပါသည်။ အဆိုပါရေအားလျှပ်စစ်စက်ရုံများဖြင့် စီးပွားဖြစ်ဓါတ်အားထုတ်လုပ်မှုအား ၁၉၇၀ ခုနှစ် မှ ၁၉၉၀ ခုနှစ် ထိဆောင်ရွက်ခဲ့ပါသည်။ စက်ရုံအကြီးစားပြုပြင်ခြင်းလုပ်ငန်းအသီးသီးအားဆောင်ရွက်နိုင်ခြင်းမရှိခဲ့ပါ။ မြန်မာနိုင်ငံ၏ယနေ့ လက်ရှိရေအားလျှပ်စစ်စက်ရုံများမှအမှန်တကယ်ထွက်ရှိသောလျှပ်စစ်ဓါတ်အားမှာယေဘုယျအားဖြင့် မိုးရာသီတွင် (၃၀%)အထိလည်းကောင်း၊ဇွန်ရာသီတွင် ယေဘုယျအားဖြင့် ၅၀%အထိ လည်းကောင်းလျော့နည်းကျဆင်းနေပါသည်။

၂၀၁၃ခုနှစ်၊ဩဂုတ်လတွင်ပြောကြားခဲ့သောနိုင်ငံတော်သမ္မတဦးသိန်းစိန်၏မိန့်ခွန်း၌မြန်မာနိုင်ငံ၏စီးပွားရေးနှင့် လူမှုရေးဖွံ့ဖြိုးတိုးတက်မှုတွင် လျှပ်စစ်နှင့်စွမ်းအင်ကဏ္ဍသည် အလွန်ပင်အရေးကြီးကြောင်း ထည့်သွင်း ပြောကြားခဲ့ပါသည်။နောက်ပိုင်းတွင်အမျိုးသားလျှပ်စစ်စွမ်းအင်မဟာဗျူဟာအစီအစဉ်အား ၂၀၁၄ခုနှစ်တွင်စတင်ရေးဆွဲခဲ့ပါသည်။ထိုအစီအစဉ်တွင်ဓါတ်အားထုတ်လုပ်မှုကျဆင်းလာပြီဖြစ်သောရေအားလျှပ်စစ်စက်ရုံများအား လေ့လာပြီးယိုယွင်းလာသောစက်ပစ္စည်းများကိုလဲလှယ်ရန်အကြံပြုခဲ့ရာတွင်ဘီလူးချောင်းအမှတ်(၁)ရေအား လျှပ်စစ်စက်ရုံနှင့်ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံတို့ပါဝင်ခဲ့ပါသည်။အကြီးစားပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်း များဆောင်ရွက်ရာတွင်စီးပွားရေးအထောက်အကူပြုမှု၊ သဘာဝပတ်ဝန်းကျင်အပေါ်တွင်အကျိုးသက်ရောက် ခြင်းနိမ့်စေမှုများကိုထည့်သွင်းစဉ်းစားခဲ့ပါသည်။ ၂၀၁၄ခုနှစ် အမျိုးသားရေးဆိုင်ရာလျှပ်စစ် စွမ်းအင်ရရှိရေး စီမံချက်အရရေအားလျှပ်စစ်စက်ရုံများအားအလုံးစုံပြန်လည်ပြုပြင်ရန်အတွက်အကြံပြုလေ့လာဆန်းစစ်ခြင်းလုပ် ငန်းကို၂၀၁၆ခုနှစ်တွင်စတင်ဆောင်ရွက်ခဲ့ပါသည်။

အမျိုးသားရေးဆိုင်ရာ လျှပ်စစ်စွမ်းအင်ရရှိရေး စီမံချက်တွင် ရေအားလျှပ်စစ်စက်ရုံများအား အရည်အသွေး ပြည့်မှီစွာထုတ်လုပ်နိုင်ရေးအတွက် စက်ပစ္စည်းကိရိယာများ၏ အဓိကအစိတ်အပိုင်း များအား ပြန်လည်ပြုပြင်မွမ်းမံခြင်း လုပ်ငန်းများကိုလုပ်ဆောင်ရန် အကြံပြု ထားပါသည်။ သက်တမ်းရင့် ဘီလူးချောင်း အမှတ် (၁) ရေအားလျှပ်စစ်စက်ရုံ၏ အဓိကစက်အစိတ်အပိုင်းများသည် အိုမင်းယိုယွင်းလာပြီဖြစ်သောကြောင့် ပြန်လည်ပြုပြင်မွမ်းမံရန်လိုအပ်လာပါ သည်။ အဆိုပါ ရေအားလျှပ်စစ် စက်ရုံအား ပြန်လည်ပြုပြင်မွမ်းမံခြင်း လုပ်ငန်းသည် သဘာဝပတ်ဝန်းကျင် ထိခိုက်မှုနည်းပါးသက်သာ စွာဖြင့် စီးပွားရေးအကျိုးကျေးဇူးရရှိမည် ဖြစ်ပါသည်။

ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စက်ရုံအား ၁၉၉၂ခုနှစ်တွင် စတင်လည်ပတ်မောင်းနှင်ခဲ့ပါသည်။ မူလတည်ဆောက်စဉ်ကတည်းကတပ်ဆင်လည်ပတ်ခဲ့သောစက်ပစ္စည်း ကိရိယာများဖြစ်သည့်အတွက် ရေထိန်းဒလက်များပွန်းစားခြင်း၊ အပူအအေးစနစ်များယိုယွင်းလာခြင်း၊ တာဗိုင်းအတွင်းရေဂျိုးအနည်အနှစ်များရှိ လာခြင်း၊ ဂါဗနာထိန်းချုပ်ခန်းတွင်း၌ဆီယိုစိမ့်မှုများလာခြင်းနှင့် အခြားသောစက်မှု လျှပ်စစ်ပစ္စည်းကိရိယာ များအား ပြန်လည်အစားထိုးတပ်ဆင်ရန်လိုအပ်လာပါသည်။

ဘီလူးချောင်းအမှတ်(၁) ရေအားလျှပ်စစ်စက်ရုံသည်သက်တမ်းနှစ်ပေါင်း (၃၀)ရှိလာပြီဖြစ်၍အကြီးပြန်လည် ပြုပြင်ရန်လိုအပ်လာပါသည်။ ထိုသို့အကြီးစားပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းဆောင်ရွက်ရာတွင် ဆည်ရေဝင် ဧရိယာနှင့်ဆည်ရေသိုလှောင်ပမာဏပါဝင်ပြောင်းလဲခြင်းမရှိပါ။

မြန်မာနိုင်ငံအစိုးရမှဂျပန်နိုင်ငံအစိုးရအားဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စက်ရုံ၏ ကြာရှည်ကြံ့ခိုင် မောင်းနှင်ရေးအတွက်အကြီးစားပြန်လည်ပြုပြင်ဆောင်ရွက်ပေးရန်မေတ္တာရပ်ခံချက်အရ (မြန်မာနိုင်ငံရေအား လျှပ်စစ်စက်ရုံများပြန်လည်ပြုပြင်နိုင်ရေး အကြံ့လေ့လာစူးစမ်းခြင်းလုပ်ငန်းကို ၂၀၁၆ ခုနှစ်တွင် စတင်ဆောင်ရွက်ခဲ့ပါသည်။

ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စီမံကိန်းအကြီးစားပြန်လည်ပြုပြင်ခြင်းဆောင်ရွက်ရာတွင်ပါဝင်သောအ ဓိကလုပ်ငန်းကဏ္ဍများမှာအောက်ပါအတိုင်းဖြစ်ပါသည်။

- ၁) လုပ်ငန်းမျက်မြင်တိုင်းတာခြင်းနှင့်တင်ဒါပုံစံပြုစုခြင်း ၂၀၁၈ ခုနှစ် မေလ မှ ၂၀၁၉ ခုနှစ် မေလ အထိ
- ၂) တင်ဒါခေါ်ယူခြင်း ၂၀၁၉ ခုနှစ် ဩဂုတ်လ မှ ၂၀၁၉ ခုနှစ် အောက်တိုဘာလ အထိ
- ၃) စက်ရုံကွင်းဆင်းပြုပြင်ခြင်း ၂၀၂၀ ခုနှစ် ဧပြီလ မှ ၂၀၂၃ ခုနှစ် ဖေဖော်ဝါရီလ အထိ
- ၄) ဓါတ်အားလှိုင်းပြန်ဆွဲခြင်းနှင့်ခွဲရုံများပြန်လည်ပြုပြင်ခြင်း ၂၀၂၀ ခုနှစ် ဒီဇင်ဘာလ မှ ၂၀၂၁ ခုနှစ် ဒီဇင်ဘာလ အထိ

ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စက်ရုံအကြီးစားပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းဆောင်ရွက်မည့်အဖွဲ့ အစည်းများမှာအောက်ဖော်ပြပါအဖွဲ့အစည်းများဖြစ်ကြပါသည်။

**၁) အကောင်အထည်ဖော်ဆောင်ရွက်မည့်အဖွဲ့အစည်း**  
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 လျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးလုပ်ငန်း (Electric Power Generation Enterprise)  
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 Contract for the Implementation of the Project Began in May 2018

**၂) အကြံပေးလုပ်ငန်းဆောင်ရွက်သည့်အင်ဂျင်နီယာအဖွဲ့အစည်း**  
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Consulting Services Began in May 2018

**၂။ စီမံကိန်း ရည်ရွယ်ချက်**

အမျိုးသားရေးဆိုင်ရာလျှပ်စစ်စွမ်းအင်ရရှိရေး စီမံချက်တွင် ရေအားလျှပ်စစ်စက်ရုံများမှအသီးသီး အရည်အသွေး ပြည့်မှီစွာထုတ်လုပ်နိုင်ရေးအတွက် စက်ပစ္စည်းကိရိယာများ၏ အဓိကအစိတ်အပိုင်းများ အား ပြန်လည်ပြုပြင် မွမ်းမံခြင်း လုပ်ငန်းကိုလုပ် ဆောင်ရန် အကြံပြု ထောက်ခံထားပါသည်။ အကြောင်းမှာ လက်ရှိဘီလူးချောင်း အမှတ် (၁) ရေအားလျှပ်စစ်စက်ရုံ၏အဓိကစက်ပစ္စည်းအစိတ်အပိုင်းများသည်သက်တမ်းကြာလာသောကြောင့် ပြန်လည်ပြုပြင်မွမ်းမံရန်လိုအပ်လာပါသည်။ အဆိုပါပြန်လည်ပြုပြင်မွမ်းမံ လည်ပတ်ခြင်းလုပ်ငန်းတို့မှာ လက်ရှိ စက်ရုံ၏ဧရိယာအတွင်းတွင်လုပ်ဆောင်သွားမည်ဖြစ်ပါသည်။

ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စက်ရုံသည်လွိုင်ကော်မြို့နယ်တွင်တည်ရှိပြီးကယားပြည်နယ်၏ မြို့(၇) မြို့၌ပါဝင်ပါသည်။အစားထိုးလဲလှယ်တပ်ဆင်မည့်စက်ပစ္စည်းကိရိယာများစက်ရုံပိုင်မြေဧရိယာဝန်းအတွင်း၌သာ သိုလှောင်ရုံများကိုတည်ဆောက်ကာထားရှိထိန်းသိမ်းထားမည်ဖြစ်ပါသည်။

ပြန်လည်ပြုပြင်မွမ်းမံခြင်းလုပ်ငန်းများအား အဆိုပါစက်ရုံဧရိယာဝန်းအတွင်း သတ်မှတ်ထားသောနေရာတွင် သာကန့်သက်ဆောင်ရွက်မည်ဖြစ်ပါသည်။ စက်အင်အားနှင့်စက်ရုံအရွယ်အစားအားတိုးချဲ့တည်ဆောက်ခြင်း မပြုလုပ်မည်မဟုတ်ပါ။

စီမံကိန်းစတင်အကောင်အထည်ဖော်ပါက တာဝန်များအစားထိုးတပ်ဆင်ခြင်း၊ရေသွင်းတံခါးပြန်လည်ပြုပြင်ခြင်း၊ လိုအပ်သောစက်ပစ္စည်းကိရိယာများလဲလှယ်တပ်ဆင်ခြင်းသာ ဆောင်ရွက်မည်ဖြစ်ပြီးတိုးချဲ့လုပ်ငန်းများ ဆောင်ရွက်မည်မဟုတ်ပါ။အဆိုပါလုပ်ငန်းများအားလျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးလုပ်ငန်းဌာနမှအကောင်အ ထည်ဖော်မည်ဖြစ်ပါသည်။

စီမံကိန်းဆောင်ရွက်မည့်အစီအစဉ်များအရ အဆိုပါစက်ရုံအကြီးစား ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းကို စီမံကိန်းအကြံပေးသူများရွေးချယ်ခြင်း၊ တင်ဒါပုံစံများရေးဆွဲခြင်း၊ တင်ဒါခေါ်ယူစီစဉ်ပြင်ဆင်ခြင်း စသည်တို့ကို ၂၀၁၈ ခုနှစ်၊ မေလမှစတင်ဆောင်ရွက်မည်ဖြစ်ပါသည်။ စက်ရုံ၌ကွင်းဆင်းပြင်ဆင်ခြင်းလုပ်ငန်းအား ၂၀၂၁ ခုနှစ် အလယ်ပိုင်းတွင် စတင်လုပ်ဆောင်မည်ဖြစ်ကာ ၂ နှစ်ကြာတွင်စီမံကိန်းလုပ်ငန်းပြီးဆုံးမည်ဖြစ်ပါသည်။

လုပ်ငန်းစီမံကိန်းအကောင်အထည်ဖော်ရာတွင် -  
၁) လက်ရှိမြေအသုံးချမှုမပြောင်းလဲခြင်း။

- ၂) စက်ရုံ၏အပြင်ပိုင်းဖွဲ့စည်းတည်ဆောက်ပုံများ၊ စက်ပစ္စည်းများမပြောင်းလဲခြင်း။
- ၃) ယိုယွင်းလာသည့်စက်ပစ္စည်းများတွင်လိုအပ်သောအစိတ်ပိုင်းများလဲလှယ်ခြင်းနှင့်ပြန်လည်မွမ်းမံခြင်း။
- ၄) လျှပ်စစ်ဓါတ်အား ထုတ်လုပ်မှုပမာဏ၊ ထုတ်လုပ်မှုအချိန်ဇယားများ၊ လုပ်ငန်း လည်ပတ်ခြင်း ပုံစံ စသည်တို့ကို ပြောင်းလဲမှုမရှိစေခြင်း။

ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စီမံကိန်းပြန်လည်မွမ်းမံပြုပြင်ခြင်းလုပ်ငန်းဆောင်ရွက်ရာတွင်ပါဝင်သည့်လုပ်ငန်းများအား စာရင်းဇယားဖြင့်ဖော်ပြထားပါသည်။ ဖြည့်စွက်ဆောက်လုပ်ရေးလုပ်ငန်း အမျိုးအစားများပါဝင်ခြင်းမရှိပါ။

Rehabilitation item		Action	Q'ty	Remarks
Turbine	Turbine Runner Vane	R	2 sets	Newly developed by CFD, and turbine model test is required.
	Turbine Runner Hub	R	2 sets	Ditto
	Guide Vane	R	2 sets	Ditto
	Guide Vanes Stem Bush	R	2 sets	All bushes are to be replaced
	Inner Head Cover	R	2 sets	Newly developed by CFD, and turbine model test is required.
	Turbine Guide Bearing	R	2 sets	Replaced for segment-type bearings
	Shaft Sleeve	R	2 sets	(one of wearing parts)
	Shaft Sealing Box	R	2 sets	Newly designed device is to be applied
	Runner Vane Return Mechanism	R	2 sets	In harmony with the rehabilitation of generator exciter and digitalized governor system.
	Pressure Oil Supply Pipe for Runner Vane Servomotor	R/A	2 sets	Components related to the new runner are to be replaced. The other existing components are to be used.
	Cooling Water Supply System	P/R	1 set	One set for the plant system Pump sets, motor-driven valves and local control panels are to be replaced. Existing hand-operated strainers are to be replaced to new motor-driven ones. Small exposed water pipes are to be replaced to stainless steel ones.
	Water Drainage System	P/R	1 set	One set for the plant system All drainage pumps, local control panels and water level detectors are to be replaced.
	Pressure Oil Supply System	P/R	1 set	One set for the plant system Oil sump tank set, air compressor sets, local control panels, etc. are to be replaced.
Overhead Crane	P/R	1 set	Parts to be repaired and/or replaced are to be checked and specified by a supervisor of the crane manufacturer.	
Generator	Stator and Rotor Winding	R	2 sets	2 sets each for Stator and Rotor Bearing
	Guide and Thrust Bearing	R	2 sets	2 sets each for Guide and Thrust Bearing
	Air cooler	R	2 sets	
	Brake system	R	2 sets	
	Lubrication oil cooling system	R	2 sets	

	Excitation system	R	2 sets	to brushless (AC) excitation system
	Neutral grounding device	R	2 sets	Neutral grounding transformers are to be replaced.
Control and Protection System	Total digital system (SCADA)	R	1 set	Updated to total digital system including SCADA function
	Automatic Voltage Regulator	R	1 set	Updated to all-in-one protective control unit and exciter control panel
	Generator Vibration Monitor	R	1 set	Replaced with new components
	Control Cable	R	1 set	Replaced with new cables
	Ventilation System	R	1 set	3 air-intake units, 3 air-exhaust units (roof-mounted), and intake/exhaust control panels are updated.
	Governor Control Equipment	R	1 set	Updated to digital PID-GOV system
	Air Conditioning System	R	1 set	Replaced with new components
Substation and Transmission Line facilities	Generator Transformer	R	7 sets	5.1MVA/set, 132/11 kV, incl. Spare Tr.
	Switch Equipment (All)	R	1 lot	132 kV CB: 5sets, 132 kV DS: 7 sets, CT: 12 pcs, CVT: 9 pcs, LA: 12 pcs
	132/11 kV Powerhouse Service Transformer	A	1 set	132/11 kV, 5 MVA, 50 Hz, ONAN
	11 kV Vacuum Circuit Breaker	R	10 panels	Metal-enclosed panel with VCB, DS, CT, VT and SA.
	11 kV Phase Shift Transformer	R	1 set	11/11 kV, 5 MVA, 50 Hz, ONAN
	Powerhouse Service Transformer	R	2 sets	Indoor type, 11/0.4 kV, 500 kVA, cast-resin mold
	Emergency Diesel Generator Set	R	1 set	300 kVA, 50Hz, 400/230V
	Plant DC Battery Bank	R	2 sets	Lead acid, valve-regulated type, 300AH
	DC Battery Charger	R	2 set	Input: AC 400V, Output: DC230V
	400 V House Service Equipment	R	1 lot	400V, Indoor, type, ACB or MCCB

Note; R: Replacement, P: Repair, A: Addition, I: Inspection

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ရာတွင်အစားထိုးလဲလှယ်တပ်ဆင်သောလျှပ်စစ်ပစ္စည်းကိရိယာ အစိတ်အပိုင်းများအားတည်ဆောက်ထားရှိသောသို့လှောင်ရုံအတွင်းတွင်သာသိမ်းဆည်းသွားမည်ဖြစ်ပါ သည်။ သို့လှောင်ရုံသည်လျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးလုပ်ငန်းပိုင်မြေဧရိယာအတွင်းတည်ရှိပါသည်။

**၃။ စည်းမျဉ်းနှင့်ဥပဒေများ**

ပတ်ဝန်းထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း အခန်း(၇) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အရ ဘီလူးချောင်း ရေအားလျှပ်စစ်စက်ရုံပြန်လည်ပြုပြင်မွမ်းမံခြင်းလုပ်ငန်းဆောင်ရွက်ရာတွင်သဘာဝပတ်ဝန်း ကျင်စီမံခန့်ခွဲမှု အစီအစဉ်နှင့် စောင့်ကြပ်ကြည့်ရှုရမည့်အစီအစဉ်များကိုရေးဆွဲပါသည်။

ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စက်ရုံပြန်လည်ပြုပြင်ခြင်းစီမံကိန်းသည် ဂျပန်နိုင်ငံ(ဂျီကီကာ)၏ ငွေကြေးအကူ အညီဖြင့်အကောင်အထည်ဖော်ဆောင်ရွက်နေသောစီမံကိန်းဖြစ်ပါသည်။ (၂၀၁၀) ခုနှစ် လူမှုရေးနှင့်သဘာဝပတ်ဝန်းကျင် ထိခိုက်မှုစမ်းစစ်ခြင်း လမ်းညွှန်ချက်နှင့်အညီဆောင်ရွက်ခဲ့ပါသည်။ ထို့အပြင် အပြည်ပြည်ဆိုင်ရာသဘောတူညီချက် ဖြစ်သော ထရန်စဖေးမာတွင်ပါရှိသည့် စွန့်ပစ်ဆီအညစ်အကြေးများ ထိန်းသိမ်းခြင်းကိုလည်း IFC, UNEP, ADB, World Bank စသောအဖွဲ့စည်းများ၏ စံချိန်စံညွှန်းများနှင့်အညီထိန်းသိမ်းဆောင်ရွက်ခဲ့ပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်းအရဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စက်ရုံ အကြီးစားပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းဆောင်ရွက်ခြင်းအတွက် မြန်မာနိုင်ငံပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်း ဥပဒေအပိုဒ်ခွဲ ၅၅ (က) အရ သဘာဝပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီစဉ် (EMP) အားအသေးစိတ်ပြင်ဆင် ပေးပို့တင်ပြခဲ့ပါသည်။ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စက်ရုံ၏ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်အား ရေးဆွဲရာတွင် စောင့်ကြပ် ကြည့်ရှုရမည့်အစီအစဉ်များကိုပါ မြန်မာနိုင်ငံ၏ သဘာဝပတ်ဝန်းကျင် ဥပဒေ စည်းမျဉ်းစည်းကမ်းများနှင့်အညီအသေးစိတ်ထည့်သွင်းရေးဆွဲခဲ့ပါသည်။အောက်ဖော်ပြပါသက်မှတ်ချက် များအားဆောင်ရွက်ခဲ့ပါသည်။

၁)ဘီလူးချောင်းရေအားလျှပ်စစ်စီမံကိန်းဧရိယာအတွင်း တည်ရှိဆဲသဘာဝပတ်ဝန်းကျင်နှင့်လူမှုစီးပွားရေး အခြေ အနေများအားလေ့လာဆန်းစစ်ခြင်းလုပ်ငန်းအားဆောင်ရွက်ခဲ့ပါသည်။

၂) ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများအား သတ်မှတ်ခြင်း၊ သက်ရောက်မှုများအား တစ်ချင်းစီအလိုက် အဆင့်ခွဲခြားခြင်း ဆောင်ရွက်ရာတွင် အမျိုးအစား (၃၆) မျိုး ပါဝင်ခဲ့ပါသည်။ လူမှုရေး (၁၇) မျိုး ၊ သဘာဝပတ်ဝန်းကျင် အခြေအနေ (၉) မျိုး နှင့် သဘာဝပတ်ဝန်းကျင် ညစ်ညမ်းမှု (၁၀) မျိုး တို့ဖြစ်ပါသည်။

၃) သက်ရောက်မှုများအား အဆင့်ခွဲခြား သတ်မှတ်အကဲဖြတ်ရာတွင် (A) သည် ပတ်ဝန်းကျင် ဆိုးကျိုးထိခိုက်မှုရှိခြင်း (B) သည် ပတ်ဝန်းကျင်ဆိုးကျိုး ထိခိုက်မှု အနည်းငယ်ရှိခြင်း၊ (C) သည်ပတ်ဝန်းကျင်ထိခိုက်မှုအနည်းငယ်ရှိခြင်း (D) သည် ပတ်ဝန်းထိခိုက်မှု မရှိခြင်း စသည်တို့ဖြင့် ခွဲခြား သတ်မှတ် ထားပါသည်။ လေ့လာစမ်းစစ်အကဲဖြတ်ချက်များအရ အဖြေမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။

- (က) လူမှုစီးပွားရေးအပေါ်တွင်ထိခိုက်မှုလုံးဝမရှိပါ။
- (ခ) စီမံကိန်းဆောင်ရွက်မှုကြောင့် သဘာဝပတ်ဝန်းကျင်ပေါ်တွင်ထိခိုက်မှုမရှိပါ။
- (ဂ)စွန့်ပစ်အစိုင်အခဲများ၊ ဆီအညစ်အကြေးပါဝင်သောစက်ကိရိယာအစိတ်ပိုင်းဟောင်းများအား သေချာစွာကန့်သန့်သိမ်းထားရပါမည်။

**၄. စီမံကိန်းဧရိယာ၏လက်ရှိပတ်ဝန်းကျင်အခြေအနေ**  
**၄.၁ .လူမှုစီးပွားရေးပတ်ဝန်းကျင်**

ဘီလူးချောင်းအမှတ်(၁) ရေအားလျှပ်စစ်စက်ရုံသည် ကယားပြည်နယ်၏မြို့တော်ဖြစ်သောလွိုင်ကော်မြို့ အရှေ့တောင်ဘက်ရှိ ဘီလူးချောင်းပေါ်တွင်တည်ရှိပါသည်။ လွိုင်ကော်ခရိုင်သည်ကယားပြည်နယ်၏မြို့တော် ဖြစ်သကဲ့သို့ မြို့ပေါင်း(၇)မြို့ပါဝင်ဖွဲ့စည်းထားပါသည်။

၂၀၁၄ ခုနှစ် မြန်မာနိုင်ငံတွင်ကောက်ယူသောသန်းခေါင်စာရင်းစစ်တမ်းများအရ လွိုင်ကော်မြို့သည်လူဦးရေ ၁၂၈၄၀၁ ရှိပါသည်။ မြို့၏ပျမ်းမျှ လူဦးရေထူထပ်မှုမှာ ၁ စက္ကယားကီလိုမီတာလျှင် ၈၃ ဦးနေထိုင်ကြပါသည်။ လူဦးရေအများစုသည် ကျေးလက်ဒေသတွင်နေထိုင်ကြပါသည်။ အမျိုးသား ဦးရေ (၆၃၁၀၉)ဦး နှင့် အမျိုးသမီးဦးရေမှာ (၆၅၂၉၂)ဦး ဖြစ်ပါသည်။ အချိုးအစားမှာ အမျိုးသမီးဦးရေ (၁၀၀)ဦး လျှင် အမျိုးသားဦးရေ (၉၇)ဦး ဖြစ်ပါသည်။ ပျမ်းမျှအိမ်ထောင်စုအရွယ်အစားမှာ (၄.၆) ယောက်ဖြစ်ပါသည်။ မြန်မာနိုင်ငံ၏ ပျမ်းမျှ အိမ်ထောင်စုအရွယ်အစားမှာ (၄.၄) ဖြစ်သဖြင့် လွိုင်ကော်မြို့၏ အိမ်ထောင်စုအရွယ်အစားမှာ ပိုမိုကြီးမားပါသည်။

စုစုပေါင်းမြေဧရိယာမှာ (၅၉၀၅၇) ဧကဖြစ်ပြီး စိုက်ပျိုးနိုင်သောမြေများဖြစ်ပါသည်။ ကြိုးဝိုင်းတော၊ ကြိုးပြင်ကာကွယ်တောမှာ (၇၂၈၇၃) ဧကရှိပါသည်။လယ်လုပ်ငန်းလုပ်ကိုင်သူများသည်ယေဘုယျအားဖြင့် မိုးစပါးတမျိုးတည်းကိုသာစိုက်ပျိုးကြပါသည်။ နွေစပါးစိုက်ပျိုးမှုအား ဆည်ရေရှိနိုင်သော ရှမ်းပြည်နယ်အနီး ဖယ်ခုံမြို့တွင်စိုက်ပျိုးကြပါသည်။

ယာလုပ်ငန်းလုပ်ကိုင်မှုတွင် (၆၆%) အားကျယ်ပြန့်သောတောင်ပေါ်မြေမြင့်ဧရိယာများတွင်စိုက်ပျိုးကြပြီး ၃၃.၃ %အား မြေနိမ့်ဒေသတွင်စိုက်ပျိုးကြပါသည်။ ၂၁၁၉ ဧရိယာဧကအား အခြားမြေအသုံးချမှုအဖြစ် မွေးမြူရေးလုပ်ငန်းများလုပ်ဆောင်ခြင်း၊ သတ္တုတူးဖော်ရှာဖွေခြင်းတို့တွင်လုပ်ကိုင်ဆောင်ရွက်ပါသည်။

အချို့သောကျေးရွာများတွင်မိုးရေချိန်ကောင်းစွာရရှိခြင်း၊ဆည်မှပိုမိုရေကောင်းစွာရရှိခြင်းတို့ကြောင့်အိမ်ခြံဥ ယျာဉ်လုပ်ငန်း၊ စားသုံးသီးနှံစိုက်ပျိုးခြင်းလုပ်ငန်းတို့ကို အိမ်ထောင်စုအပိုဝင်ငွေအဖြစ် လုပ်ကိုင် ဆောင်ရွက်ကြပါသည်။ နှစ်ရှည်ပင်များအား အချို့သောအိမ်ခြံဝန်းများအတွင်းတွေ့ရှိရပါသည်။ လယ်ယာလုပ်ငန်းများတိုးချဲ့လုပ်ကိုင်ခြင်း၊ ထင်းလောင်စာထုတ်ခြင်း၊ မီးသွေးထုတ်ခြင်း၊ သစ်အသုံးပြုခြင်း တို့ကြောင့် သစ်တောများလျော့နည်းလာခဲ့ပါသည်။

ယက်ကန်းယက်လုပ်ခြင်း၊ ပန်းပဲလုပ်ငန်း၊ ပန်းထိမ်လုပ်ငန်း၊ စက်ချုပ်လုပ်ငန်း တို့အား လူဦးရေ (၃၀၀) ခန့်လုပ်ကိုင်ဆောင်ရွက်ကြပါသည်။ ကျေးလက်ဒေသများ၏ အဓိကဝင်ငွေမှာ မွေးမြူရေးလုပ်ငန်း ဖြစ်ပါသည်။ အဓိကသီးနှံများမှာ စပါး၊ ပြောင်း၊ ပဲစင်းငုံ၊ နှမ်း၊ မြေပဲတို့ဖြစ်ကြပါသည်။

အထွေထွေအုပ်ချုပ်ရေးဌာန၏စာရင်းအရ လွိုင်ကော်မြို့နယ်တွင် စုစုပေါင်းလူဦးရေ (၇၂၄၆၂) ဦး မှာအလုပ်လုပ်ကိုင်ကြပါသည်။ (၃၁၃၅၁) ဦးမှာ လယ်သမားများဖြစ်ကြပါသည်။ စုစုပေါင်းအလုပ်သမားအရေအတွက်၏ (၄၄.၁%) ဖြစ်ပါသည်။ နေ့စားလုပ်ငန်းလုပ်ကိုင်ဆောင်ရွက်သူ (၂၆%)ရှိပြီး (၁၈၆၆၂) ဦးဖြစ်ပါသည်။ အစိုးရဝန်ထမ်းအရေအတွက်မှာ(၅၃၇၃) ဦးဖြစ်ပြီး (၇.၄ %)ဖြစ်ပါသည်။

၂၀၁၄ ခုနှစ်ကောက်ယူသော သန်းခေါင်စာရင်း အချက်အလက်များအရ လွိုင်ကော်မြို့တွင် အိမ်ထောင်စုစုပေါင်း၏ (၃၂%) သည်လျှပ်စစ်ဓါတ်အားကိုကောင်းစွာရယူသုံးစွဲနေကြပြီဖြစ်သည်။ ကျေးလက်ဒေသများတွင်လျှပ်စစ်ဓါတ်အားလုံလောက်စွာမရရှိနိုင်သေးပါ။နွေရာသီအလွန်ပူပြင်းသောအချိန်အ ဓါတွင်ရေအားလျှပ်စစ်စက်ရုံများကောင်းစွာမလည်ပတ်နိုင်သဖြင့်လျှပ်စစ်ဓါတ်အားထုတ်လုပ်မှုလျော့ကျလာပါ သည်။ ထိုအချိန်ခါတွင်ကျေးလက်ဒေသဧရိယာသာမက လွိုင်ကော်မြို့ပေါ်တွင်ပါလျှပ်စစ်ဓါတ်အား



လုံလောက်ခြင်းမရှိပါ။

လွိုင်ကော်မြို့တော်သည်ဘာသာရေးအဆောက်အဦးများတည်ရှိမှုတွင်လည်းအောင်မြင်သောမြို့တော်ဖြစ်ပါသည်။ စေတီပုထိုးပေါင်း (၉၃) ဆူရှိပါသည်။ မြို့တော်၏ အလယ်တွင်တည်ရှိသော တောင်ကွဲစေတီတော်သည်အထင်ကရကြော်ကြားလှပြီးခရီးသွားလုပ်ငန်းများအတွက်ဆွဲဆောင်မှုရှိသောစေတီတော်ဖြစ်ပါသည်။ ရွှေလက်ယာစေတီနှင့်မြကလက်စေတီတော်တို့သည်လည်းအထူးပင်ကြော်ကြားလှပြီး တောင်ထိပ်တွင်တည်ရှိသဖြင့် အလွန်ပင် ကြည်ညိုဖွယ်ကောင်းပြီး လှပသောရှုခင်းများကိုလည်း တွေ့မြင်နိုင်ပါသည်။

**၄.၂။ သဘာဝပတ်ဝန်းကျင်**

လွိုင်ကော်မြို့တော်သည်ပင်လယ်ရေမျက်နှာပြင်အမြင့်(၈၉၉)မီတာတွင်တည်ရှိပါသည်။ ကယားပြည်နယ် သည်ရှမ်းကုန်းပြင်မြင့်၏အစိတ်အပိုင်းတစ်ခုဆက်ဆက်တည်ရှိနေပါသည်။ တောင်ကုန်းတောင်တန်းများပြား ပြီးခန္တီးတောင်မှာကြော်ကြားပါသည်။ ခန္တီးတောင်သည် ဘီလူးချောင်းမြစ်အထက်အမြင့် (၁၅၆၅) မီတာတွင်တည်ရှိနေပါသည်။

ဇလပေဒအခြေအနေအရ နန့်ဖယ်၊ နန့်စံခ၊ ငွေတောင် ချောင်းများသည် ဘီလူးချောင်းမြစ် အတွင်းသို့စီးဝင်နေကြပါသည်။ ဘီလူးချောင်းမြစ်သည် (၈၇၅) မီတာမှ (၉၀၅) မီတာ အထိရှည်လျားပါသည်။

လွိုင်ကော်မြို့သည်လှပသောရေတံခွန်များ၊ရေကန်များဖြင့်ကြော်ကြားပါသည်။ ဘီလူးချောင်းမြစ်သည် လွိုင်ကော်မြို့ အလယ် (၁၀) ကီလိုမီတာခန့်ဖြတ်သန်းစီးဆင်းသွားပါသည်။ အရှေ့တောင်ဘက်တွင် မထွော့ရ ရေတံခွန်အနီးဖြတ်သန်းပြီးနောက် လောပိတကျေးရွာအနီး လောပိတရေတံခွန် ဖြစ်ပေါ် စေပါသည်။ ရေတံခွန်အမြင့်မှာ (၄၄၂) မီတာအမြင့်ရှိပါသည်။ ထိုရေတံခွန်မှရေအားကိုအသုံးပြုကာ ဘီလူးချောင်းအမှတ်(၁) နှင့် အမှတ် (၂)ရေအားလျှပ်စစ်စက်ရုံတို့ကိုမောင်းနှင်ပြီး လျှပ်စစ်ဓါတ်အား ထုတ်လုပ်နေပါသည်။

လွိုင်ကော်ကုန်မြင့်လွင်ပြင်ဒေသတွင် မြေဆီမြေဩဇာကောင်းမွန်သော မြေအမျိုးစား(၆)မျိုးကို တွေ့ရပါသည်။ (၁) နန်းဆန်သောမြေ (၂)ကောက်ရိုးဆွေးမြေ (၃)စနယ်မြေ (၄)စနယ်မြေဆန်သောမြေနီသဲဝန်း (၅)ဝါညိုရောင်သစ်ဆွေးမြေ (၆)နီညိုရောင်တောင်တန်းမြေ တို့ဖြစ်ပါသည်။

လွိုင်ကော်မြို့၏ရာသီဥတုပတ်ဝန်းကျင်အခြေအနေမှာကုန်းမြင့်သောအပိုင်းတွင်ပူပိုင်းမှတ်သန်ရာသီအခြေအနေ ရှိပြီး ကုန်နိမ့်ပိုင်းဒေသများတွင် စိုစွတ်သောနွေးသမရာသီဥတုအမျိုးအစားကိုရရှိပါသည်။ ဧပြီလတွင် ဖြစ်သောအမြင့်ဆုံး အပူချိန်သည် ၃၆.၇ ဒီဂရီစင်တီဂရိတ်ရှိပြီး ဇန်နဝါရီလတွင်ဖြစ်သော အနိမ့်ဆုံးအပူချိန်မှာ ၈.၁ ဒီဂရီစင်တီဂရိတ်ဖြစ်ပါသည်။ တနှစ်ပါတ်လုံးပျမ်းမျှအပူချိန်မှာ အမြင့်ဆုံး ၃၂.၃ ဒီဂရီစင်တီဂရိတ် နှင့်အနိမ့်ဆုံး ၁၃.၈ စင်တီဂရိတ်ဖြစ်ပါသည်။

မေလ မှ အောက်တိုဘာလထိသည်မိုးရာသီဥတုဖြစ်ပါသည်။ မိုးရာတွင်ရရှိသောမိုးရေချိန်ပမာဏများသည်

ဘီလူးချောင်းရေအားလျှပ်စစ်စက်ရုံလျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးအတွက်အလွန်ပင်အရေးကြီးပါသည်။ ဒီဇင်ဘာလ မှဖေဖော်ဝါရီလအထိသည် မိုးရွာသွန်းမှုအနည်းဆုံးကာလဖြစ်ပြီး တခါတရံမရွာသွန်းပေ။ ဘီလူးချောင်းရေအားလျှပ်စစ်စက်ရုံတည်ရှိသော လွိုင်ကော်မြို့သည်ကုန်းမြင့်လွင်ပြင်နှင့်နီးကပ်ပြီး ဆည် ဧရိယာနှင့်လည်းနီးကပ်နေသောကြောင့်အခြားသောမြို့နယ်အစိတ်ပိုင်းများထက်မိုးရွာသွန်းမှုပိုများသည်။

ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စက်ရုံတည်ရှိသောနေရာသည် မြောက်အင်ဒိုချိုင်းနားနွေးသမ သစ်တောဧရိယာနှင့်နီးသောကြောင့် ဂေဟစနစ်ကောင်းမွန်ပါသည်။ ၁၉၉၉ - ၂၀၀၀ စစ်တမ်းကောက်ချက်များအရ လွိုင်ကော်မြို့နယ်၏သဘာဝသစ်တောဧရိယာသည် ကယားပြည်နယ်သစ်တော ဧရိယာ၏ ၉.၁ %ရှိပါသည်။

သစ်တောဦးစီးဌာနသည် မြေယာအသုံးချခွင့်နှင့်အညီ ကာကွယ်တောများ၊ တောင်ယာစိုက်ပျိုးခြင်း လုပ်ငန်းများ၊ ဒေသခံများအတွက် ထင်းလောင်စာရရှိရန်စိုက်ခင်းများထူထောင်ထားရှိခဲ့ပါသည်။ ၂၀၁၆ ခုနှစ်က အကောင်အထည်ဖော်ဆောင်ရွက်ခဲ့သောအစီအစဉ်အရသဘာဝပတ်ဝန်းကျင်တည်ထောင်မှုအစီအစဉ်တွင်သစ်တော ဦးစီးဌာနမှကယားပြည်နယ်လွိုင်ကော်မြို့အဝင်လေယာဉ်ကွင်းအနီးတွင်ကျွန်းပင်ပေါင်း(၂၆၀၀)ပင်စိုက်ပျိုးခဲ့ ပါသည်။ ယခင်စိုက်ပျိုးခဲ့သော လွိုင်ကော် - ပင်လောင်းအဝေးပြေးလမ်းမတလျှောက်တွင်လည်း စိုက်ပျိုးခဲ့ပြီးသောစိုက်ခင်းများကိုပြန်လည်ပြုစုခြင်းလုပ်ငန်းများကိုလည်းဆောင်ရွက်ခဲ့ပါသည်။

ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စက်ရုံအနီးရှိမိုက်ကမ်းကျေးရွာ မှလည်းဒေသခံပြည်သူအစုအဖွဲ့ပိုင် သစ်တော ၂၁၀ ဧကကိုတည်ထောင်ခဲ့ပါသည်။ သစ်တောများပြန်လည်ထိန်းသိမ်းကာကွယ်ခြင်း၊ သစ်တောထွက်ပစ္စည်းများစဉ်ဆက်မပျက်သုံးနိုင်ခြင်း၊ဒေသခံများ၏လူမှုစီးပွားရေးကိုအထောက်အကူပြုနိုင်ရန် ရည်ရွယ်ခဲ့ပါသည်။ အများဆုံးထိန်းသိမ်းစိုက်ပျိုးခဲ့သောသစ်မျိုးများမှာ အင်၊ အင်ကြင်း၊ သစ်ယာ၊ ထောက်ကြန့်၊ သစ်မျိုးများဖြစ်ပါသည်။ လွိုင်ကော်မြို့သစ်တောဧရိယာအတွင်း တားမြစ်ထိန်းသိမ်းထားသော စာရင်းဝင်သစ်မျိုးမရှိပါ။

**၅။ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုထိန်းသိမ်းရေးနှင့်စောင့်ကြည့်လေ့လာရေးအစီအစဉ်**

**၅.၁။ ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများမှဖြစ်ပေါ်လာနိုင်သောအကျိုးသက်ရောက်မှုများ**

ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စက်ရုံပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများ ဆောင်ရွက်ရာတွင်ဖြစ်ပေါ် လာနိုင်သောအကျိုးသက်ရောက်မှုများအားလေ့လာတိုင်းတာပြီးနောက် ဆိုးကျိုးသက်ရောက်မှုမရှိနိုင်သည်ကို လေ့လာမှတ်တမ်းတင်ထားပါသည်။အသေးစိတ်လေ့လာမှုများပြုလုပ်ရာတွင်လျှပ်စစ်ဓါတ်အားထုတ်လုပ်မည့် အင်ဂျင်အတွက်လိုအပ်သောပြန်လည်အစားထိုးတပ်ဆင်ရမည့်အစိတ်အပိုင်းများလေ့လာခြင်း၊ သိုလှောင်မည့် ဧရိယာသတ်မှတ်ခြင်း၊ဒေသသစ်ပြည်သူများနှင့်တွေ့ဆုံခြင်းလုပ်ငန်းများလုပ်ဆောင်ခဲ့ပါသည်။

တည်ဆောက်ခြင်းလုပ်ငန်းဆောင်ရွက်သည့်အခါတွင် အစားထိုးတပ်ဆင်မည့်ပစ္စည်းကိရိယာများတင်သွင်း မည့်အဖွဲ့အားရွေးချယ်ပြီးနောက် လုပ်ငန်းအကောင်အထည်ဖော်ဆောင်ရွက်ခြင်းကိုလျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီး

ဌာန၊ ရေအားလျှပ်စစ်ထုတ်လုပ်ရေးလုပ်ငန်းဌာနမှဆောင်ရွက်မည်ဖြစ်ပါသည်။

**(က) လူမှုစီးပွားရေးပတ်ဝန်းကျင်**

စီမံကိန်းဧရိယာအတွင်းသို့ စက်များသယ်ဆောင်ခြင်းနှင့် လိုအပ်သောကိရိယာများသယ်ဆောင်ခြင်းလုပ်ငန်း ဆောင်ရွက်ရာတွင်လုပ်ငန်းသုံးကားကြီးများအသုံးပြုရမည်ဖြစ်ပါသည်။ ထိုကားကြီးများအားဖြေးညင်းစွာ မောင်းနှင်မည်ဖြစ်ပါသည်။ ၄ မီတာမှ ၆ မီတာကျယ်သောလမ်းများအတွင်းသို့ဝင်ရောက်ရမည်ဖြစ်ပါသဖြင့် ယာဉ်ကြောကျပ်တောက်မှုအနည်းငယ်ဖြစ်ပွားနိုင်ပါသည်။ စီမံကိန်းလုပ်ငန်းများမှဒေသခံအချို့အလုပ်အကိုင် ကာလတခုထိရရှိမည်ဖြစ်သောကြောင့် ဝင်ငွေတိုးလာမည်ဖြစ်ပါသည်။

**(ခ) သဘာဝပတ်ဝန်းကျင်**

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းအားဆောင်ရွက်ရာတွင် ရေအားလျှပ်စစ်ထုတ်လုပ်ရေးလုပ်ငန်းပိုင်ဘီလူးချောင်း အမှတ်(၁)စက်ရုံ ဝန်းအတွင်းသာဆောင်ရွက်မည်ဖြစ်သောကြောင့်သဘာဝပတ်ဝန်းကျင် ထိခိုက်မှုမရှိပါ။

**(ဂ) ပတ်ဝန်းကျင်ညစ်ညမ်းခြင်း**

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများ ဆောင်ရွက်ရာတွင် အစားထိုလဲလှယ်တပ်ဆင်ရာမှထွက်ပေါ်လာမည့် အနံ့ငယ်သော ကျောက်ဂွမ်းမှုန့်၊ မာကျူရီ၊ ခဲအစရှိသည်တို့အားသေချာစွာသိုလှောင်သိမ်းဆည်းမည်ဖြစ်ပါ သည်။ စီမံကိန်းစက်ရုံဧရိယာအတွင်းရှိ သိုလှောင်သောဧရိယာတွင်သာသေချာစွာသိမ်းဆည်းမည်ဖြစ်သဖြင့် ပတ်ဝန်းကျင်ညစ် ညမ်းမှုမဖြစ်ပေါ်စေပါ။

**၅.၂။ သဘာဝပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်**

• **ကြိုတင်ပြင်ဆင်ခြင်းနှင့်စီစဉ်ခြင်းအဆင့်**  
ပေါ်လာနိုင်သောအကျိုးသက်ရောက်မှုများအားလေ့လာတိုင်းတာပြီးနောက်ဆိုးကျိုးသက်ရောက်မှုမရှိနိုင်သည်ကို လေ့လာမှတ်တမ်းတင်ထားပါသည်။အသေးစိတ်လေ့လာမှုများပြုလုပ်ရာတွင်လျှပ်စစ်ဓါတ်အားထုတ်လုပ် မည့်အင်ဂျင်အတွက်လိုအပ်သောပြန်လည်အစားထိုးတပ်ဆင်ရမည့်အစိတ်အပိုင်းများလေ့လာခြင်း၊သိုလှောင် မည့်ဧရိယာသတ်မှတ်ပြင်ဆင်ခြင်း၊ဒေသသံ့ပြည်သူများနဲ့တွေ့ဆုံခြင်းလုပ်ငန်းများလုပ်ဆောင်ခဲ့ပါသည်။

• **ပြန်လည်ပြုပြင်ခြင်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့်အဆင့်**

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ခြင်းကိုစီမံကိန်းဧရိယာစက်ရုံအတွင်းသာ လုပ်ကိုင်ဆောင်ရွက်မည် ဖြစ်သောကြောင့်လူမှုစီးပွားရေးပတ်ဝန်းကျင်နှင့်သဘာဝပတ်ဝန်းကျင်ကိုထိခိုက်မှုမရှိစေပါ။ လျှပ်စစ်နှင့်သက်ဆိုင်သောစက်ပစ္စည်းကြီးများအားသယ်ဆောင်လဲလှယ်ရာတွင် ကျောက်ဂွမ်းမှုန့်၊ မာကျူရီ၊ ခဲ အစရှိသော စွန့်ပစ်ပစ္စည်းများအား သယ်ဆောင်လဲလှယ်ပြီး စက်ရုံဝန်းအတွင်း သိုလှောင်သည့် ဧရိယာ တွင်သာထားရှိမည်ဖြစ်သောကြောင့်ပတ်ဝန်းကျင်ထိခိုက်မှုမရှိဟုမျှော်လင့်ပါသည်။ စီမံကိန်းလုပ်ငန်းများ အကောင်အထည်ဖော်ဆောင်ရွက်ရာတွင်အောက်ဖော်ပြပါ လမ်းညွှန်ချက်များ၊စံချိန်စံညွှန်းများနှင့်အညီ ဆောင်ရွက်သွားရန်ဖြစ်ပါသည်။

- a. World Bank Good Practice Note - Asbestos: Occupational and Community Health Issues
- b. IFC: Guidance Note 4: Community Health, Safety and Security
- c. IFC: Environmental Health, Safety (EHS) Guidelines-General EHS Guidelines: Construction and Decommissioning

**စက်ပြန်လည်မောင်းနှင်ခြင်းနှင့်ထိန်းသိမ်းခြင်းအဆင့်**

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းပြီးစီးသွားပါက ပြန်လည်မောင်းနှင်ခြင်းနှင့် ထိန်းသိမ်းခြင်းလုပ်ငန်းအား လုပ်ကိုင်ဆောင်ရွက်မည်ဖြစ်ပါသည်။ စီမံကိန်းအတွင်း ပြုပြင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ခြင်းအတွက် (CSR – Cooperative Social Responsibility )အစီအစဉ်အား ရေအားလျှပ်စစ်ထုတ်လုပ်ရေးလုပ်ငန်း EPGC မှတာဝန်ယူဆောင်ရွက်မည်ဖြစ်ပါသည်။

**၅.၃။ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးစောင့်ကြည့်လေ့လာရေးအစီအစဉ်**

ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်စီမံကိန်းပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်း ဆောင်ရွက်ရာတွင်အကောင်အထည်ဖော်ဆောင်ရွက်ခြင်း၊ပြန်လည်မောင်းနှင်ခြင်းနှင့်ထိန်းသိမ်းခြင်းစသောအဆင့်များတွင် သဘာဝပတ်ဝန်းကျင်၊လူမှုစီးပွားရေးပတ်ဝန်းကျင်တို့ အပေါ်တွင်ဆိုးကျိုးထိုခိုက်မှုအောက်ပါအချက်များဖြင့်စောင့်ကြည့်တိုင်းတာခြင်းအားဆောင်ရွက်မည်ဖြစ်ပါသည်။

၁) သဘာဝပတ်ဝန်းကျင်၏မည်သည့်အစိတ်ပိုင်းမျှမထိခိုက်ခြင်း

၂) ဒေသခံပြည်သူများ၏အလုပ်အကိုင်အခွင့်အလမ်းများတိုးတက်လာသဖြင့်အပြုသဘောဆောင်ခြင်း

၃) ကနဦးအဆင့်တွင်သာ ယာဉ်ကြောသွားလာမှုကြပ်တည်းခြင်း

ပတ်ဝန်းကျင်ထိန်းသိမ်းမှုစောင့်ကြည့်လေ့လာရေးလုပ်ငန်းများအားလုပ်ငန်းအကောင်အထည်ဖော်ဆောင်ရွက်သည့်အဆင့်၊စက်ပြန်လည်မောင်းနှင်သည့်အဆင့်နှင့်ထိန်းသိမ်းသည့်အဆင့်တို့တွင် သေချာစွာဆောင်ရွက်ရမည်ဖြစ်ပါသည်။ လေထုအရည်အသွေး၊ မြေအရည်အသွေး၊ ရေအရည်အသွေးတို့ မသိမသာပြောင်းလည်းခြင်းရှိမရှိကိုသေချာစွာစောင့်ကြည့်ရမည်သာမကဒေသခံများ၏စီးပွားရေး၊ဝင်ငွေရရှိမှုအခြေအနေတို့ကိုလည်းသေချာစွာစောင့်ကြည့်ရမည် ဖြစ်သည်။

အစီရင်ခံစာများမှအစီရင်ခံမှုတွင်လည်းအောက်ပါအချက်အလက်များကိုစောင့်ကြည့်လေ့လာရမည်။

၁) ရေအရည်အသွေးနှင့်မြေအရည်အသွေးစစ်ဆေးမှုကို ၆ လလျှင်တကြိမ်အစီအရင်ခံခြင်း

၂) ဒေသခံပြည်သူများနှင့်တွေ့ဆုံဆွေးနွေးခြင်းကို (၂၀၁၆)ခုနှစ် တွင် ၂ ကြိမ်ပြုလုပ်ခဲ့ပါသည်။ ထိုစဉ်ကထွက်ပေါ်ခဲ့သောအချက်အလက်များကိုအခြေခံကာစီမံကိန်းကာလအတွင်းပြောင်းလဲမှုနှင့်တိုးတက်မှုကိုအစီ အရင်ခံခြင်း

၃)စီမံကိန်းလုပ်ဆောင်ချက်များနှင့်ပါတ်သက်ကာဒေသတွင်းဖွံ့ဖြိုးတိုးတက်မှုများအတွက်လူမှုတာဝန်ယူမှုအစီအစဉ်ကိုရေးဆွဲရပါမည်။ စီးပွားရေးဖွံ့ဖြိုးတိုးတက်မှု၊ လူမှုရေးဖွံ့ဖြိုးတိုးတက်မှု၊ သဘာဝဘေးအန္တရာယ်ကာကွယ်ရေးနှင့် ကယ်ဆယ်ရေးအစီအစဉ်များကိုရေးဆွဲထားရှိရပါမည်။

**Environmental Management Plan (EMP)**  
**for**  
**Rehabilitation Project of Baluchaung No.1 Hydropower Plant**

**Executive Summary**

**1 Outline of the Project**

- There are 18 HPPs that are of the run-of-river type out of total 24 existing HPP in Myanmar. Total installed capacity of the run-of-river type power plants is 1,082 MW, which is equivalent to around 36% of total hydropower output of the country. The commercial operation of the run-of-river type HPPs started from 1970s to 1990s are aging without appropriate rehabilitation works to date.
- As compared to rated power output of all existing HPPs in Myanmar, actual power output has been decreasing by approximately 30% in the rainy season. Furthermore, in the dry season, actual output decreased by approximately 50% due to the lack of rainfall i.e. decrease of river flow rate. Baluchaung No.1 HPP is one of the old HPPs.
- In the speech by the President U Thein Sein in August 2013, power sector is considered to be the top priority of economic and social development. Subsequently, in the scheme of the National Electricity Master Plan carried out in 2014, it is suggested that rehabilitation of these deteriorating hydropower plants is recommended from a standpoint of preventive measures against failures because deterioration of major equipment and parts of Baluchaung No.1 HPP and Baluchaung No.1 HPP among others are progressing. Thus, rehabilitation of the existing power plants is regarded as the top priority measure from viewpoint of high economic efficiency, low environmental burden, and no need of additional fuel purchasing for thermal power generation plants.
- It is during the 2014 survey of the National Electricity Master Plan, and subsequent “Preparatory Survey on Hydropower Plants Rehabilitation Project in the Republic of the Union of Myanmar” carried out in 2016, for which assessment of natural wear and tear of Myanmar’s power generation system, including weathering conditions of the Baluchaung No.1 HPP was studied and that the survey concluded rehabilitation works for a number of areas on the Baluchaung No.1 HPP has to be carried out as preventive measures.
- Baluchaung No.1 HPP began its operation in 1992. There has not been any overhaul works carried out while aging of equipment as normal wear and tear are noticed such as water leakages of guide vane and cooling system for pumps, sedimentation inside the turbine pit, and oil leakages from the hydraulic equipment for turbine governor control mechanism and other part of the power generation system.
- Because of the natural wear and tear during the past 30 years, and because of the scheduled maintenance works, Baluchaung No.1 HPP has therefore become subject to rehabilitation works on the various parts of the electric power generation plant. This work excludes the dam body itself.
- Considering the above, the Government of Myanmar requested the Government of Japan regarding the rehabilitation of Baluchaung No.1 HPP in order to acquire further lifetime for power generation. In response to the request, JICA conducted the “Preparatory Survey on Hydropower Plants Rehabilitation Project in the Republic of the Union of Myanmar” in 2016.

- Project area is confined within the compound of the powerhouse Baluchaung No.1 HPP. The area is approximately 95 m x 57m and some 4,800 m<sup>2</sup> of the area.
- Salient features of Baluchaung No.1 HPP is shown in the table below:

#### **Salient Features of Baluchaung No.1 HPP**

Location	Loikaw, Kayah State (20 km southeast of the township)
Construction Starting Year	1987
Commercial Running Year	1992
Weir	Concrete weir 11.0 m
Catchment Area	7,960 km <sup>2</sup> (Baluchaung River of Thanlwin River System)
Max. Discharge	2 × 840 ft <sup>3</sup> /s = 1680 ft <sup>3</sup> /s
Effective Head	69.6 m
Intake Reservoir	Earth fill Dam, 11 m (36 ft) height, 530 m (1738.4 ft) Length, 2.07 Cu.m (70.6 m.c.f)
Regulation Pondage	Effective Storage: 112000 cu.m (3.96 m.c.f) Syphon Spillway: 1680 Cusec
Installed Capacity	28 MW (14 MW x 2 Nos)
Generator	Vertical Shaft, Rotating Field totally enclosed 3 phase, 50 Cycles A.C. Synchronous Generator-semi-umbrella Type
Type of Turbine	Francis turbine vertical (Hitachi-Mitsubishi) 14 MW x 2 Nos
Type of Governor	Electro-hydraulic Governor
Number of Vanes	Guide Vanes: 20 No., Stay Vanes: 20 No.
Outdoor Switchyard	132 kV Single Buster System
Breakers	132kV/33 kV Oil Minimum 3 Phase auto-recloser and also single phase auto-recloser for 132 kV Feeder
Transformers	Main Step-up: 5,100 kVA Single Phase, Distribution Transformer: 5,000 kVA 11/33 kV 3 Phase, Isolating Transformer: 5,000 kVA 11/11 kV 3 Phase, Station Transformer 500 kVA 11/0.4 kV 3 Phase
Transmission Line	132 kV BHP (2) Line (9.3) miles, 11 kV Loikaw Line (10.5) miles, and 11 kV Dawtachar Line (5.5) miles

Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

- General schedule of the rehabilitation works is as follows:
  - 1) Survey and Design of the Rehabilitation Works: May 2018-May 2019
  - 2) Tender Process for Electro-mechanical Supplier: August 2019-October 2019
  - 3) Implementation of Rehabilitation Works: April 2020-February 2023
  - 4) Transmission Line and Substation: December 2020-December 2021

- The following organizations are involved in executing the rehabilitation works of the Baluchaung No.1 HPP:

**1) Implementation Organization**

Ministry of Electricity and Energy (MOEE), Electric Power Generation Enterprise (EPGE)

Office No. 27, Nay Pyi Taw

Tel. +95-067-8104290

E-mail: hpgemd@moep.gov.mm

Contract for the Implementation of the Project Began in May 2018.

**2) Consulting Engineers**

NEWJEC Inc. (with a joint venture of: Nippon Koei Co.Ltd. and Myanmar International Consultant)

Head Office: NEWJEC Inc.

3-20, Honjo-Higashi 2-chome, Kita-ku, Osaka 531-0074, Japan

Tel. 81-6-6374-4059, Fax. 81-6-6374-5198,

Project Manager: Mr. Mikio Takahashi E-mail: takahashiko@newjec.com

Local Office: NEWJEC Inc. Myanmar Branch

Room No.506, 5th floor, La Pyi Wun Plaza,

No.37, Alanpya Pagoda Road, Dagon Tsp, Yangon Region, Myanmar

Tel. +95(0)1-376947, Fax. +95(0)1-376947

Consulting Services Began in May 2018

## 2 Objectives and Scope of the Project of Rehabilitation Works

- Within the framework of this EMP Report, the “Project” implies “Rehabilitation Works of replacing electro-mechanical parts of the power generation system of the Baluchaung No.1 HPP”.
- In the scheme of the National Electricity Master Plan carried out in 2016, it is suggested that rehabilitation works of hydropower plants is recommended from a standpoint of preventive measures against failures because natural wear and tear have been leading to the deterioration of major hydropower equipment and the existing Baluchaung No.1 Hydropower Plant (HPP) is one of them.
- The rehabilitation works is carried out within the existing Baluchaung No.1 HPP and its working area. The site is in on the northeastern corner of Loikow Township, which is one of the 7 townships of Kayah State. Replaced electric parts and equipment are subject to store in the storage buildings constructed on the land owned by EPGE.
- The Project of rehabilitation works for Baluchaung No.1 HPP takes place within the confined space of electric power plant would cause relatively low environmental impact as there is no need of additional large-scale construction works of hydropower plant, gas-fired or coal-fired thermal plants.
- The Project is implemented through replacement of turbines, repairing works of water intake structures and addition of equipment and devices without expansion of site while increase in power generation capacity is achieved and that the Project is planned to implement by Electric Power Generation Enterprise (EPGE).
- As for the implementation schedule, the Project for rehabilitation works of the existing Baluchaung No.1 HPP will start with preparation works such as selection of consultant, detailed design study and documentation for tender procedures in May 2018. The Project on site will start during the first half of 2021 and it has to be completed within 2 years.
- Objectives of the rehabilitation works is to 1) No changes in the existing land use; 2) No changes in the civil structures; 3) Changes of the internal facilities related to power generation system; and 5) replace parts of power generation system without stoppage of the power generation operation.
- Contents of the rehabilitation works on Baluchaung No.1 HPP are shown in the following table. As is shown, Turbine, Generator, Control System, and Transmission Line are the major areas of the rehabilitation works. As stated above, no part of civil works are subject to the habilitation works.

### Contents of the Rehabilitation Works

Rehabilitation item	Action	Q'ty	Remarks	
Turbine	Turbine Runner Vane	R	2 sets	Newly developed by CFD, and turbine model test is required.
	Turbine Runner Hub	R	2 sets	ditto
	Guide Vane	R	2 sets	ditto
	Guide Vanes Stem Bush	R	2 sets	All bushes are to be replaced
	Inner Head Cover	R	2 sets	Newly developed by CFD, and turbine model test is required.
	Turbine Guide Bearing	R	2 sets	Replaced for segment-type bearings
	Shaft Sleeve	R	2 sets	(one of wearing parts)
	Shaft Sealing Box	R	2 sets	Newly designed device is to be applied
	Runner Vane Return Mechanism	R	2 sets	In harmony with the rehabilitation of generator exciter and digitalized governor system.
	Pressure Oil Supply Pipe for Runner Vane	R/A	2 sets	Components related to the new runner are to be replaced. The other existing components are to be



	Servomotor			used.
	Cooling Water Supply System	P/R	1 set	One set for the plant system. Pump sets, motor-driven valves and local control panels are to be replaced. Existing hand-operated strainers are to be replaced to new motor-driven ones. Small exposed water pipes are to be replaced to stainless steel ones.
	Water Drainage System	P/R	1 set	One set for the plant system All drainage pumps, local control panels and water level detectors are to be replaced.
	Pressure Oil Supply System	P/R	1 set	One set for the plant system Oil sump tank set, air compressor sets, local control panels, etc. are to be replaced.
	Overhead Crane	P/R	1 set	Parts to be repaired and/or replaced are to be checked and specified by a supervisor of the crane manufacturer.
Generator	Stator and Rotor Winding	R	2 sets	2 sets each for Stator and Rotor Bearing
	Guide and Thrust Bearing	R	2 sets	2 sets each for Guide and Thrust Bearing
	Air cooler	R	2 sets	-
	Brake system	R	2 sets	-
	Lubrication oil cooling system	R	2 sets	-
	Excitation system	R	2 sets	to brushless (AC) excitation system
	Neutral grounding device	R	2 sets	Neutral grounding transformers are to be replaced.
Control and Protection System	Total digital system (SCADA)	R	1 set	Updated to total digital system including SCADA function
	Automatic Voltage Regulator	R	1 set	Updated to all-in-one protective control unit and exciter control panel
	Generator Vibration Monitor	R	1 set	Replaced with new components
	Control Cable	R	1 set	Replaced with new cables
	Ventilation System	R	1 set	3 air-intake units, 3 air-exhaust units (roof-mounted), and intake/exhaust control panels are updated.
	Governor Control Equipment	R	1 set	Updated to digital PID-GOV system
	Air Conditioning System	R	1 set	Replaced with new components
Substation and Transmission Line facilities	Generator Transformer	R	7 sets	5.1MVA/set, 132/11 kV, incl. Spare Tr.
	Switch Equipment (All)	R	1 lot	132 kV CB: 5sets, 132 kV DS: 7 sets, CT: 12 pcs, CVT: 9 pcs, LA: 12 pcs
	132/11 kV Powerhouse Service Transformer	A	1 set	132/11 kV, 5 MVA, 50 Hz, ONAN
	11 kV Vacuum Circuit Breaker	R	10 panels	Metal-enclosed panel with VCB, DS, CT, VT and SA.
	11 kV Phase Shift Transformer	R	1 set	11/11 kV, 5 MVA, 50 Hz, ONAN
	Powerhouse Service Transformer	R	2 sets	Indoor type, 11/0.4 kV, 500 kVA, cast-resin mold
	Emergency Diesel Generator Set	R	1 set	300 kVA, 50Hz, 400/230V
	Plant DC Battery Bank	R	2 sets	Lead acid, valve-regulated type, 300AH
	DC Battery Charger	R	2 set	Input: AC 400V, Output: DC230V
	400 V House Service Equipment	R	1 lot	400V, Indoor, type, ACB or MCCB

Note: R: Replacement, P: Repair, A: Addition, I: Inspection

- All of the replaced electro-mechanical parts are stored in the storage area constructed for storage purposes as per the drawing shown below. These storage facilities are constructed within the area currently in the possession of EPGE.

### 3 Laws and Regulations Applied to the Rehabilitation Works of Baluchaung No.1 HPP

- The laws and regulations for environmental requirement of the Government of Myanmar, particularly the “Environmental Impact Assessment Procedure of Myanmar” Chapter VII Environmental Management Plan is applied in respect to the study on the environmental impact assessment and consequent Environmental Management and Monitoring Plan.
- Because of the rehabilitation works of Baluchaung No.1 HPP is generally funded by JICA, “JICA Guidelines for Environmental and Social Considerations (2010)” is applied. Further, there are international agreements on the disposal of PCB contained in the insulation oil of transformers. Thus, environmental safeguard policies of IFC, UNEP, ADB and World Bank are applied where appropriate.
- Based on the “Environmental Impact Assessment Procedure of Myanmar”, rehabilitation works for Baluchaung No.1 HPP requires elaboration of EMP according to the Article 55 (a) of the Rules or Article 24 of the Procedure, EPCG is to prepare EMP in relation to the .
- Environmental Management Plan (EMP) including Environmental Monitoring Plan (EMoP) has to be elaborated for the rehabilitation work of Baluchaung No.1 HPP based on the general method of environmental impact assessment as per Myanmar’s environmental laws and regulations. The following has therefore been carried out:
  - 1) Examination of the existing environmental conditions around the project area of Baluchaung No.1 HPP in terms of the local natural environment and socio-economic environment;
  - 2) Possible impacts are identified, and the extent of the impacts have been evaluated for 17 items on the Social Environment, 9 items on the Natural Environment and 10 items of the Environmental Pollution have been examined in terms of the effect of the rehabilitation works on the environmental and social conditions around the project area;
  - 3) Evaluation of expected environmental and social impacts have been classified as 1) There is significantly and adversely affected environment - rating A; 2) The environment affected with some significance - rating B; 3) The environment not significantly affected but some negative impact involved in it – rating C; and 4) Rating D for the environment of no impact induced by the project. As a result of evaluation, the following is noted;
    - a. No part of the socio-economic environment is significantly affected;
    - b. No part of the natural environment is directly affected by the Project;
    - c. Solid waste and other electric equipment/parts are stored on site including insulating oil that contains PCB with strict safety majors.

## 4 Existing Environmental Conditions of the Project Area

### 4.1 Socio-economic Environment

- Baluchaung No.1 HPP is located on Baluchaung River in the southeaster corner of Loikaw Township, which is the capital city of Kayah State. The area is in the southern rim of Eastern Highland of Myanmar where the area is generally covered with thick highland vegetation. It is one of the seven townships of Loikaw District in Kayah State.
- Based on the 2014 Myanmar Population and Housing Census, the demographic information in Loikaw Township, total populations are 128,401. Population density of the township is approximately 83 persons per km<sup>2</sup>. There are 63,109 males and 65,292 females. This make there are 97 males per 100 females. Average size of household is 4.6 persons. It is comparatively higher than Myanmar’s average of 4.4 persons per household.
- The cultivated areas were recorded as 59,057 acres while the reserved and non-reserved forest areas were 72,873 acres in 2018. Farmers usually grow crops only in monsoon season. Summer rice is grown with irrigation in the area of Moby Dam in Phekon Township in Shan State.
- There are huge areas of upland, *Ya*, which occupies 66.0 %, the low land rice area is 33.3% in the total township’s cultivated areas. The other land utilization in reserved and non-reserve forest, such as farming and mining industries, are observed with total area of 2,119.48 acres.
- With good rainfalls and irrigation facilities, some villages have homestead gardens, growing vegetables and kitchen crops for extra income. The perennial trees are also found in several villages although forest areas do not generally exist in rural area. Because of the timber extraction, charcoal making and fuel wood for several decades, the lands were already deforested, encroached by agriculture lands.
- The cottage industries like loom weaving, blacksmith, goldsmith, sewing etc. provide job opportunities to about 300 workers. In the rural area, farming is the major activity for income generation of all households. The major crops are rice, maize, pigeon peas, groundnut and sesame.
- According to the data recorded by the GAD, Loikaw Township has the work force of total 72,462 people. Among them the highest number is 31,351 farmers (44.1%), followed by casual workers of 18,662 (26.0%). Government staffs are recorded as 5,373 (7.4%).
- In Loikaw Township, approximately 32% of households use electricity as their main source of energy for lighting, although disparities between urban and rural areas are striking (Myanmar Census, 2014). Even those who have access are suffering from frequent power outage due mainly to the deterioration of power generation facilities, shortage of fuel gas, and limited output of hydropower stations in the hot summer season. It is a common issue that the urban areas of Myanmar, including Loikaw Town and rural villages, have limited electricity access or a poor electricity power situation. With increasing population, the electricity demand has risen gradually; insufficient amount/voltage of electricity becomes a major issue.
- Based on the Myanmar Census of 2014, some 32.4% of households use electricity as their main source of energy for lighting, although disparities between urban and rural areas are strikingly different. Even those who have access to electricity are suffering from frequent power outage due to mainly to the deterioration of power generation facilities, shortage of fuel gas, and limited output of hydropower stations in the hot summer season.
- Loikaw Township is a thriving place with religious infrastructure. There are 93 pagodas in Loikaw Township. The most famous and much attractive to the tourists, local and abroad is the “Taung-kwe Sedi (Broken Hills)”, which is located in the center of the town. Taung-thone-lone (Three mountain ranges),

Shwe-letwar (Gold palm pagoda) and Mya-kalart pagodas are the most well-known pagodas located on the hill tops, with a scenic beauty of Loikaw.

## 4.2 Natural Environment

- Loikaw Township is located in Kayah State at 899 meters above sea level. Kayah State is a part of Shan Plateau, however when it stretches out southwards, it gradually loses its plateau character. In the whole township, a number of hills and mountain ranges are seen. The Kanti Mountain Range, with the highest peak about 1,565 meters lies on the east of Baluchaung River.
- Hydrologically, small streams flowing into the Baluchaung River are Namphe, Namsamkha and Ngwegaung streams. Generally, water level of Baluchaung River ranges from 905 m to 875 m.
- Loikaw Township is famous for its beautiful waterfalls and lakes. The Baluchaung River passes through in the centre of Loikaw and then continues about 10 km southeast ward approaching Mahtawkhu Waterfall (76.2 m high) and then continues flowing southeast, in the Lawpita village where Lawpita waterfall appears with an altitude of the 442 m. These waterfalls are now used as the site of the Baluchaung No.1 and No.2 HPPs.
- Because of the plateau type of land scape in the eastern part of Loikaw Township and sloping toward west, soil conditions generally found in Loikaw Township from the west to east are: 1) Alluvial Soil, 2) Meadow and Meadow Alluvial Soil, 3) Dark Compact Savanna Soil, 4) Dark Compact Irrigated Savanna Soil; 5) Yellow Brown Savanna Soil; and 6) Mountainous Red Brown Forest Soil.
- Climatically, Loikow Township's upland areas enjoy humid subtropical type of climate and the lower portions have tropical monsoon type of climate. From 2001 to 2010, the highest maximum temperature was 36.7°C (in April) and the minimum of 8.1°C (in January). The average maximum and minimum temperatures were 32.3°C and 13.8°C, respectively. The mean temperature was 23.1°C.

Rainy months are from May to October. The amount of rainfall during the monsoon season is an important source of the inflow for electricity generation of Baluchaung No.1 HPP. January, February and December are months with fewer rains or sometimes no rain. Since Baluchaung No.1 HPP site is located in Loikow Township and it is very close to the "Eastern Highland", the area around dam site receives more rains than the other parts of Loikow Township.

- Ecologically, Baluchaung No.1 HPP is located right on the border between "Northern Indochina Subtropical Forest". Because of the easy-to- access of these eco-system area, natural forest area of the Loikow Township has become 9.1 % of the total land area based on the 1999-2000 survey record.
- Forest Department has been striving for the establishment of Protected Public Forest from the unclassified forests, with the land use right of Taung-ya cultivation and fuel wood collection to the community. As a part of "Green Environment Campaign (Year 2016)", Kayah Regional Forest Department cultivated 2,600 teak tress near the Loikaw airport at the entrance of the Loikaw Town. Forest Department also takes care of the tree plantation previously cultivated along the Loikaw - Pinlong highway for the reforestation of the surroundings areas.
- Among the five villages of study sites in the vicinity of Baluchaung No.1 HPP, Mite Kan village established a "Community Forest" of 210 acres from their traditionally conserved forests in 2015. The objectives are conservation of forests and spring sources, sustainable use of forest products and to improve the socio-economy of the local community. Most tree species in the Community Forest are Inn, In-gyin, Thit-yar, Htauk-kyant trees (in Myanmar language).
- There is no known wildlife/plant protected area within the boundaries Loikow Township. There is also no known landscape of tourism value in Loikow Township.

## 5 Environmental Management and Monitoring Plan

### 5.1 Environmental Impacts Induced by the Rehabilitation Works

- Based on the current operation of Baluchaung No.1 HPP, no significant environmental impacts have been recorded to date i.e. this is the conditions of the Planning Stage of the Rehabilitation Works for Baluchaung No.1 HPP. Detailed study on the replacement and/or addition of power generation system, securing stockyard/storage area including stakeholder engagement was carried out.
- During the implementation stage, upon spare parts suppliers are determined, and all the replacement works are carried out by EPGE, the following impacts are induced by the implementation of rehabilitation Works.
  - 1) Socio-economic Environment
    - Heavy trucks should transport transformers and other equipment subject to replacement into the project site at very slow speed. Thus, during the initial months, there would be occasional traffic congestion as they enter the local road of 4 – 6 m wide; and
    - Local unskilled laborers are employed for a limited period i.e. cash income opportunities are increased to some extent.
  - 2) Natural Environment: No significant impact is induced by the rehabilitation works because all the works are carried out within the confined area in the possession of EPGE; and
  - 3) Environmental Pollution: Chemicals possibly generated as a result of the rehabilitation works would be nominated amount of Asbestos, Mercury (Hg) and Lead (Pb). They are not causing hazard because of the form of them are in the end products and no dismantle or disposal of them are carried out on site but stored in the designated storage area within the framework of the rehabilitation works.

### 5.2 Environmental Management Plan

- **Preparation and Planning Period:** Based on the current operation of Baluchaung No.1 HPP, no significant environmental impacts have been recorded to date i.e. this is the conditions of the Planning Stage of the Rehabilitation Works for Baluchaung No.1 HPP. Thus, during this time, detailed study on the replacement and/or addition of power generation system, securing stockyard/storage area including stakeholder engagement are carried out.
- **Implementation Period of the Rehabilitation Works:** Because of the nature of works carried out generally inside the sub-station, rehabilitation works are not causing hazard to the socio-economic and the natural environment in most cases. Relatively large number of electro-mechanical parts that some of them contain Asbestos, Mercury and Lead are removed from sub-station and operation system and that they are stored on site. However, because of the form of them are in the end products and no dismantle or disposal of them are carried out on site, no hazardous operation is expected to take place.

Based on the MDBs safeguard policies, the following guideline are adapted for safety measures during the Rehabilitation works for Baluchaung No.1 HPP:

- d. World Bank Good Practice Note - Asbestos: Occupational and Community Health Issues
- e. IFC: Guidance Note 4: Community Health, Safety and Security
- f. IFC: Environmental Health, Safety (EHS) Guidelines-General EHS Guidelines: Construction and Decommissioning

- **Operation and Maintenance Period:** Upon completion of the rehabilitation works, Baluchaung No.1 HPP is put into regular operation and maintenance period. No part of the operation of hydropower generation is subject to cause significant impacts on the natural environment induced by the operation. However, EPGE is responsible for dissemination of the completion of rehabilitation works upon resumption of the operation of hydropower generation as well as various activities under the scheme of Corporate Social Responsibility (CSR).

### 5.3 Environmental Monitoring Plan

- During the rehabilitation works implementation period as well as the operation and maintenance period of the Project for Baluchaung No.1 HPP, impacts induced by the project on the natural environment and socio-economic environment as well as the environmental pollution is summarized as follows::

- 1) No part of the natural environment is significantly affected;
- 2) Local employment could be positively enhanced because of the increased opportunities for casual labor;
- 3) The traffic condition is affected during the initial stage of the Project; and
- 4) Storage of electro-mechanical parts, which contains nominal amount of toxic chemicals.

Thus, monitoring works should be carried out during the operation and maintenance period in order to which if ambient soil or water is contaminated during the period of storage of the electro-mechanical parts and that if it would be of cumulative nature. Socio-economic environment should also be monitored in order to find if there were no significant negative changes of the socio-economic conditions of the local population.

- Periodical monitoring should be carried out as follows:
  - 1) Water and soil contamination test should be carried out every 6 months;
  - 2) Stakeholder meetings held two times in June and September 2016 for information disclosure and public participation is the baseline data. Followed up for further monitoring of the social environment in relation to the project has to be carried out; and
  - 3) Corporate social responsibility (CSR) incorporated into the business model of EPGE would have to be developed in the light of the energy development scheme of Myanmar. Any organization implementing infrastructure projects significant to the national economy in these days are requested to draw attention for elaborating stakeholder engagement plan. Organization's commitment is strongly required for periodical implementation of stakeholder engagement, industrial safety drills including evacuation plan at the time of natural disaster, and any other commitment for the welfare of the local population that are affected by the project implementation.

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*Abbreviations*

ADB	:	Asian Development Bank
PAPs	:	Project Affected Persons
BAP	:	Biodiversity Action Plan
Cu.m	:	Cubic meter
CSR	:	Corporate Social Responsibility
DHPI	:	Department of Hydropower Implementation
ECD	:	Environmental Conservation Department of MONREC
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
EMoP	:	Environmental Monitoring Plan
EPGE	:	Electric Power Generation Enterprise
ESIA	:	Environmental and Social Impact Assessment
GAD	:	General Administration Department
GOJ	:	Government of Japan
GOM	:	Government of Myanmar
HPP	:	Hydropower Plant
IEE	:	Initial Environmental Examination
IFC	:	International Finance Corporation
JICA	:	Japan International Cooperation Agency
kV	:	Kilo Volt
kVA	:	Kilo Volt Ampere
m.c.f	:	Million Cubic Feet
MCCB	:	Molded Case Circuit Breaker
MDB	:	Multinational Development Bank
MOALI	:	Ministry of Agriculture, Livestock and Illigation
MOEE	:	Ministry of Electricity and Energy
MONREC	:	Ministry of Natural Resources and Environmental Conservation
MW	:	Mega Watt
NCS	:	National Conservation Strategy
NEP	:	National Environmental Policy
NEAP	:	National Environmental Action Plan
NEQS	:	National Environmental Quality Standards
NHLH	:	National History and Literary Heritage
NOC	:	Non-Objection Certificate
NGOs	:	Non-Governmental Organizations
OP	:	Operational Policy
PCB	:	Polychlorinated Biphenil
PS	:	Performance Standards
PAI	:	Project Area of Influence
SPS	:	Safeguard Policy Statement
SR	:	Safeguard Requirements
S/S	:	Substation
T/L	:	Transmission Line
SWM	:	Solid Waste Management

UNEP : United Nations Environment Programme  
UNFCCC : United Nations Framework Convention on Climate Change  
WB : World Bank  
WBG : World Bank Group

## 1 Outline of the Project

### 1.1 Background of the Project

In the speech by the President U Thein Sein in August 2013, power sector is considered to be the top priority of economic and social development. In the scheme of the National Electricity Master Plan carried out in 2014, it is suggested that rehabilitation of these power plants is recommended from a standpoint of preventive measures against failures because deterioration of major equipment and parts of Baluchaung No.1 HPP and Baluchaung No.1 HPP among others are progressing. Thus, rehabilitation of existing power plants is regarded as the top priority measure from viewpoint of high economic efficiency, low environmental burden, no need of additional fuel purchasing for thermal power generation plants.

In Myanmar, there are 18 HPPs that are of the run-of-river type out of total 24 existing HPPs, and total installed capacity of run-of-river type power plants is 1,082 MW, which is equivalent to around 36% of total hydropower output. The commercial operation of the run-of-river type HPPs started from 1970s to 1990s are aging without appropriate rehabilitation. Due to deterioration of facilities and failures of equipment, etc. as compared to rated power output of all existing HPPs actual power output decreased by approximately 30% in the rainy season and furthermore in the dry season actual one decreased by approximately 50% due to decrease of river flow.

As of November 2015, regarding power supply composition of existing power sources in the Republic of the Union of Myanmar (Myanmar), installed capacity of hydropower is 3,011 MW (including export amount to China of 521 MW), one of gas-fired thermal power is 1,520 MW and one of coal-fired thermal power is 120 MW. Installed capacity of hydropower occupied around 64.7% of total one. Because large-scale HPPs (Hydropower Plants) have operated since 2005, total installed capacity increased up to about 4,651 MW in 2015, which is approximately 1.3 times more than one in 2010.

However due to output reduction during the dry season, aging (deteriorated) equipment and so on actual maximum power supply was only around 2,000 MW in 2014. On the other hand total power demand reached around 2,500 MW in 2014, power shortage of around 500 MW occurred and frequent planned power outage cannot be avoided. According to the scheme of the National Electricity Master Plan by MOEE (Ministry of Electricity and Energy) in Myanmar, which JICA (Japan International Cooperation Agency) assisted to formulate, total power demand in 2030 is forecasted to increase up to around 14,500 MW at maximum, therefore enhancement of power supply is urgent issue.

Considering above-mentioned situations, GOM (Government of Myanmar) requested the GOJ (Government of Japan) regarding the rehabilitation of Baluchaung No.1 HPP and Baluchaung No.1 HPP to acquire further lifetime for power generation. In response to the request, JICA decided to conduct the “Preparatory Survey on Hydropower Plants Rehabilitation Project in the Republic of the Union of Myanmar”. Thus, the GOJ (Government of Japan) extended the technical and financial assistance for rehabilitation of Baluchaung No.1 HPP in order to acquire further lifetime for power generation.

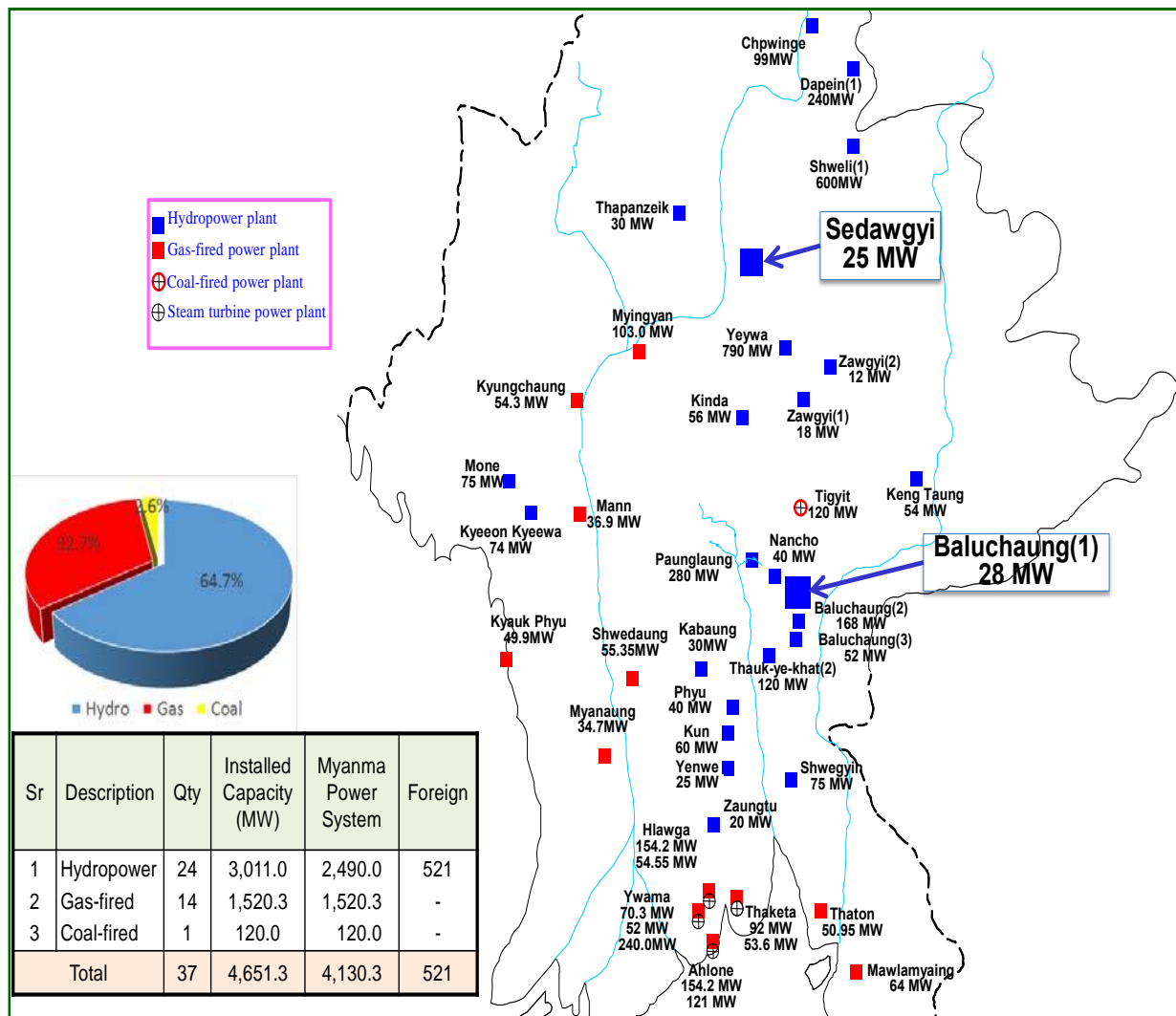
Based on the “Preparatory Survey on Hydropower Plants Rehabilitation Works in the Republic of the Union of Myanmar”, the design works of the feasibility study for the rehabilitation works of the Baluchaung No.1 HPP is implemented and the subsequent selection process of the spare parts suppliers for the rehabilitation works is undertaken.

### 1.2 Preparatory Survey on Hydropower Plants Rehabilitation Works

In 2016, “Preparatory Survey on Hydropower Plants Rehabilitation Works” was carried out by JICA was

to find the level and extent of rehabilitation works and that it carried out the study for the existing hydropower generation facilities of Baluchaung No.1 HPP and Baluchaung No.1 HPP as one package of feasibility study.

Survey team investigated the outline of the works necessary to rehabilitate these two hydropower plants, current conditions of the power generation equipment, and required repair/replacement works. Cost estimation, jurisdiction of the implementation of structural rehabilitation, management system of the power generation works as whole, and improvement of the operation and maintenance works are also studied along with the environmental and social considerations and economic and financial evaluation of Baluchaung No.1 HPP and Baluchaung No.1 HPP rehabilitation works for validation of the feasibility of project. Fig. 1.1 shows the study area of Baluchaung No.1 HPP and Baluchaung No.1 HPP.



Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

**Fig. 1.1** Location of the Hydropower Plants Studied for the Preparatory Survey

### 1.3 Outline of the Preparatory Survey for Rehabilitation Works

Table 1.1 shows the Preparatory Survey on Hydropower Plants Rehabilitation Works Baluchaung No.1 HPP and Baluchaung No.1 HPP. As is shown, the survey is carried out for which feasibility of the rehabilitation of the facilities of these hydropower generation plants and verifies the extent the area subject

to rehabilitation works.

As a result of the survey for rehabilitation works, because of the natural wear and tear advanced since the commissioning of Baruchaung No.1 HPP in 1992, specifically electricity generation facilities including control system has become of the subject to major rehabilitation works. On the other hand, no part of dam is subject to rehabilitation.

**Table 1.1 Outline of the Study for Rehabilitation of Baluchaung No.1 HPP**

Item	Description	Special note / point of concern etc.
Objectives	The Survey aims to carry out the following study of HPP rehabilitation project required for validating project feasibility. 1) Objectives examination 2) Feasibility study 3) Procurement / construction method 4) Project implementation plan / schedule 5) Project cost estimate 6) Implementation structure and capability of the project implementation agency 7) Operation and management plan / O&M structure 8) Economic & financial analysis / Project evaluation 9) Environmental and social considerations	1) Selection of equipment / facilities required for rehabilitation 2) Utilization of prominent technologies of Japan 3) Design based on the concept of preventive maintenance
Objective area	Mandalay Region (Sedawgyi HPP) Kayah State (Baluchaung No.1 HPP)	Attention on security situation
Implementation agency	MOEE (Ministry of Electricity and Energy :former MOEP* <sup>1</sup> ) EPGE (Electric Power Generation Enterprise, former HPGE* <sup>2</sup> )	Correspondence to institutional reforms of MOEE Consideration for participation of MEPE* <sup>3</sup> depending on scope of the Project
Scope of Work	The Survey is to be implemented by the following 3 phases (1) Data Collection and Project Site Investigations (2) Selection of Rehabilitation Equipment / Facilities for the Future Project (3) Feasibility Study for the Future Rehabilitation Project ✓ Rehabilitation of existing HPP facilities (Sedawgyi HPP: 25MW, Baluchaung No.1 HPP: 28MW) ✓ Rehabilitation of relevant transmission and substation facilities (230kV, 132kV) ✓ Consulting services (preliminary design, bidding, construction supervision, technical facilitation for capacity building of O&M, etc.)	1) Site investigation in consideration of local conditions 2) Ensuring opportunity of discussion with MOEE

\*1 MOEP: Ministry of Electric Power, currently reformed to MOEE (Ministry of Electricity and Energy)

\*2 HPGE: Hydropower Generation Enterprise, currently reformed to EPGE (Electric Power Generation Enterprise)

\*3 MEPE: Myanma Electric Power Enterprise, currently reformed to Power Transmission and System Control Department (PTSCD)

Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

## 1.4 Details of Project Implementation Organizations

### 1) Implementation Organizations

Ministry of Electricity and Energy (MOEE), Electric Power Generation Enterprise (EPGE)

Office No. 27, Nay Pyi Taw

Tel. +95-067-8104290

E-mail: [hpgemd@moep.gov.mm](mailto:hpgemd@moep.gov.mm)

Contract for the Implementation of the Project Began in May 2018.

### 2) Consulting Engineers

NEWJEC Inc. (with a joint venture of: Nippon Koei Co.Ltd. and Myanmar International Consultant)

Head Office: NEWJEC Inc.

3-20, Honjo-Higashi 2-chome, Kita-ku, Osaka 531-0074, Japan

Tel. 81-6-6374-4059, Fax. 81-6-6374-5198,

Project Manager: Mr. Mikio Takahashi E-mail: [takahashiko@newjec.com](mailto:takahashiko@newjec.com)

Local Office: NEWJEC Inc. Myanmar Branch

Room No.506, 5th floor, La Pyi Wun Plaza,

No.37, Alanpya Pagoda Road, Dagon Tsp, Yangon Region, Myanmar

Tel. +95(0)1-376947, Fax. +95(0)1-376947

Consulting Services Began in May 2018



## 2 Objectives and Scope of the Rehabilitation Works of Baluchaung No.1 HPP

### 2.1 Objectives

In the scheme of the National Electricity Master Plan (NEMP), it is suggested that rehabilitation of hydropower plants in Myanmar is recommended from a standpoint of preventive measures against failures caused by progressive deterioration of major equipment in general. One of the hydropower plants subject to rehabilitation is Baluchaung No.1 HPP, which various parts of the existing Baluchaung No.1 HPP are considered necessary in order to maintain efficiency of power generation in particular.

Rehabilitation of Baluchaung No.1 HPP is considered as one of the highly significant measure from the viewpoints of maintaining good economic performance in Kayah State. It is important since 1) Its primary energy is water i.e. it causes relatively low environmental impact; 2) there is no need of additional construction of dam; and 3) gas-fired or coal-fired thermal plants.

As improvement of existing Baluchaung No.1 HPP is achieved, deterioration in terms of power generation and distribution efficiency is expected to improve while reduction of blackout incidents should be achieved in order to meet the expanding demand of electricity in Myanmar.

### 2.2 Scope of the Rehabilitation Works

The Project of Rehabilitation Works for Baluchaung No.1 HPP through replacement, repair or addition of facilities, equipment and devices without expansion of site/facilities and increase in power generation capacity should be implemented in view of the conditions as follows:

#### a. Overview of the Rehabilitation Works

Definition of the Project is that it is a series of electro-mechanical parts replaced or renewed for the existing power generation facilities of Baluchaung No.1 HPP, which has shown significant wear and tear over the past 27 years is implemented through replacement, repair or addition of facilities, equipment and devices without expansion of dam/site area/facilities and increase in power generation capacity.

#### b. No Changes in the Dam and Reservoir Area

Because of the jurisdiction of the project is vested with EPGE for electricity generation operation only, no rehabilitation work on the body of dam and the area of reservoir are implemented. Thus no changes in space, capacity and dimension from the existing hydropower plant are not expected for following facilities and structures of: 1) raising/expansion of the existing body of dam; 2) changes in the amount, length, and dimension and route of flow channel related to sluice intake water; and 3) changes in dimension of civil facilities such as powerhouse and other buildings.

#### c. No Changes in Existing Land Use

Rehabilitation work and subsequent operation of the Baluchaung No.1 HPP will be carried out within the existing plant site. Thus, there will be no changes in the surrounding environment i.e. there is no involuntary resettlement including land acquisition, no disturbance to the existing economic activities such as farming and livestock and other businesses, and no changes on the living conditions of residents of surrounding area.

#### d. No Changes in the Operational System of Hydropower Generation

There will be no change in the operational system for electric power generation such as power generation capacity, patterns and schedule of operation.

**e. Replacement of the Existing Electro-mechanical System**

The preliminary inspection and records of the failure of existing Baluchaung No.1 HPP found considerable deterioration of major parts and systems relevant to turbine and auxiliary equipment, generator and auxiliary equipment, plant control and protection system, substation and transmission facilities, gates and penstock, as well as civil facilities. Therefore, rehabilitation through replacement and/or repair is expected to improve such equipment.

### **2.3 Outline of the Project Area**

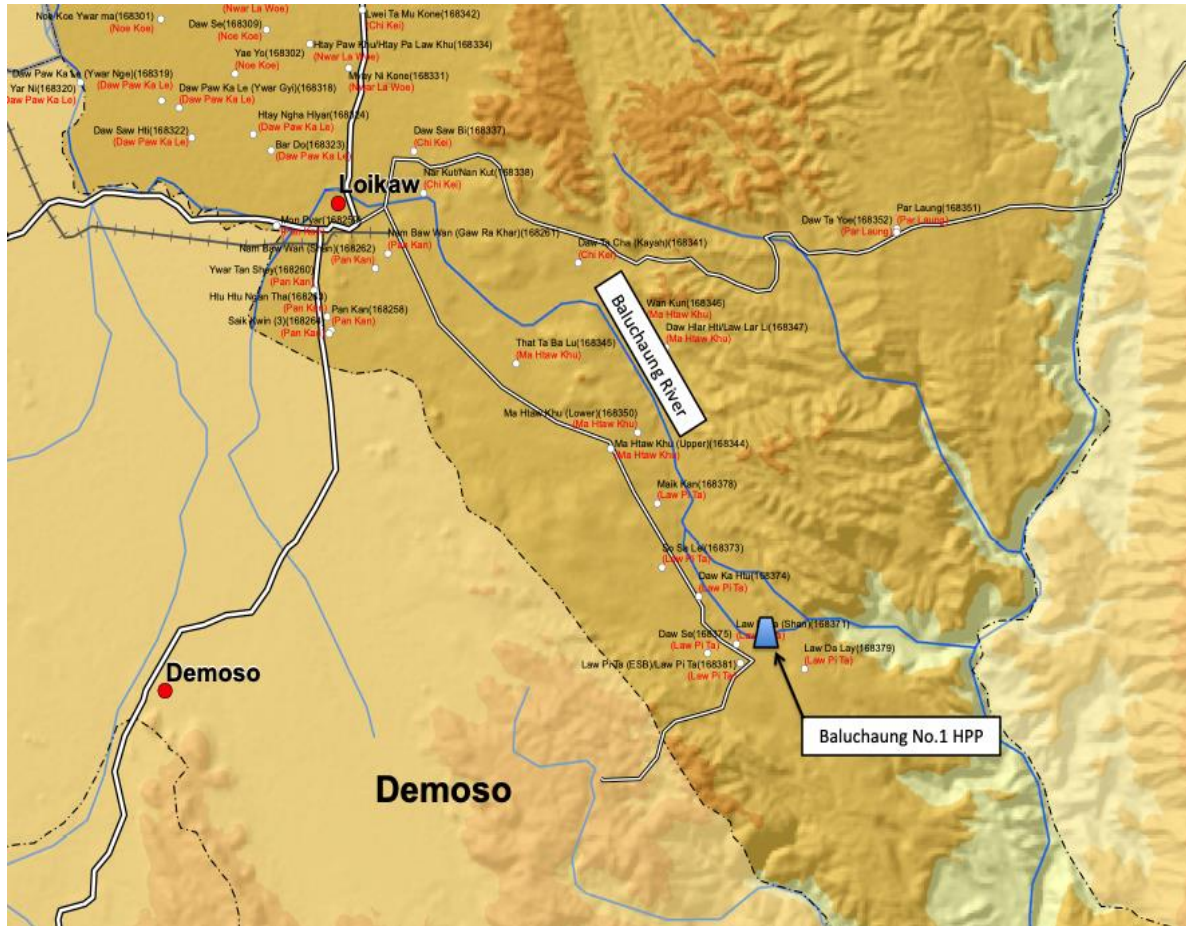
Baluchaung No.1 HPP is located in the Baluchaung River, which is a tributary of Nam Pawn River of Thanlwin River system. Its operation commenced in 1992 as one of the cascade-type of power generation scheme utilizing geographic advantages of the local area with ample supply of the river flow during the rainy season.

In the same river system Baluchaung No.2 HPP (MOEE: Ministry of Electricity and Energy) and Baluchaung No.3 HPP (Future Energy, 2014) are operating, which are important hydropower generation system for Myanmar as a whole and which can supply stable power throughout the year by regulating river flow at Moby Lake in the upstream. The electric power generated by Baluchaung No.1 HPP is transmitted to the S/S (Substation) located in Baluchaung No.2 HPP by 132 kV T/L (Transmission Line) and to Taungoo S/S by 230 kV T/L.

Loikaw Township as per Fig. 2.1 is located in Kayah State and its altitude is about 900 m above sea level. From Loikaw to Baluchaung No.1 HPP, Shan Plateau stretches out southwards and gradually loses its plateau character. Kanti Mountain Range of Kayah State with the highest peak of 1,565 m lies on the east of Baluchaung River.

The small streams flowing into the Baluchaung River are Namphe, Namsamkha and Ngwegaung streams. Generally, water level of Baluchaung River ranges from 905 m to 875 m.

Baluchaung No.1 HPP is located approximately 20 km southeast of Loikow, which is the capital city of Loikaw Township. Fig. 2.1 shows general location of Baluchaung No.1 HPP.



Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

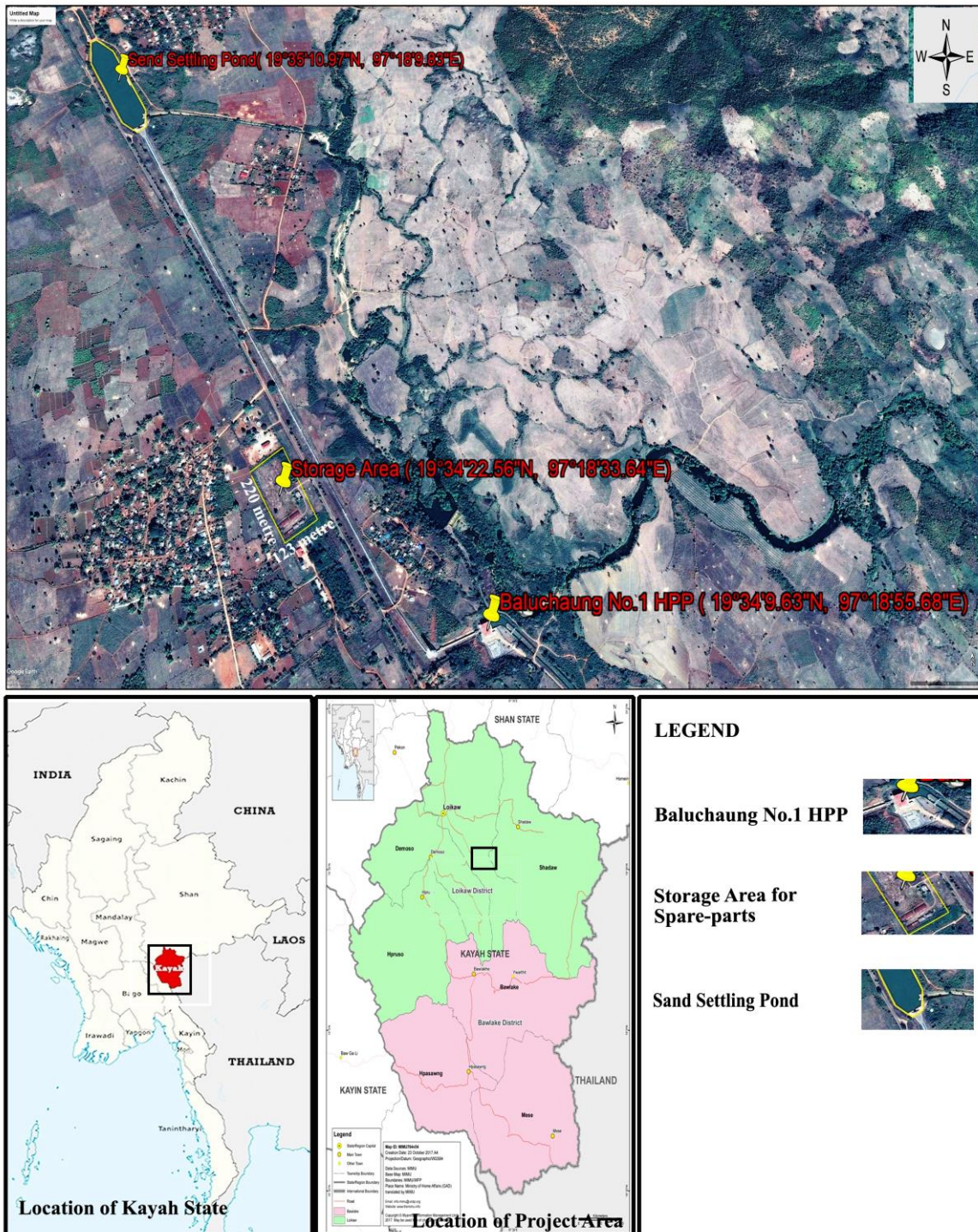
**Fig. 2.1** Location of Baluchaung No.1 HPP

As is shown in Fig. 2.2, Baluchaung No.1 HPP is located in the down stream area of Dawtacha Reservoir, where water intake weir is located. Steel pipe and open channel water way lead water from the reservoir over 10.2 km to a sand-settling pond, which has been created specifically for sand trap purpose of water for hydropower generation. Size of the sand-settling pond is approximately 90 m x 470 m and that the water is led to the powerhouse via low pressure pipeline and penstock that they run for 2.2 km to the powerhouse of Baluchaung No.1 HPP.

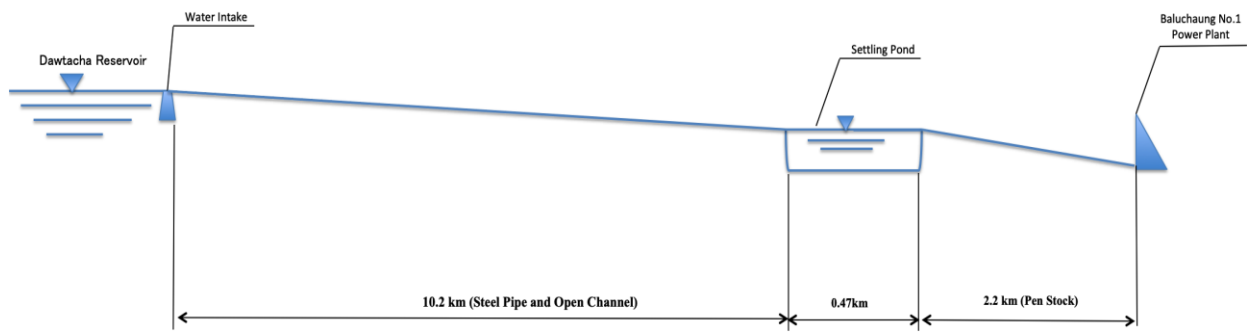
Fig. 2.3 shows schematic profile of the layout of Baluchaung No.1 HPP. As is shown, there is no dam and reservoir but a run-of-river type of hydropower plant and that the rehabilitation works take place within the powerhouse area only.

Fig. 2.4 shows the project area where rehabilitation works for the power generation system of Baluchaung No.1 HPP. As is shown, the Project takes place within the compound of powerhouse, which is approximately 95 m x 57 m. Total area of land is estimated at 4,800 m<sup>2</sup> of land owned by EPGE.





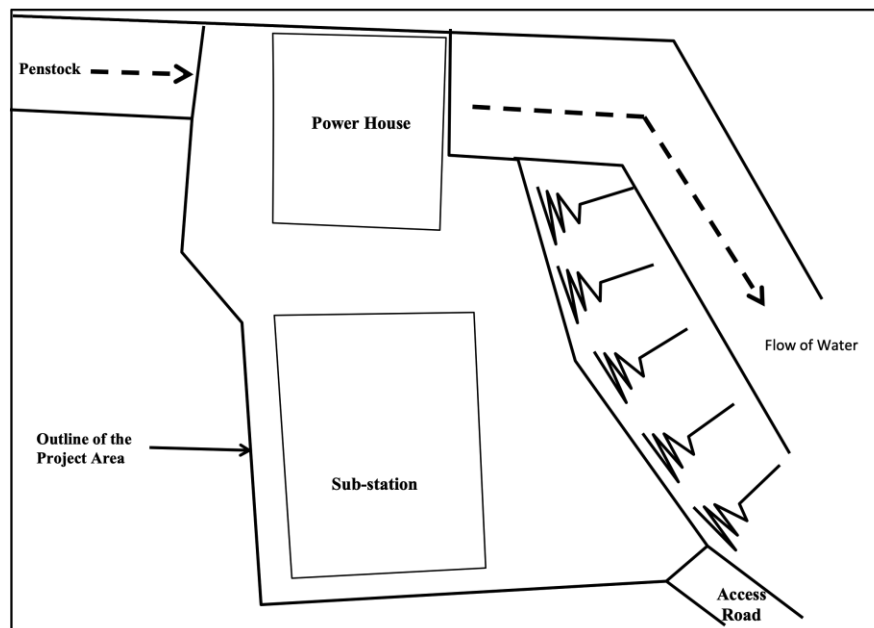
Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works  
**Fig. 2.2** Location Map of Baluchaung No.1 HPP and Storage Areas



Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

Note: Drawing not to scale

**Fig. 2.3 Schematic Profile of Baluchaung No.1 HPP**



Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

**Fig. 2.4 Project Area Confined to the Powerhouse Area of Baluchaung No.1 HPP**

## 2.4 Salient Features of the Baluchaung No.1 Hydropower Plant

Baluchaung No.1 HPP is located in the Baluchaung River, which is a tributary of the Nam Pawn River of the Thanlwin River system. The electric power generated by Baluchaung No.1 HPP is transmitted to the substation the Baluchaung No.2 hydropower plant by 132 kV transmissions line and to Taungoo substation by 230 kV transmission line. The plant is located about 20 km southeast from the central area of Loikaw Township, the capital of Kayah State as shown in Figure 1.2. The salient features of Baluchaung No.1 HPP are shown in Table 2.1

**Table 2.1 Salient Features of Baluchaung No.1 HPP**

Location	Loikaw, Kayah State (20 km southeast of the township)
Construction Starting Year	1987
Commercial Running Year	1992
Weir	Concrete weir 11.0 m

Catchment Area	7,960 km <sup>2</sup> (Baluchaung River of Thanlwin River System)
Max. Discharge	$2 \times 840 \text{ ft}^3/\text{s} = 1680 \text{ ft}^3/\text{s}$
Effective Head	69.6 m
Intake Reservoir	Earth fill Dam, 11 m (36 ft) height, 530 m (1738.4 ft) Length, 2.07 Cu.m (70.6 m.c.f)
Regulation Pondage	Effective Storage: 112000 cu.m (3.96 m.c.f) Syphon Spillway: 1680 Cusec
Installed Capacity	28 MW (14 MW x 2 Nos)
Generator	Vertical Shaft Type of Francis Turbine. Rotating Field totally enclosed 3 phase, 50 Cycles A.C. Synchronous Generator-semi-umbrella Type
Type of Turbine	Francis turbine vertical (Hitachi-Mitsubishi) 14 MW x 2 Nos
Type of Governor	Electro-hydraulic Governor
Number of Vanes	Guide Vanes: 20 No., Stay Vanes: 20 No.
Outdoor Switchyard	132 kV Single Buster System
Breakers	132kV/33 kV Oil Minimum 3 Phase auto-recloser and also single phase auto-recloser for 132 kV Feeder
Transformers	Main Step-up: 5,100 kVA Single Phase, Distribution Transformer: 5,000 kVA 11/33 kV 3 Phase, Isolating Transformer: 5,000 kVA 11/11 kV 3 Phase, Station Transformer 500 kVA 11/0.4 kV 3 Phase
Transmission Line	132 kV BHP (2) Line (9.3) miles, 11 kV Loikaw Line (10.5) miles, and 11 kV Dawtachar Line (5.5) miles

Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

## 2.5 Details of the Rehabilitation Works

Rehabilitation Works for the existing Baluchaung No.1 HPP are shown in Table 2.2 and their drawings in details are shown in *Fig. 2.5* to *Fig. 2.9*. *Fig. 2.12* shows overall schedule of the rehabilitation works.

As per the list, minor electric equipment and other ancillary parts are subject replacement. No part of the dam, substation, or any other major structural works is not subject to implementation. For the storage of replaced parts, stockyard constructed during the initial rehabilitation works is used. The storage area for spare parts is 250 meter and 200 meter in existing EPGE compound. Planned storage area is shown in *Fig. 2.10* and *Fig. 2.11*

There is no area of earth moving, cutting and filling, excavation, and concrete placing of any major scale. In order to prevent oil, rust of steel materials and third parties from entering into the stockyard, fencing and bund would be constructed. There is no toxic chemical, explosives or any other substance subject to control and regulation of the Government of Myanmar or International regulations is involved. The store yard will be place in the area of EPGE compound. Total 45,000 square meters wide and near of powerhouse.

Expected number of workers engaged to the rehabilitation works would be approximately 50 skilled workers that are the employees of EPGE. In addition, local population of the surrounding area will be employed as unskilled labor for a limited period.

Because of the employees of EPGE that are the main workforce of the project are put up in Loikaw city and commute to Baluchaung No.1 HPP daily for rehabilitation works, there is no workforce camp created on site.

The Project should begin with preparation work such as selection of consultant, detailed design study followed by replacement of the power generation facilities.

**Table 2.2 Summary of Rehabilitation Works for Baluchaung No.1 HPP**

Rehabilitation item	Measure	Q'ty	Remarks	
Turbine	Turbine Runner	R/A	1 set	The existing spare runner for one unit. A new runner for another unit.
	Guide Vane	R/A	1 set	One new complete set for one unit. One complete existing set for another unit, if the component condition is good. If the condition is unfavorable, additional one complete set will be ordered for another unit.
	Guide Vane Bearing and Stem Bush	R	2 sets	for 2 units
	Shear Pin	R	2 sets	for 2 units
	Gate Servomotor	P	2 sets	only for consumable parts
	Guide Bearing	R	2 sets	for 2 units
	Shaft Sleeve	R	2 sets	for 2 units
	Head Cover	P	2 sets	only for wearing parts
	Stay Ring	P	2 sets	only for wearing parts
	Inlet Valve	P	2 sets	only for wearing parts
	Inlet Valve Servomotor	P	2 sets	only for wearing parts
	Cooling Water Supply System	P/R	1 set	One set for the plant system for local On-Off switches. A dusting screen device for the inlet of cooling water pipe is to be provided.
	Water Drainage System	P/R	1 set	One set for the plant system for local control panels and local On-Off switches. Water level detecting equipment is to be replaced.
	Pressure Oil Supply System	P/R	1 set	One set for the plant system. Oil sump tanks and air compressor sets are to be replaced. Local On-Off switches are to be replaced.
Overhead Crane	P/R	1 set	Parts to be repaired and/or replaced are to be checked and specified by a supervisor of the crane manufacturer.	
Generator	Stator winding	R	2 sets	-
	Rotor winding	R	2 sets	-
	Guide bearing	R	2 sets	-
	Thrust bearing	R	2 sets	to plastic bearing
	Oil cooler	R	2 sets	-
	Air cooler	R	2 sets	-
	Excitation system	R	2 sets	to brushless (AC) excitation system
Control and Protection System	Operation Board	R	1 set	Updated to total digital system without SCADA system
	Speed Governor System	R	1 set	Updated to integrated GOV / AVR system
	Automatic Voltage Regulator	R	1 set	Updated to integrated GOV / AVR system
	Protection Relay (Analog Type)	R	1 set	Updated to digital type
	SSG Speed Monitor	R	1 set	Replaced with new components
	Fire Alarm System	R	1 set	Replaced with new components
	Control Cable	R	1 set	Replaced with new cables

S/S and T/L facilities	132kV Circuit Breaker	R	1 set	3 phase, 145kV, 800 A, 20kA (1sec)
	11 kV Main and Local Cubicle	R	12 panels	All panels will be replaced with VCB.
	LV Switchgear	R	1 lot	400V, Indoor, type, ACB or MCCB
	DC battery	R	2 sets	Lead acid, valve-regulated type, 300AH
	DC Battery Charger	R	2 set	Input: AC 400V, Output: DC230V
	Emergency Diesel Generator Set	R	1 set	300 kVA, 50Hz, 400/230V
	T/L Protection Panel	R	1 set	Over current/ground fault relay is equipped as back-up.

Note: R-Replacement, P-Repair, A-Addition, I-Inspection

Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

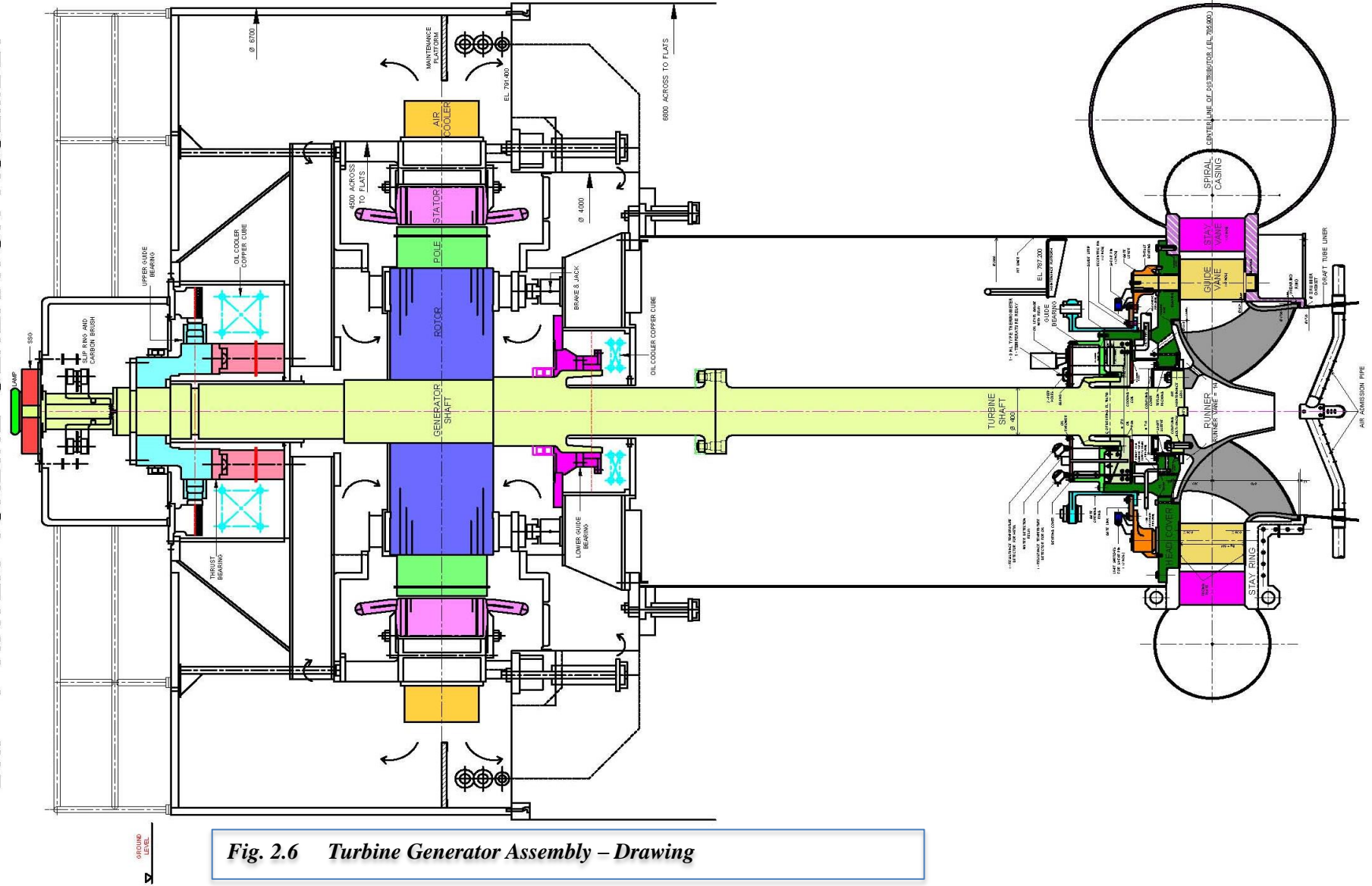


Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

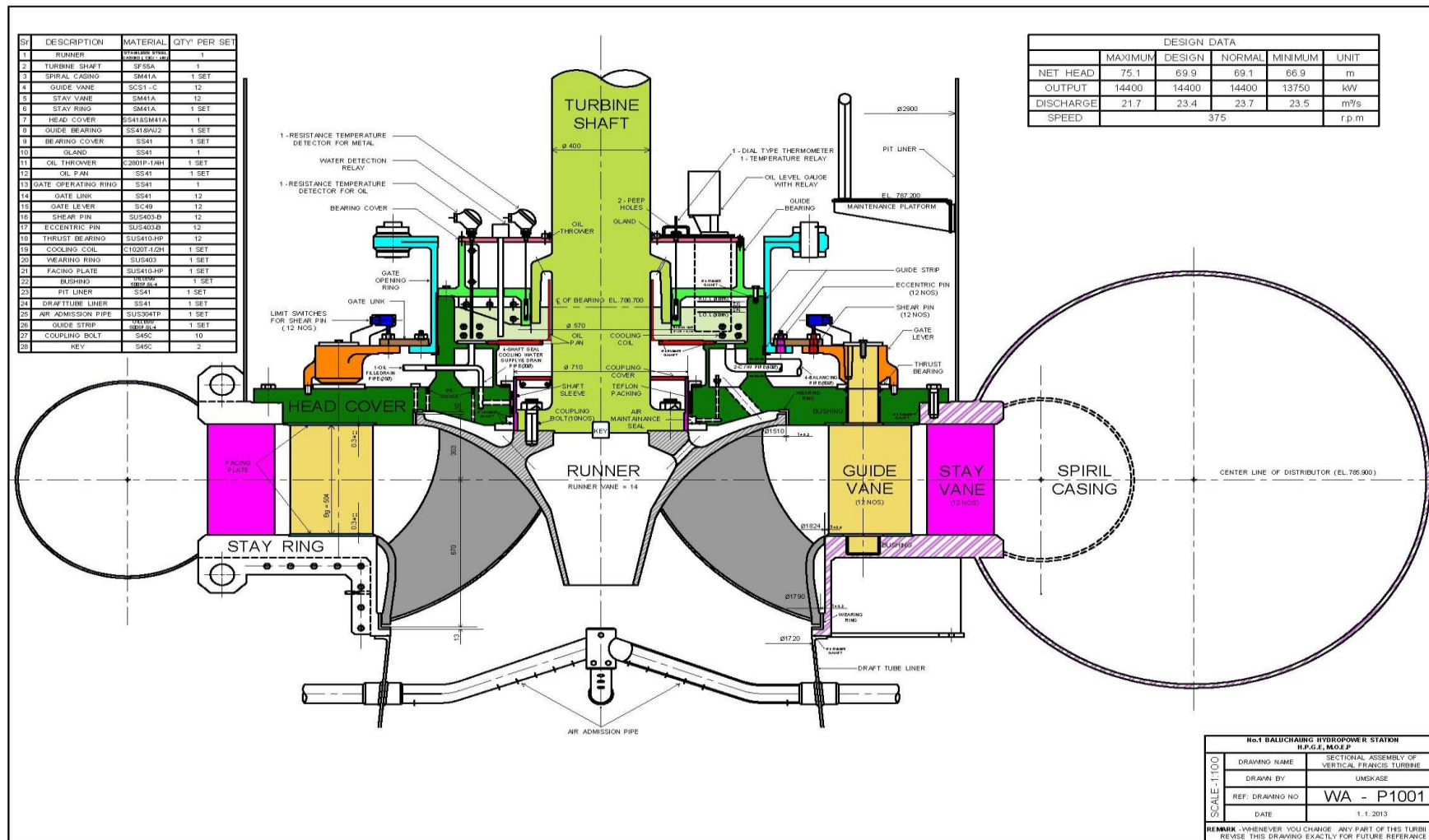
**Fig. 2.5 Turbine Runner – Photo**



**BHP - 1 WATER TURBINE GENERATOR ASSEMBLY**

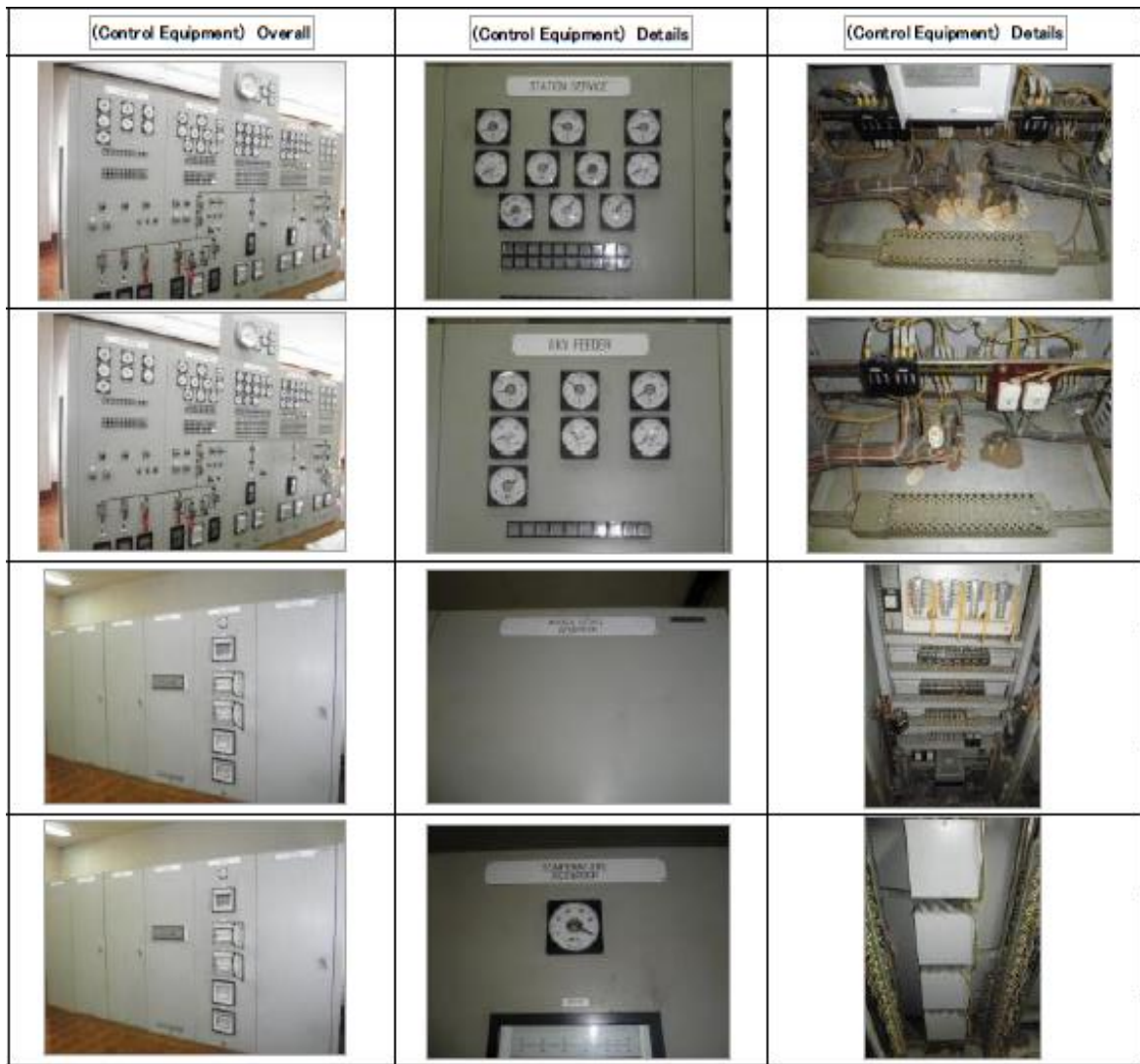


**Fig. 2.6 Turbine Generator Assembly – Drawing**



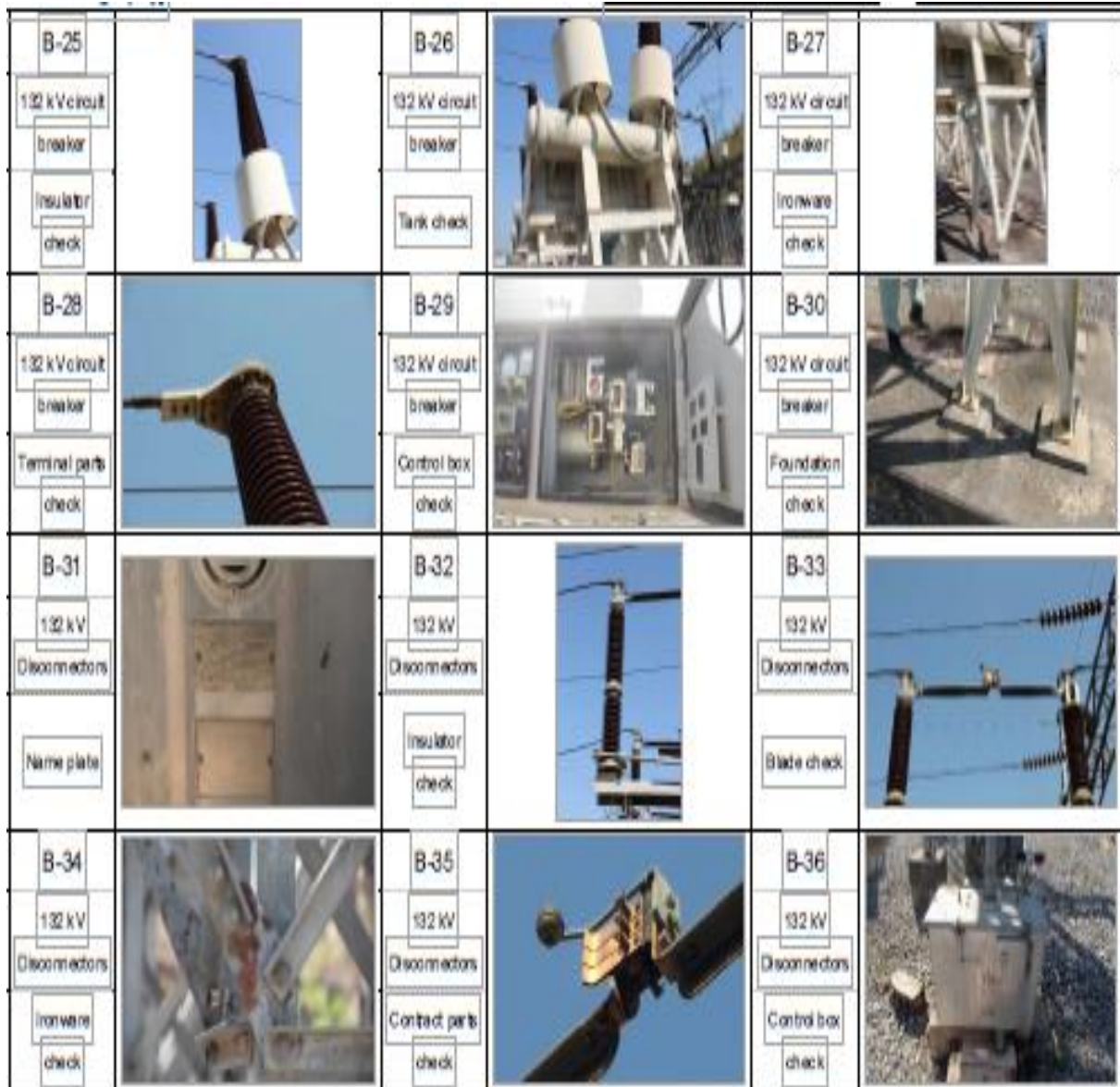
Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

**Fig. 2.7 Turbine Runner for Major Replacement – Drawing**



Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works  
**Fig. 2.8 Control Equipment in Project Site**





Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

**Fig. 2.9 Transmission Line in Baluchaung No. 1 HPP**

## 2.6 Waste Generated by the Project Activities

There are a number of electro-mechanical parts removed from the operating system as described above. These electro-mechanical parts could contain asbestos on the brake pad of which rotating parts might have to be stopped from time to time for maintenance purposes.

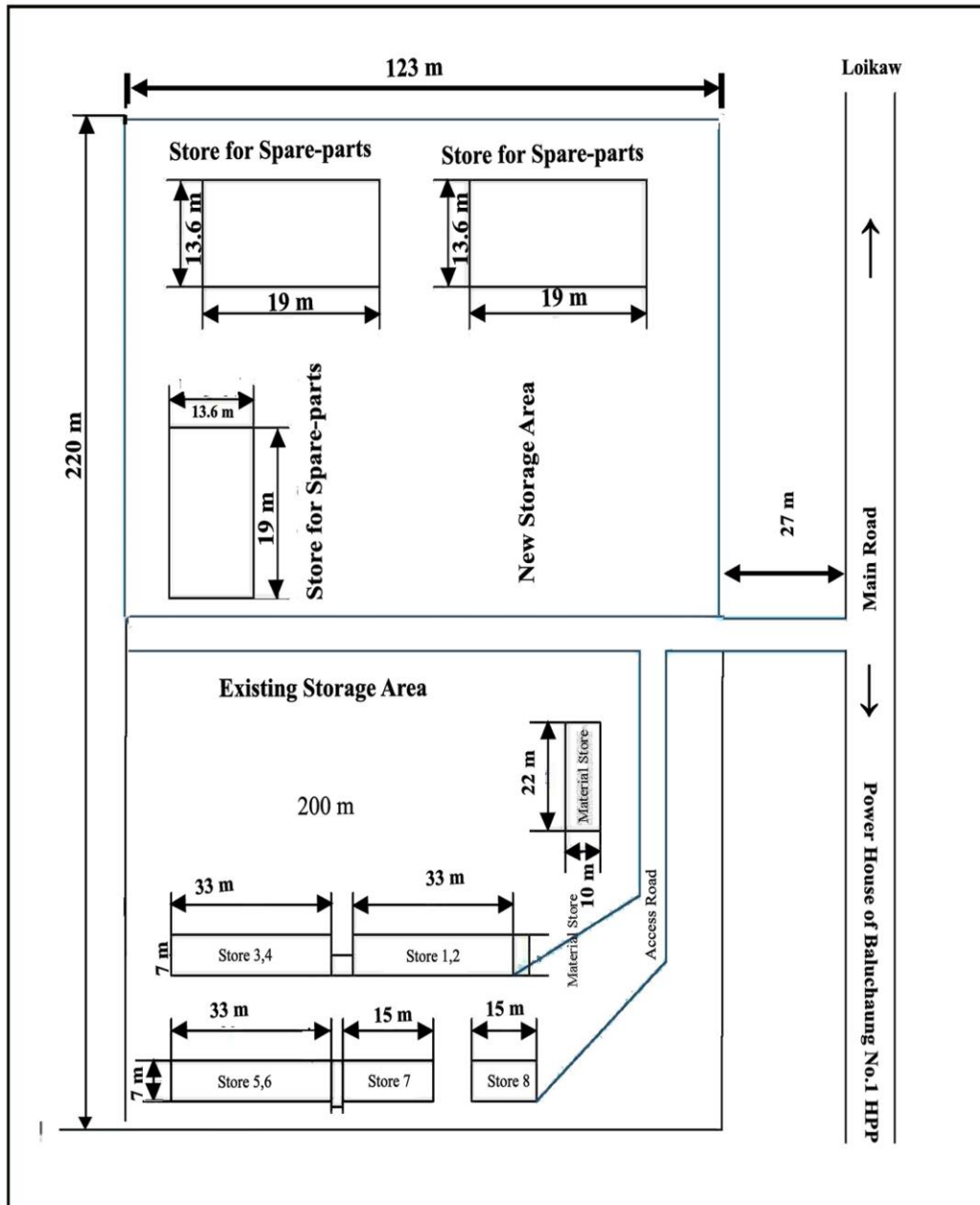
Most of the electric parts contain lead where electric wires are soldered. Thermometers manufactured 30 years or more years ago contain mercury. Because of the industrial disposal system of these chemical substance is not available yet in Myanmar, these parts are stored on site. For the storage purposes, therefore storage buildings are constructed on site as per Fig. 2.10 and Fig. 2.11. They are built on the land in possession of EPGE at present i.e. no land acquisition is involved in the Project.

There is no other toxic chemical, explosives or any other substance subject to control and regulation of the Government of Myanmar or international regulations is involved.

There is no area of earth moving, cutting and filling, excavation, and concrete placing of any major scale within the framework of the Rehabilitation Works.

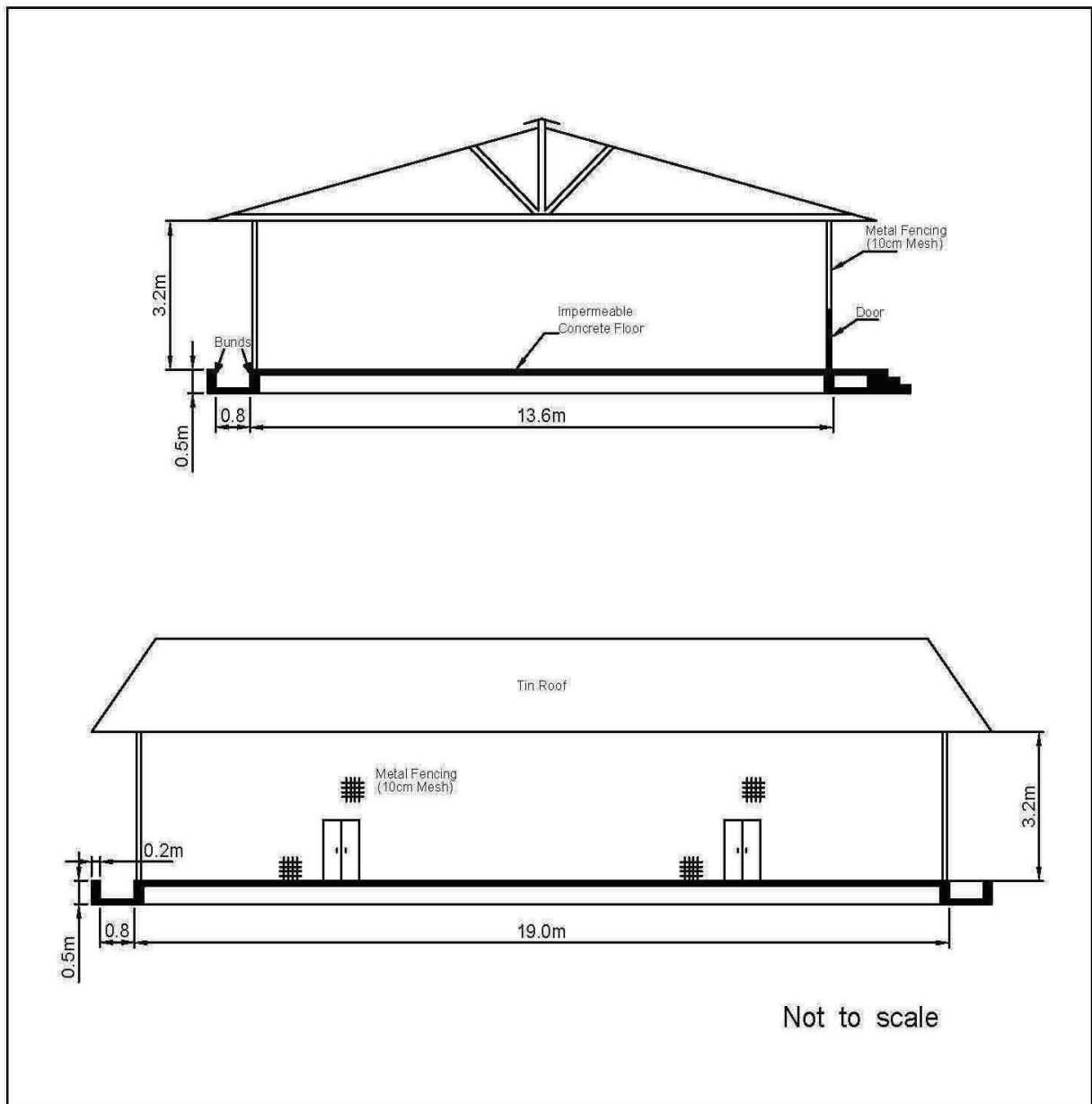
Expected number of workers engaged to the Project would be approximately 50 skilled workers that are the employees of EPGE i.e. no workforce camp is constructed. In addition, local population of the surrounding area will be employed as unskilled labor for a limited period.

Because of the employees of EPGE who are the main workforce of the Project that are the residents of villages in the local area and commute to Baluchaung No.1 HPP daily for project implementation, there is no workforce camp created on site.



Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works  
 Note: Drawing not to scale

**Fig. 2.10** *Layout of the Storage Area for the Equipment of Baluchaung No.1 HPP*

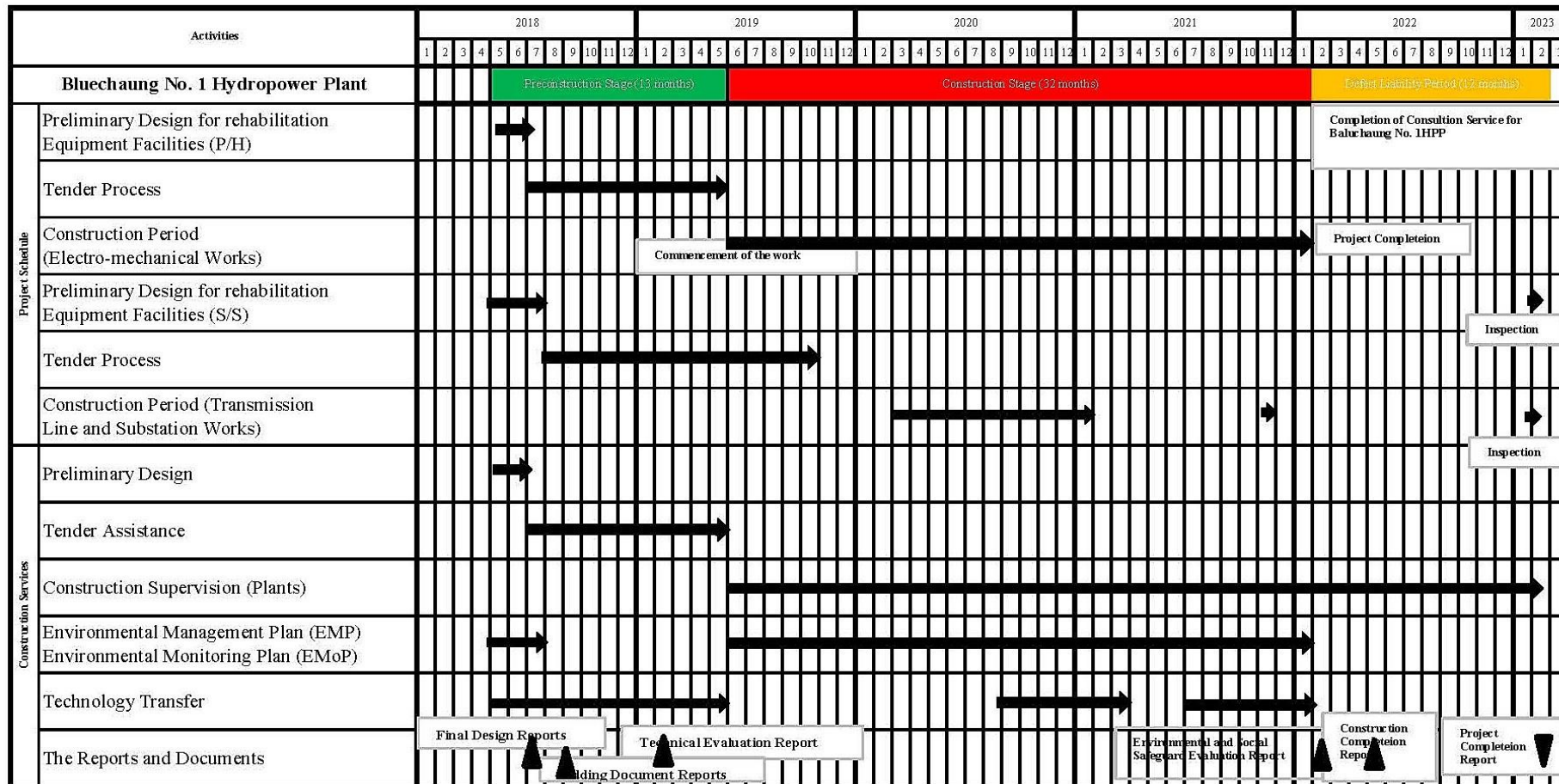


Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

**Fig. 2.11** *Layout of the New Storage Building for Equipment of Baluchaung No.1 HPP*

## 2.7 Schedule of Project Implementation

The project should begin with preparation work such as selection of consultant, detailed design study and tender as shown in Fig. 2.12



Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works  
**Fig. 2.12 Implementation Schedule of the Rehabilitation Works for Baluchaung No.1 HPP**

### 3 Laws and Regulations for the Environmental and Social Considerations

#### 3.1 Prevailing Laws and Regulations of Myanmar

##### 3.1.1 Primary Laws and Regulations

The primary laws and regulations related to the environmental and social considerations and health in respect to which since the inception of the Baluchaung No.1 HPP in 1980s as well as the implementation of the Rehabilitation Works are shown in Table 3.1.

Environmental Conservation Law (2012) and Environmental Conservation Rules (2014) of the government of Myanmar are the major laws generally applied to the Project as they are currently enacted and prevailing in order to determine comprehensive environmental conservation and management of the impacts affected by the project implementation of the rehabilitation works of Baluchaung No.1 HPP.

Within the framework of the Project for Rehabilitation Works of Baluchaung No.1 HPP, where applicable, these laws are generally applied since the beginning of the project implementation of Baluchaung No.1 HPP. Within the framework of the up-coming Rehabilitation Works, laws on the pollution control and occupational health are the major concern among others because of the storage of insulating oil containing PCB on site as well as water and soil contamination are the major concerns of the rehabilitation works. Where no specific provision is made for water and soil contamination is given, known international standard applicable to this project is considered.

As is shown in the appendix, PCB has to be inventoried according to UNEP guidelines. Since method of industrial disposal of PCB is not available in Myanmar, it is appropriate to apply internationally applicable guidelines. IFC's occupational safety guidelines and other policies of multinational financial corporations are from time to time consulted with as becomes necessary.

**Table 3.1 Primary Laws and Regulations Related to EMP**

No.	Primary Laws and Regulations of Myanmar
<b>Environmental Framework</b>	
1	The National Environment Policy (1994)
2	The Environmental Conservation Law (2012)
3	The Environmental Conservation Rule (2014)
4	EIA Procedures (December 2015)
5	National Environmental Quality (Emission) Guidelines (December 2015)
6	National Sustainable Development Strategy (2009)
<b>Conservation/Forestry/Biodiversity</b>	
7	The Forest Law (1992)
8	The Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994)
9	Wildlife Protection Act (1936)
10	Freshwater Fisheries Law (1991)
11	The Law Relating to Aquaculture (1989)
12	Animal Health and Development Law (1993)
13	The Conservation of Water Resources and Rivers Law (2006)
14	The Conservation of Water Resources and River Rules (2013)
15	The National Biodiversity Strategy Action Plan (2012)
<b>Water Environment</b>	
16	The Underground Water Act (1930)
17	Irrigation Laws and Regulations (1982)
<b>Cultural Heritage</b>	
18	The Protection of Preservation of Cultural Heritage Region Law (1994)



19	The Heritage Goods Protection Law (2015)
Land Use	
20	The Land Acquisition Act (1894)
21	The Upper Burma land and Revenue Regulations (1889)
22	Land Nationalization (1953)
23	Wasteland Instruction (1991)
24	The Farmland Law (2012)
25	The Farmland Rules (2012)
26	The Vacant, Fallow and Virgin Lands Management Law (2012)
27	The Vacant, Fallow and Virgin Lands Management Rules (2012)
Public Health	
28	The Public Health Law (1972)
29	The Prevention and Control of Communicable Diseases Law (1995, revised in 2011)
Pollution Control/Industrial Law	
30	The Explosive Act (1884)
31	The Explosive Substances Act (1908)
32	The Prevention of Hazard from Chemicals and Related Substances Law (2013)
33	The Business for Ozone Depleting Substances: Notification No.37/2014
34	The Factory Act (1951)
35	The Worker's Compensation Act (1923)
36	Occupational Safety and health Laws (Draft)
Working Environment	
37	The Payment of Wages Act (1936)
38	The Shops and Establishment Act (1951)
39	The Leave and Holiday Act (1951, partially revised in 2014)
40	The Labor Organization Law (2011)
41	The Social Security Law (2012)
42	The Labor Organization Rule (2012)
43	The Labor Dispute Settlement Law (2012)
44	The Employment and Skill Development Law (2013)
45	The Minimum Wage Law/Rules (2013)
Infrastructure/Economic Development	
46	The Foreign Investment Law (2012)
47	The Export and Import Law (2012)
48	The Myanmar Citizen Investment Law (2013)
49	The Electricity Law (2014)
50	The Boiler Law (2015)

Source: EMP Study Team

Further, because of the nature of funding the project is extended by JICA of the Government of Japan, its guidelines as well as internationally prevailing environmental safeguard policies of World Bank and Asian Development Bank as well as International Funding Corporation's Performance Standards are applied.

### 3.1.2 Environmental Conservation Law, 2012

The principal law governing environmental management in Myanmar is the Environmental Conservation Law (ECL), which was enacted in March, 2012 (The Pyidaungsu Hluttaw Law No.9/2012). The law stipulates that government bodies are in charge of environmental conservation as well as their relevant roles and responsibilities. It touches on water, noise, vibration and solid waste qualities but does not provide specific standards to be met.

It also states that any new development project must perform a system of Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) in order to find out 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 or not.

Summary of objectives of the law are as follows:

- To implement the Myanmar National Environment Policy;
- To provide basic principles and give guidance on systematic integration of environmental and conservation matters for sustainable development process;
- To promote a good and clean environment and to conserve the natural and cultural heritage for the benefit of both present and future generations;
- To reclaim damaged ecosystems at the earliest stages;
- To manage prevention of natural resources degradation and to enable its sustainable use;
- To implement promotion of public understanding and dissemination of educational programs on environmental awareness;
- To promote international, regional, and bilateral cooperation in environmental affairs; and
- To enable cooperation among government departments, government organizations, international organizations, NGOs (non-governmental organization(s)), and individuals in terms of environmental conservation.

Chapter 7 of the law stipulates that MONREC (Ministry of Natural Resources and Environmental Conservation) has duties and power to carry out EIAs regarding projects or activities undertaken by any government department, organization or person that may cause a significant impact on the environment.

The Environmental Conservation Law 2012 contains a number of by-laws shown in Fig. 3.1. As is shown, EIA-related laws and regulations are in its process of developing for legally binding. Thus further legislation is needed in order to ascertain enforcement. Policy documents should serve as a formal communication document at the highest levels of the Myanmar government system while it is not realizing its aims.

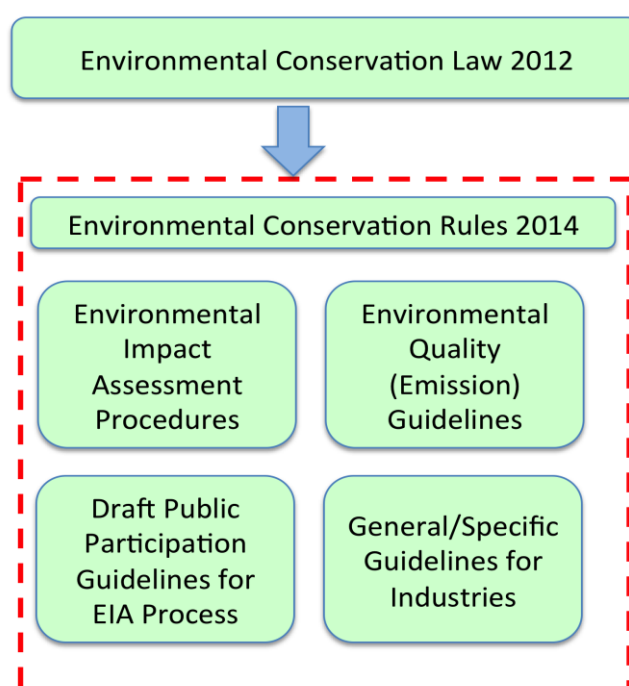
Further, other ministries and relevant departments are preparing policies, strategic action plans and sectoral master plans, which guide the planning and implementation of sector-specific development and regulation activities in relation to the Environmental Conservation Law 2012.

Most of the sectoral master plans aiming for leading up to the initial achievement of economic development in Myanmar by the Year 2030 are yet to put out and it is not clear which of the master plans will be adopted by the NLD (National League of Democracy) government including National Electricity Master Plan (NEMP) 2014, which is under revision by JICA Study Team is yet to adapt as legally binding document for the electricity sector in Myanmar.

Within the framework of the Environmental Conservation Law 2012, coordination between ministries and departments is also in the process of establishment. However, the following national level inter-ministerial committees for addressing multi-sectoral issues in respect of which energy sectors and the environmental safeguard are inter-related to each other has been established to date.

- a. National Environmental Conservation and Climate Change Central Committee (NECCCCC);
- b. National Water Resource Committee (NWRC) ; and
- c. National Land Committee

In the context of project development, it is important to note that the law adopts the notion of 'Polluter Pays Principle' as it implies that the project proponents are responsible for covering all environmental and social costs generated by the project. The law serves as the basis for founding of Environmental Conservation Department (ECD) under the Ministry of Natural Resources and Environmental Conservation (MONREC). Following the Environmental Conservation Law are two legal instruments: Environmental Conservation Rules (2014); and EIA Procedures (2015).



Source: SEA of the Hydropower Sector in Myanmar, IFC 2017

**Fig. 3.1** *Relevant Laws Related to Environmental Protection*

### 3.1.3 Environmental Conservation Rules, 2014

Environmental Conservation Rules (ECR) No. 59/2014 emphasizes the importance of conservation of cultural heritage areas, natural heritage areas, cultural monuments, buildings and natural area and to set up the method to mitigate the impact of polluted waste during destruction, storage, placement and transportation of such waste. In addition, ECR stipulates basic policy and concept of Environment Impact Assessment (EIA) application in developing Projects in Section 55 of Chapter XI) as follows: Section 55. The Government department, organization or person which carry out the plan, business service or activity which are responsible to carry out the environmental impact assessment or initial environmental examination which is established before the issue of these rules;

- a. Shall submit to the Ministry, after drawing environment management plan in accord with the procedure relating to the environmental impact assessment; and

- b. Shall implement and carry out the environment management plan which approved and scrutinized by the Ministry and matters stipulated by the Ministry within the time stipulated by the Ministry.

As described below, according to the EIA Procedure 2015, Prior Permission is required for economic activities including certain types of business, work-site or factory, workshops which may cause an impact on the environmental quality.

### 3.1.4 Environmental Assessment (EIA) Procedure, 2015

#### (1) Chapter II - Establishment of the EIA Process

##### a. Section 3

Pursuant to Section 21 of the Law and Articles 52, 53 and 55 of the Rules, all Projects and Project expansions undertaken by any ministry, government department, organization, corporation, board, development committee and organization, local government or authority, company, cooperative, institution, enterprise, firm, partnership or individual (and/or all Projects, field sites, factories and businesses including expansions of such Projects, field sites, factories and businesses identified by the Ministry, which may cause impact on environmental quality and are required to obtain Prior Permission in accordance with Section 21 of the Law, and Article 62 of the Rules) having the potential to cause Adverse Impacts, are required to undertake Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) or to develop an Environmental Management Plan (EMP), and to obtain an Environmental Compliance Certificate (ECC) in accordance with this Procedure.

##### b. Section 5

In accordance with Article 68 of the Rules, small-scale Projects, field sites, factories or businesses which are not specifically identified by the Ministry, but which may impact on environmental quality and as such are required to obtain Prior Permission in accordance with Section 21 of the Law or Article 62 of the Rules, and which are also not included in Annex 1 'Categorization of Economic Activities for Assessment Purposes', shall obtain the recommendation of the Department as to whether or not such a Project has Environmental Impacts and shall comply with the terms and conditions prescribed by the Department before applying for a permit or license from the relevant ministry or governmental organization.

- i. EIA procedures describe types of categories of business which are necessary to carry out IEE/EIA studies before the implementation of the project. In the Annex 1 of the EIA Procedure, guidance as to whether an IEE or an EIA is required for 141 types of projects or activities.
- ii. In the Annex 1, economic activities relating to schemes of hydropower development are reproduced in Table 3.2.

**Table 3.2 Criteria for IEE and EIA Implementation in Power Sector Development**

No.	Type of Economic Activity	Type of Economic Activities that requires IEE	Type of Economic Activities that requires EIA
1	HPPs (hydropower plant(s))	Installed capacity $\geq 1$ MW but $< 15$ MW and Reservoir volume	Installed capacity $\geq 15$ MW or Reservoir volume

		< 20,000,000 m <sup>3</sup> and Reservoir area < 400 ha	≥ 20,000,000 m <sup>3</sup> or Reservoir area ≥ 400 ha
2	Nuclear Power Plants	-	All sizes
3	Natural Gas or Bio Gas Power Plants	≥ 5 MW but < 50 MW	≥ 50 MW.
4	Coal-fired Power Plants	< 10 MW	≥ 10 MW
5	TPPs (thermal power plant(s)) other than the above types	≥ 5 MW but < 50 MW	≥ 50 MW
6	Wind Power Plants	≥ 1 MW but < 50 MW	≥ 50 MW
7	Geothermal Facilities	≥ 1 MW but < 50 MW	≥ 50 MW
8	Solar Power Plants	≥ 1 MW but < 5 MW	≥ 5 MW or ≥ 100 ha
9	Electrical Power Transmission Lines < 230kV	< 50 km	≥ 50 km
10	Electrical Power Transmission Lines ≥ 230kV		All sizes
11	High Voltage Transformer Substations	< 10 ha	≥ 10 ha

Source: MONREC, Myanmar

EIA is required in all cases where the project or activity will be located in or will have foreseeable adverse effects on any legally protected national, regional or state area, without exemption as follows:

- i. Forest conservation area (including biodiversity reserved areas);
- ii. Public forest;
- iii. National park (including marine parks);
- iv. Mangrove swamp;
- v. Any other sensitive coastal area;
- vi. Wildlife sanctuary;
- vii. Scientific reserve;
- viii. Nature reserve;
- ix. Geophysical significant reserve;
- x. Any other nature reserve nominated by the Minister;
- xi. Protected cultural heritage area; and
- xii. Protected archeological area or area of historical significance.

**c. Section 6**

The ECC issued by the Ministry shall reflect any terms and conditions that are contained in any relevant Prior Permission.

**d. Section 8**

Any Project already in existence prior to the issuance of the Rules, or the construction of which has already commenced prior to the issuance of the Rules, and which, in either case, shall be required to undertake, within the timeframe prescribed by the Department, an environmental compliance audit, including on-site assessment, to identify past and/or present concerns related to that Project's Environmental Impacts, and to:

- i. Develop an EIA or IEE or EMP;

- ii. Obtain an ECC; and
- iii. Take appropriate actions to mitigate adverse impacts in accordance with the laws and regulations.

**(2) Chapter III - Screening**

**a. Section 23**

- i. The Project Proponent shall submit the Project Proposal to the Ministry for Screening. In accordance with this Procedure, the submission of the Project Proposal for Screening is the same as the submission of an application for Prior Permission.
- ii. The Ministry will send the Project Proposal to the Department to determine the need for environmental assessment.
- iii. Following the preliminary Screening and verification that the Project Proposal contains all required documents and related materials, subject to Articles 8, 9, 10, 11, 26 and 27 the Department shall make a determination in accordance with Annex 1 ‘Categorization of Economic Activities for Assessment Purposes’, taking into account Article 25 and the additional factors listed in Article 28 in order to designate the Project as one of the following, and then submit their designation to the Ministry:
  - EIA Type Project; or
  - IEE Type Project; or
  - Non-IEE or EIA Type Project, and therefore not required to undertake any environmental assessment.

**b. Section 24**

The Ministry shall also make a determination whether an EMP shall be required in respect of any Project.

**(3) Chapter VII - Environmental Management Plan**

**a. Section 76**

For Project types which require EMP according to the Article 55 (a) of the Rules or Article 24 of the Procedure, the Project Proponent may prepare an EMP by itself or may appoint a person or organization who/which is registered according to the Article 18.

**b. Section 77**

The Project Proponent shall issue a letter of endorsement in a format prescribed by the Ministry according to the Article 63. Such letter shall be submitted to the Department prepared either in the Myanmar language, or in the English language or both. The Project Proponent shall submit the EMP to the Department in both digital form and complete paper copies, together with the required service fee as prescribed by the Department, and confirming:

- i. the accuracy and completeness of the EMP;
- ii. that the EMP has been prepared in strict compliance with applicable laws including this Procedure; and

- iii. that the Project will at all times comply fully with the commitments, mitigation measures, and plans in the EMP.

**c. Section 78**

Upon receipt of the EMP from the Project Proponent, the Department shall review and submit to the Ministry to enable it to make a final decision on approval of the EMP.

**d. Section 79**

If it is determined by the Ministry that the EMP does not satisfy requirements, then the Project Proponent shall be called upon by the Department to undertake necessary amendments and/or to provide supplementary information as directed by the Ministry.

**e. Section 80**

Upon completion of its review of the EMP, the Ministry shall;

- i. Approves the EMP, subject to any conditions it may prescribe, and issue an ECC; or
- ii. Requires that the Project carry out an IEE or EIA, citing the reasons for this decision and informing the Project Proponent of its decision; and, in either case
- iii. Publicly discloses its decision.

**f. Section 81**

The Department shall deliver the final decision of the Ministry within thirty (30) working days of receipt of an EMP. If the Ministry requires an EMP to be amended, then the due date for delivery of the Ministry's decision shall be extended accordingly.

**g. Section 82**

Any additional costs associated with reaching a determination regarding project types, which require EMP shall be borne by the Project Proponent.

### **3.1.5 Environmental Quality Standards**

On 22<sup>nd</sup> April 2015, final draft of National Environmental Quality (Emission) Standard Guidelines has been put out for formal promulgation. Scope of application of the Guidelines is as follows:

- a. These Guidelines have been primarily excerpted from the International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines, which provide technical guidance on good international industry pollution prevention practice for application in developing countries. The Guidelines are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of these Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them;
- b. Unless otherwise indicated, these guidelines refer to emission sources, and are intended to prevent or minimize adverse impacts to environmental quality or human health by ensuring that pollutant concentrations do not reach or exceed ambient guidelines and standards. The Guidelines apply to projects that generate noise or air emissions, and / or that have either

direct or indirect discharge of process water, wastewater from utility operations or storm water to the environment;

- c. General and industry-specific guidelines as set out in Annex 1 – Emissions Guidelines shall apply to any project subject to EIA Procedure, as adopted by the Ministry, in order to protect the environment and to control pollution in the Republic of the Union of Myanmar. These Guidelines specifically apply to all project types listed in the EIA Procedure under ‘Categorization of Economic Activities for Assessment Purposes’ which sets out projects that are subject to EIA or initial environmental examination;
- d. Provisions of the general and applicable industry-specific Guidelines shall be reflected in project environmental management plan (EMP) and environmental compliance certificate (ECC) and together constitute a project’s commitment to take necessary measures to avoid, minimize and control adverse impacts to human health and safety, and the environment through reducing the total amount of emissions generation; to adopting process modifications, including waste minimization to lower the load of pollutants requiring treatment; and as necessary, to apply treatment techniques to further reduce the load of contaminants prior to release or discharge;
- e. Recognizing that these Guidelines are intended to prevent pollution through reducing the mass of pollutants emitted to the environment, dilution of air emissions and effluents to achieve maximum permitted values is not acceptable. Specified guideline values should be achieved, without dilution, at least 95 percent of the time that a project is operating, to be calculated as a proportion of annual operating hours;
- f. Further reference should be made by projects to applicable industry-specific IFC EHS guidelines for advice on means of achieving guideline values set out in Annex 1;
- g. As specified in the EIA Procedure, all projects are obliged to use, comply with and refer to applicable national guidelines or standards or international standards adopted by the Ministry. These Guidelines will henceforth be applied by the Ministry in satisfying this requirement until otherwise modified or succeeded by other guidelines or standards;
- h. As specified in the EIA Procedure, following project approval a project shall commence implementation strictly in accordance with the project EMP and any additional requirements set out in the project ECC, which will encompass conditions relating to emissions. In this regard, the Ministry will require that projects adhere to general and applicable industry guidelines as set out in Annex 1;
- i. While these Guidelines generally apply to all projects subject to the EIA Procedure, it is the prerogative of the Ministry to decide how the Guidelines should be applied to <sup>[[ ]]</sup><sub>SEP</sub> existing projects as referred to in the EIA Procedure, as distinguished from new projects. At the Ministry’s discretion less stringent levels or measures than provided for in these Guidelines may be specified as appropriate, and a timeframe agreed for a project to fully comply with these Guidelines;
- j. As specified in the EIA Procedure, projects shall engage in continuous, proactive and comprehensive self-monitoring of the project and comply with applicable guidelines and standards. For the purposes of these Guidelines, projects shall be responsible for the monitoring of their compliance with general and applicable industry-specific Guidelines as specified in the project EMP and ECC; and



- k. Emissions of pollutants, noise, odor, and liquid/effluent discharges will be sampled and measured at points of compliance as specified in the project environmental management plan (EMP) and the requests made by the environmental conservation committee (ECC) of MONREC.

### **3.1.6 Forest Law, 1992**

#### **(1) Purpose of Forest Conservation**

Article 3 of the Forest Law stipulates that the GoM shall develop and promote environmental

Article 3 of the Forest Law stipulates that the GoM shall develop and promote environmental conservation policies in respect of forestry activities. Article 4 stipulates that controlled yield of forest products shall be maintained in consideration of environmental conservation. Article 5 stipulates the purposes for designation of communal forest reserves (other than to reserve/protect forests) consisting of:

- Protection of water areas and soil;
- Conservation of Dry-Zone Forests;
- Conservation of mangroves;
- Conservation of environment and biodiversity; and
- Sustainable production of forest products.

#### **(2) Classification of Forest Reserves**

Reserved Forests and Protected Public Forests are designated for conservation as follows:

- Commercial reserved forest (mainly timber production);
- Local supply reserved forest (mainly for local inhabitants benefit);
- Watershed or catchments protection reserved forest (mainly for water catchments);
- Environment and biodiversity conservation reserved forest; and
- Other categories of reserved forest (protection of water, earth, mangroves.).

### **3.1.7 Protection of Wildlife and Conservation of Natural Area Law, 1994**

The Protection of Wildlife and Conservation of Natural Area Law specifies the following:

- Hunting without license is prohibited;
- Violation of terms of hunting license is punished;
- Fattening for commercial purpose, without license, of wild animals protected throughout the year or seasonally is prohibited;
- Pollution of water zones or air in natural conservation areas, damages to water passages or throwing of poison in water passages is prohibited;
- Transportation or disposal of contaminants or mineral pollutants in natural conservation areas or destruction of ecosystems or natural conditions in natural conservation areas is prohibited.

### 3.1.8 Protected Areas in Myanmar

Protected areas are designated for the nature conservation. In 2009, the Forest Department provided a list of 43 sites consisting a total of 35 designated and 8 proposed protected areas. The 35 designated protected areas cover approximately 42,000 km<sup>2</sup> of land, representing 6.2% of the total land area of the country<sup>1</sup>. Categories and numbers of protected areas are as follows.

- Scientific Reserve : 0 site
- National Park : 2 sites
- Marine National Park: 1 site
- Nature Reserve : 1 site
- Wildlife Sanctuary : 26 sites
- Geo-physically Significant Reserve: 0 site
- Other Nature Reserve: 5 sites

### 3.1.9 Conservation of Water Resources and Rivers Law, 2006

The purposes of the Conservation of Water Resources and Rivers Law are for the conservation and protection of water resources and rivers for beneficial use by the people of Myanmar and reduction of environmental loads. To that end, the prohibited conduct as stipulated in Articles 8, 9, 11, 13, 14, 22 and 24 of the Law are as follows:

- Destruction of water resources, rivers and creeks or change of water passage.
- Intentional reduction of volume of water.
- Overall or partial destruction of training walls of rivers, damage to training walls or collision with ships.
- Damage to the environment by disposal of engine oil, chemical substance, toxic substance or other substances or throwing away of explosives from river banks or from ships under way or berthed, including stranded or sunken ships.
- Suction of sand, dredging of sand, excavation of sand, suction of gravel from rivers, use of gold panning for obtaining gold dust, dredging without permission from the Directorate of Water Resources and Improvement of River Systems for the purpose of obtaining minerals such as gold in rivers or creeks.
- Production of any resources for commercial purpose in prohibition areas or creation of water passages at sand banks, rivers or creeks reserved for construction of training walls.
- Building up of sand, gravel or other heavy materials at a bank or riverside for commercial purpose.
- Violation of ship traffic terms and conditions at rivers or creeks designated by the Directorate of Water Resources and Improvement of River Systems for the purpose of conservation of its water resources.
- Violation of terms and conditions specified by the Directorate of Water Resources and Improvement of River Systems for the purpose of prevention of pollution of water resources and prevention of change of their passages.

### 3.1.10 Protection and Preservation of Cultural Heritage Regions Law, 1998

Article 20 of the Protection and Preservation of the Cultural Heritage Regions Law specifies following prohibited conduct:

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<sup>1</sup> Myanmar Protected Areas 2011.

- Destruction of ancient ruins;
- Intentional change of original shape or structure or initial state of ancient ruins;
- Excavation for the purpose of exploration of ancient ruins; and
- Exploration of oil, natural gas, precious stones or minerals.
- Any exploratory activities to:
  - Ancient monumental zones;
  - Ancient site zones; and
  - Protected and preserved zones.

### 3.1.11 Solid Waste Management

In Myanmar, solid waste management is mostly under the control of local government. For example, large cities such as Yangon and Mandalay City, Township Development Committee has a principal function of solid waste management including industrial and hazardous waste as part of pollution control. On the other hand, in national level ECD is preparing national policy of solid waste management. However, no regulation of solid waste management including hazardous waste has been established in Myanmar until now.

### 3.1.12 International Agreements and Treaties

The Government of Myanmar has ratified to date a number of International Agreements and Treaties as per **Error! Reference source not found.**

*Table 3.3 Myanmar's Major International Agreements and Treaties*

No.	International Agreements and Treaties	Date Ratified
1	Ramsar Convention (Convention on Wetlands of International Importance Especially as Waterfowl Habitat) 1971	2005
2	Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, D.C., 1973; and this convention as amended in Bonn, Germany, 1979	1997
3	Vienna Convention for the Protection of the Ozone Layer, 1985	1993
4	Basel Convention, 1989	2015
5	Montreal Protocol on Substances that Deplete the Ozone Layer, 1989	1993
6	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990	1993
7	United Nations Framework Convention on Climate Change (UNFCCC), New York, 1992	1994
8	Convention on Biological Diversity, Rio de Janeiro, 1992	1994
9	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	2004 (Accession)

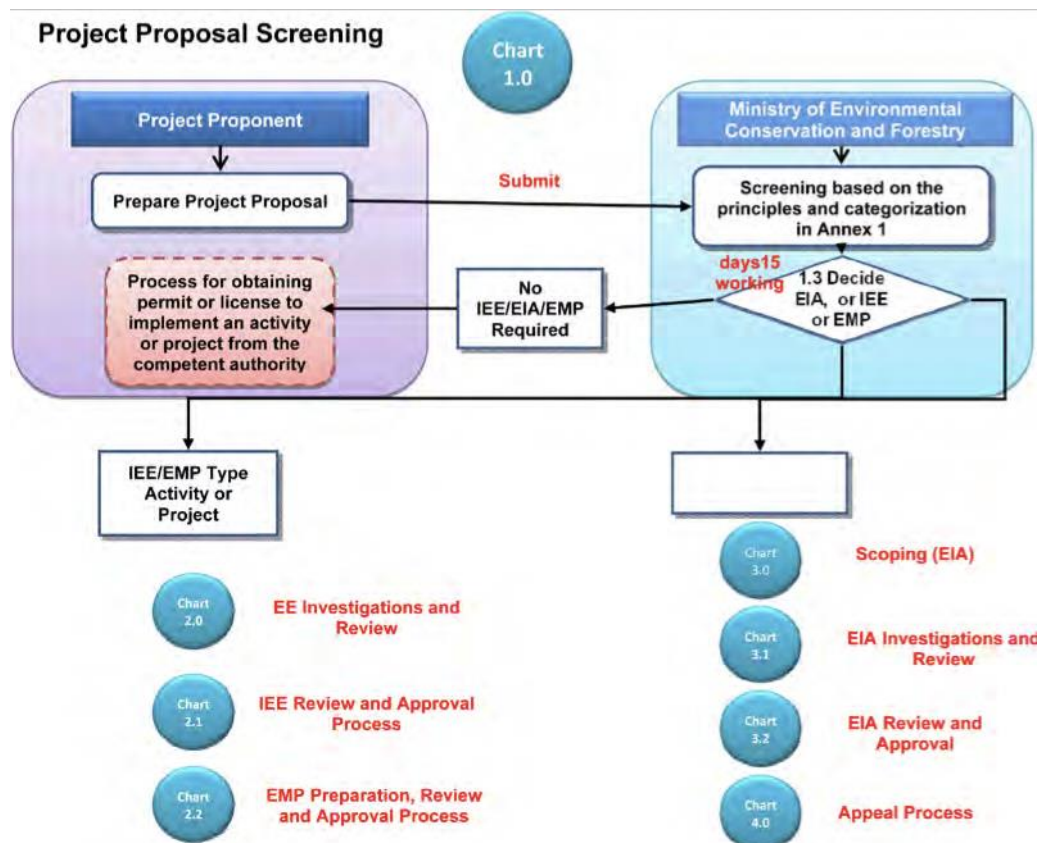
Source: The Republic of the Union of Myanmar, National Biodiversity Strategy and Action Plan (2011); Basel Convention - [http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/ tabid/4499/ Default.aspx](http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/tabid/4499/Default.aspx) (As of May 2016)

### 3.1.13 Procedures of Environmental Impact Assessment

The EIA Procedures are expected to stipulate the conditions under which EIA is required and the steps to be followed in conducting and assessing the EIA. Under the EIA Procedure, the Ministry, as the Executing Agency sets an EIA Review Committee, is to give recommendations from an

environmental point of view whether to approve the EIA reports or not. Composition of the EIA Review Committee will be determined by the Minister of MONREC but needs to include persons from the industry, academia, and civil society, as well as government officials.

EIA includes an environmental management plan and a social impact assessment report. The Procedures may also include a clause for public participation in implementing the Initial Environmental Examination (IEE), EIA, and Environmental Management Plan (EMP), yet only if deemed necessary by the Ministry. Procedure of Screening is shown in Fig. 3.2 and EMP review and approval is shown in Fig. 3.3.



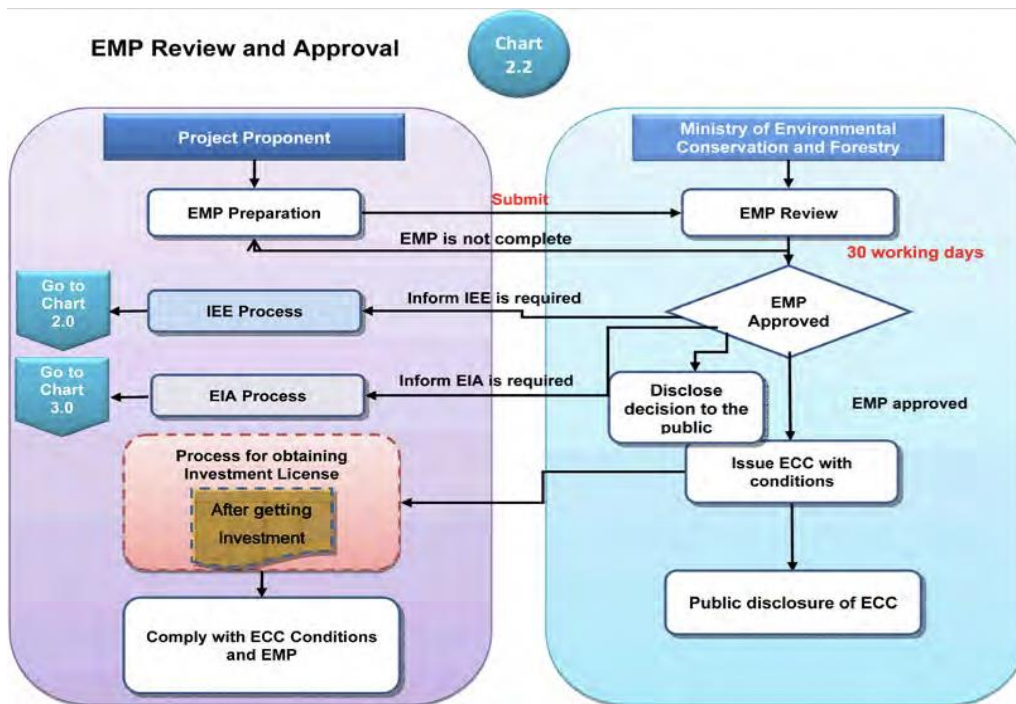
Source: ICA Study Team Based on EIA Rules, MONREC

**Fig. 3.2 Screening of Project Proposal**

The approval process is generally as follows:

- 1) Project proposal screening;
- 2) IEE investigation and review;
- 3) IEE review and approval;
- 4) EMP review and approval;
- 5) Scoping of EIA;
- 6) EIA investigation and review;
- 7) EIA review and approval; and
- 8) Issuance of ECC.

If the proponent intends to obtain ECC for the project implementation from MONREC, a series of procedure has to be processed that it depends on the type and/or feature of the project. Thus proponent is required to go through MONREC and other related organizations such as EIA Report Review Body, third person or organization undertaking IEE and EIA.



Source: JICA Study Team Based on EIA Rules, MONREC

**Fig. 3.3 EMP Review and Approval**

## 3.2 International Guidelines for Protection of the Environment

### 3.2.1 Safeguard Policies of MDBs Adapted for the Project

The following Multilateral Development Banks (MDBs) could be involved in Project financing:

- Asian Development Bank (ADB); and
- World Bank (WB)/International Finance Corporation (IFC).

Each institution has published its own safeguard policy as the standards for the environmental protection policy of their financed infrastructure development projects. An assessment to identify gaps between these safeguard policies and the Pakistan's environmental protection policies has been conducted.

### 3.2.2 Safeguard Policy Statement (SPS) of ADB

The following standards, manuals and policy documents are relevant to this Project in respect to the safeguard policy of ADB:

- Safeguard Policy Statement (June 2009);

- Safeguard Requirements (SR) 1: Environment (2009);
- Safeguard Requirements (SR) 2: Involuntary Resettlement (2009);
- Safeguard Requirements (SR) 3: Indigenous Peoples (2009);
- Policy on Gender and Development (2003);
- Operations Manual: Section C2, Gender and Development in ADB Operations (2010); and
- Operations Manual: Section F1, Safeguard Policy Statement (October 2013).

ADB's SPS sets out the objectives, principles and delivery process of ADB's safeguard policy. The objectives of ADB's safeguards are to:

- “(i) Avoid adverse impacts of projects on the environment and affected people, where possible;*
- (ii) Minimise, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and*
- (iii) Help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks”.*

Borrowers and clients of ADB are expected to comply with SR 1, SR 2 and SR 3 during both project preparation and project implementation. All three SRs include requirements for impact assessment, planning and mitigation measures necessary to undertake throughout the project cycle in order to address adverse environmental and social impacts.

The Policy on Gender and Development requires gender concerns to be treated as a cross cutting theme across all social and economic processes. It aims to promote gender equity by mainstreaming gender issues into all ADB activities. Projects will need to consider gender issues at all appropriate stages of the project cycle.

The Operations Manual is a collection of operational policies (known as Bank Policies) that specify ADB's internal review process for due diligence and supervision of borrowers and clients. Section C2 sets out how ADB will ensure compliance with the Policy on Gender and Development (approved 1998, published 2003). Section F1 outlines the procedural requirements for ADB to ensure environmental and social sustainability of projects, in line with the SPS and SRs.

### **3.2.3 World Bank's Operational Policy for the Environmental and Social Framework**

The hitherto applicable Environmental and Social Assessment Guidelines of World Bank such as the “Operational Policy (OP)” and “Bank Procedures (BP)” have now been replaced by “Environmental and Social Policy” put out in October 2018. The ten Environmental and Social Standards establish the standards that the Borrower and the project will meet through the project life cycle, as follows:

- Environmental and Social Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Environmental and Social Standard 2: Labor and Working Conditions;
- Environmental and Social Standard 3: Resource Efficiency and Pollution Prevention and Management;

- Environmental and Social Standard 4: Community Health and Safety;
- Environmental and Social Standard 5: Land Acquisition, Restrictions on Land Use and Involuntary resettlement;
- Environmental and Social Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Environmental and Social Standard 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities;
- Environmental and Social Standard 8: Cultural Heritage;
- Environmental and Social Standard 9: Financial Intermediaries; and
- Environmental and Social Standard 10: Stakeholder Engagement and Information Disclosure.

### 3.2.4 IFC Performance Standards

The “OP 4.03 - Performance Standards for Private Sector Activities” put out by WB in May 2013 states that the “Eight IFC Performance Standards have been adopted by World Bank as the World Bank Performance Standards for Projects Supported by the Private Sector”. Because of IFC is a member of World Bank Group, the “World Bank support for projects” or their “components that are designed, owned, constructed and/or operated by a Private Entity”.

Thus, the IFC Performance Standards are considered as being equivalent to or more stringent than the other guidance listed above. Depending on the nature and financing entity of the project, IFC Performance Standards are adapted as the international standard referred to the social and environmental development strategies and that the project is expected to comply with these requirements throughout all stages of the project.

The IFC has established a framework comprising of eight performance standards in respect to the environmental sustainability with their objectives described as follows:

- 1) Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
  - a. To identify and evaluate environmental and social risks and impacts of the project;
  - b. To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment;
  - c. To promote improved environmental and social performance of clients through the effective use of management systems;
  - d. To ensure that grievances from affected communities and communications from other stakeholders that are responded to and managed appropriately; and
  - e. To promote and provide means for adequate engagement with affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.
- 2) Performance Standard 2: Labour and Working Conditions;
  - a. To promote the fair treatment, non-discrimination, and equal opportunity of workers;

- b. To establish, maintain, and improve the worker-management relationship;
  - c. To promote compliance with national employment and labor laws;
  - d. To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain;
  - e. To promote safe and healthy working conditions, and the health of workers; and
  - f. To avoid the use of forced labor.
- 3) Performance Standard 3: Resource Efficiency and Pollution Prevention;
- a. To avoid or minimize adverse impacts on the environment and human health by avoiding or minimizing pollution from project activities;
  - b. To promote more sustainable use of resources, including energy and water; and
  - c. To reduce project-related GHG emissions.
- 4) Performance Standard 4: Community Health, Safety and Security;
- a. To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances; and
  - b. To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.
- 5) Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- a. To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs;
  - b. To avoid forced eviction;
  - c. To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost<sup>4</sup> and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
  - d. To improve, or restore, the livelihoods and standards of living of displaced persons; and
  - e. To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
- 6) Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- a. To protect and conserve biodiversity;
  - b. To maintain the benefits from ecosystem services;
  - c. To promote sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.
- 7) Performance Standard 7: Indigenous Peoples;
- a. To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples;



- b. To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts;
  - c. To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner;
  - d. To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle;
  - e. To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present; and
  - f. To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.
- 8) Performance Standard 8: Cultural Heritage
- g. To protect cultural heritage from the adverse impacts of project activities and support its preservation; and
  - h. To promote the equitable sharing of benefits from the use of cultural heritage.

Since IFC Performance Standards are primarily general and qualitative guidelines, they often do not provide quantitative targetable goals. Therefore, the World Bank Group (WBG) have adapted IFC's Environmental, Health and Safety General Guidelines (IFC EHS Guidelines, 2007), which are defined in the IFC Performance Standards as "Technical Reference Documents with General and Industry-specific Examples of Good International Industry Practice".

Annex II shows Letter of Commitment stating that this study including Environmental Management and Monitoring Plan are carried out in compliance with the laws and regulations of Myanmar as well as those of the safeguard policies of MDBs for safeguarding the environment of Myanmar.

## 4 Existing Environmental Conditions of Project Area

### 4.1 Socio-economic Environment

#### 4.1.1 Administrative Divisions

Baluchaung No.1 HPP is located on Baluchaung River in the southeaster corner of Loikaw Township, which is the capital city of Kayah State. The area is in the southern rim of Eastern Highland of Myanmar where the area is generally covered with thick highland vegetation. It is one of the seven townships of Loikaw District in Kayah State. It lies between 19°14' and 20°59' north latitudes and also between 97°07' and 97°22' east longitudes. Fig. 4.1 shows the Kayah State and its townships.



Source: Township Peace and Development Council

**Fig. 4.1 Administrative Area of Kayah State**

Loikaw Township has an area of 1,548.97 km<sup>2</sup>. Longest length is 132.14 km from east to west and 146.03 km from north to south. It is bounded on the east by Shartaw Township, on the west by Demoso Township, on the south by Bawlakhe Township and on the north and northwestern by Hsesaing and Phekon Townships.

There are 13 Wards and 12 village tracts in Loikaw Township. The eastern part of the boundary line is only 32.2 km away from Myanmar-Thailand international boundary. The northern part is more extensive than to southern part.

#### 4.1.2 Demography of the Project Area

##### 1) Population

Based on the 2014 Myanmar Population and Housing Census, the demographic information in Loikaw Township, total populations are 128,401. As is shown in Table 5.1, population of the Loikaw Township is widely distributed over the area of 1,549 km<sup>2</sup>. Population density of the township is approximately 83 persons per km<sup>2</sup>. There are 63,109 males and 65,292 females. This make there are 97 males per 100 females. Average size of household is 4.6 persons. It is comparatively higher than Myanmar's average of 4.4 persons per household.

Project area is in Law Pi Ta village tract where the local population is 1,902. Slightly more than 20 % of the villagers are the EPGE staff workers, and workforces of skilled and unskilled workers. Table 4.1 shows ward-wise and village-wise population of Loikaw Township.

**Table 4.1 No. of households and Population of the Words and Villages in Loikaw Township**

No.	Ward Tracts	Population	No.	Village Tracts	Population
1	Naung Yar ( Ka )	1,971	1	Pan Kan	3,023
2	Naung Yar (Kha )	257	2	Htee Se Kha	952
3	Daw Au Khu	1,876	3	Loylen Lay	1,781
4	Maing Lone	1,155	4	Noe Koe	502
5	Min Ga Lar	635	5	Kone Thar	1,175
6	Dhammar	184	6	Daw Paw Ka Le	775
7	Zey Paing	162	7	Nwar La Woe	2,262
8	Shwe Taung	231	8	Chikle	1,959
9	Law Da Ma	1,079	9	Mahtawkhu	888
10	Daw Tan Ma	807	10	Parlong	309
11	Daw Noe Ku	567	11	Teelon	545
12	Shan Su	275	12	Lawpita	1,902
13	Min Su	1,223	-	-	-
Total		10,422	Total		16,073

Source: Township Peace and Development Council, 2018

##### 2) Ethnicity

As is shown in Table 4.2, ethnicity in the project area is generally classified into seven to ten ethnic groups (not including ethnic sub-groups) as native to Kayah State. In addition, Shan, Intha, and Bamar live in the north and Pa-O in the surrounding hills. Each group is also known by more than one ethnic name. Among them, Kayah is the largest groups of ethnic group, which occupies 38.4%, followed by Bamar with 29.6% and Shan with 25%. The foreign residents, mainly Thai in this Township are 2.5%.

Padaung, a group of Kayan ethnic group and known as women wearing brass neck and leg rings reside in a community located in Demoso Township in Loikaw District. Their livelihood depends upon rain-fed rice production, maize and animal husbandry. In addition, their community is a spot of tourist attraction and they sell hand-woven traditional clothes as souvenir.

**Table 4.2 Ethnicity of Loikaw Township**

No.	Ethnic Group	Population	Percent of the Total Population
1	Kachin	140	0.12
2	Kayah	46,632	38.45
3	Kayin	4,068	3.47
4	Chin	366	0.31
5	Mon	291	0.25
6	Bamar	34,597	29.76
7	Rakhine	322	0.27
8	Shan	28,902	24.53
9	Forienger	3,365	2.85
<b>Grand Total</b>		<b>118,683</b>	<b>100%</b>

Source: Township Peace and Development Council, 2018

#### 4.1.3 Land Use

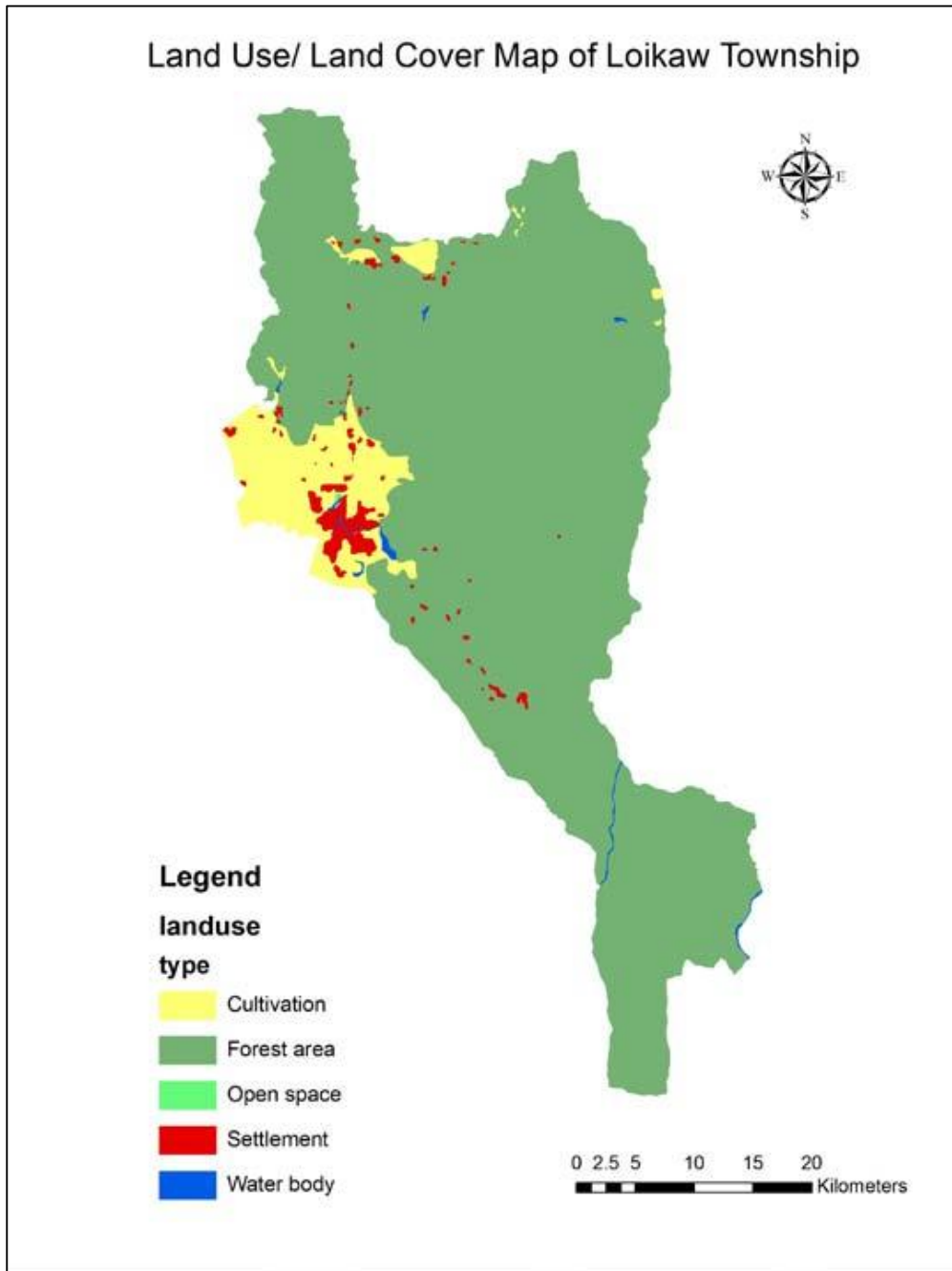
Fig. 4.2 shows patters of land use in Loikaw Township. The cultivated areas were recorded as 59,057 acres while the reserved and non-reserved forest areas were 72,873 acres in 2018. Farmers usually grow crops only in monsoon season. Summer rice is grown with irrigation in the area of Moby Dam in Phekon Township in Shan State.

In the township level, monsoon rice and three types of rice ecosystems cover the largest areas: 1) *Le* land (flooded rice); 2) *Ya* Land (rain-fed;) and 3) *Taung-ya* Land (rain –fed land in hilly area, mostly with rotational cropping) were observed. Out of the total land of 382,686 acres, the cultivated areas are 59,057 acres (14.3 %), while reserved and non-reserved forests are 72,873 acres (19.0 %). Major land use in Loikaw Township is shown in

*Table 4.3*

There are huge areas of upland, *Ya*, which occupies 66.0 %, the low land rice area is 33.3% in the total township's cultivated areas. The other land utilization in reserved and non-reserve forest, such as farming and mining industries, are observed with total area of 2,119.48 acres.

With good rainfalls and irrigation facilities, some villages have homestead gardens, growing vegetables and kitchen crops for extra income. The perennial trees are also found in several villages although forest areas do not generally exist in rural area. Because of the timber extraction, charcoal making and fuel wood for several decades, the lands were already deforested, encroached by agriculture lands. Major land use in Loikaw Township is shown Table 4.4 and land use cover in Loikaw Township is shown in Table 4.5.



*Fig. 4.2 Land Use/Land Cover Map of Loikaw Township*

**Table 4.3 Major Land Use in Loikaw Township**

No.	Particular	Area (acre)	%
1	Net Cultivated Area	59,057	15.4
	Le	18,348	4.8
	Ya	40,534	10.6
	Alluvial (Kaing/ Kyun)	0	0.0
	Orchard	175	0.0
2	Fallow Land	1,998	0.5
3	Habitat		0.0
4	Industrial	2,143	0.6
5	City, Village and other	10,933	2.9
6	Reserve/ Non Reserve Land	72,873	19.0
7	Wild forest	44,042	11.5
8	Uncultivated Land	14,873	3.9
9	Other	176,767	46.2
<b>Total</b>		<b>382,686</b>	<b>100.0</b>

Source: Township Peace and Development Council, 2018

**Table 4.4 Land Utilization in Reserved and Non-Reserved Forest in Loikaw Township**

No.	Name of Reserved/ Non Reserved Forest	Area (Acre)	Private Forest		Other Uses of Forest Area (Acre)				%
			Teak	Hard wood	Farming	Mine	Water Logged	Total	
1	Mahtaw Khu	1214	140	-	200	-	-	200	16.47
2	Pain Chit	24,320	-	-	44.6	199.59	-	244.19	1.09
3	Nant Per Mone	46,080	50	-	52.5	-	-	52.5	0.11
4	Konethar (non)	1,353	-	-	543.05	-	-	543.05	40.11
<b>Total</b>		<b>72,967</b>	<b>190</b>	<b>-</b>	<b>840.15</b>	<b>199.59</b>	<b>-</b>	<b>-</b>	<b>57.78</b>

Source: Department of Forest, Loikaw Township, 2018

**Table 4.5 Land Use/Cover in Loikaw Township**

Township Area:	1,535.3 km <sup>2</sup>	(%)
Cultivation Area:	127.8 km <sup>2</sup>	8.32
Forest Area:	1,374.2 km <sup>2</sup>	89.51
Settlement Area:	26.6 km <sup>2</sup>	1.73
Others	6.7 km <sup>2</sup>	0.44

Source: JICA Study Team's F/S Report

Note: Where the Data in 2018 is the same as the data 2015 has not been changed

#### 4.1.4 Local Economy

Because of the capital city of Kayah State, Loikow Town ship is the largest urban area and has the largest economic activities. Its population is largest among others in Kayah State, and the largest town in the state, most of infrastructure, such as health, education, roads, electricity, telecommunication, and electricity are readily available. Because of the relatively flat terrain, most arable farmland has been developed. On the other hand, village like Law Pi Ta where Baluchaung No.1 HPP is located, not much of development initiatives are seen.

With the improvement in transport and communication sectors in recent years, Loikaw Township has a direct air link with the major tourist areas, such as Yangon, Mandalay and Nyaung-u. Although the Kayah State has rugged terrains, the transportation network is being developed. Roads connecting Loikaw Township with Shan State, Kayin State and central and lower parts of Myanmar provide the easy access to Kayah State.

With the development in trading, the economy of the Kayah State is visibly enhancing. As for existing economic conditions in Loikaw Township, there are 173 commercial industries, such as rice mills, saw mills, bakery, water purification, furniture industries, and automobile repair with the total workers of about 1,000. Unemployment rate based the 2014 Myanmar Population and Housing Census is 3.1 % of the total population of the township.

The cottage industries like loom weaving, blacksmith, goldsmith, sewing etc. provide job opportunities to about 300 workers. In the rural area, farming is the major activity for income generation of all households. The major crops are rice, maize, pigeon peas, groundnut and sesame. According to the data recorded by the GAD, Loikaw Township has the work force of total 72,462 people. Among them the highest number is 31,351 farmers (44.1%), followed by casual workers of 18,662 (26.0%). Government staffs are recorded as 5,373 (7.4%). Livelihood and working population of Loikaw Town ship is shown in Table 4.6 and Table 4.7 respectively.

Casual labor is the largest among others followed by the government employee. This reflects that Loikaw Township is behind the development of industrial economy. No agriculture population means families generally do agricultural works. There are local grocery stores that are probably included in the “Others”. In general the statistics indicates that the economic conditions are not active comparing to other state.

**Table 4.6 Population by Livelihood in Loikaw Township**

No.	Type of Job	No. of Working Population
1	Government Staff	5,373
2	Services	589
3	Agriculture	31,531
4	Livestock	9,751
5	Trading	2,152
6	Small Industry	
7	Fishery	
8	Casual Labor	18,662
9	Others	4,404
<b>Total</b>		<b>72,462</b>

Source: Township Peace and Development Council, 2018



**Table 4.7 Working Population in Loikaw Township**

No.	Type of Job	No. of Working Population	%
1	Government Staff	5,373	17.2
2	Services	589	1.9
3	Agriculture	-	-
4	Livestock	-	-
5	Trading	2,152	6.9
6	Small Industry	-	-
7	Casual Labor	18,662	59.9
8	Others	4,404	14.1
<b>Total</b>		<b>31,180</b>	<b>100</b>

Source: Township Peace and Development Council, 2018

#### 4.1.5 Livestock Rearing

It was recorded that firewood is the main source of energy for cooking for 69.2% of the households in Myanmar (Myanmar Census, 2014). Therefore, the major forest products the village communities rely on for their daily life are fuel wood and charcoal. The forest products from Loikaw Township also include bark (for tanning), gums, medicinal plant, lac which are important items for household extra income. The quantity of the NTFPs (Non-Timber Forest Products) produced is listed in Table 4.8

**Table 4.8 Livestock Breeding in Loikaw Township**

No.	Year	Buffalo	Cow	Pig	Goat	Chicken	Duck
1	2015 - 2016	7,003	17,155	22,174	244	461,953	1,321
2	2016 - 2017	7,178	17,583	23,257	261	489,421	1,431
3	2017 - 2018	7,877	17,511	22,377	266	484,856	1,242

Source: Township Peace and Development Council, 2018

#### 4.1.6 Utilization of Local Resources

Most households have small scale livestock husbandry for home consumption, such as swine and chicken. Cattle raising is becoming uncommon with the scarcity of pasture and grazing lands and availability of small machines. However, many farmers use draft cattle for their farming activities. In 2015 -2016, the number of buffalo and cows were 6,912 and 16,689 numbers, respectively as per Table 4.9.

These days, many affordable farmers use power tillers for tillage and farm machinery for harvesting and threshing. Some villages have more commercial scale farmers while the subsistence farming is more common in some other villages.

**Table 4.9 Forest Products in Loikaw Township**

No.	Particular	Unit	Production
1	Fuel Wood	Ton	750
2	Charcol	Cubie Feet	1395
3	Bamboo	Number	132
4	Teak	Ton	3
5	Catechu	Viss	5150
6	Barks	Viss	34800
7	Orchid	Viss	
8	Thanet Khar	Viss	100
9	Honey	Viss	150
10	Bat Guano	Viss	
11	Thatch/ Roofing	Unit	209

Source: Township Peace and Development Council, 2018

#### 4.1.7 Social Services

##### 1) Water Supply and Sewage System

Based on the Census of Myanmar 2014, 69.5% of all households' main source of drinking water is classified as an improved water source across the country. In the Loikaw Town, sources for household water use and drinking water are one water pond and 23 tube wells. Moreover, deep tube wells and shallow tube wells are 23 and 4, respectively.

There is 26 piped water supply systems that the sources of water are generally from natural springs. In the rural areas, many villages which are located to the water sources, they are accessible to Baluchaung River and along the waterway to Mite Kan pondage. The villages near the hilly areas, have water access from the spring sources. However, it is common that many villages suffer water shortage particularly in summer season. Villagers have to fetch water from distance using a small cargo truck (*Traw-ler-gy* in Myanmar language) and motorbikes, bicycles, bullock carts, etc.

In Myanmar existing sewerage system covers only a small part of the big city such as Yangon and Mandalay City. People living Loikaw Township the sewerage service area employ on-site disposal systems such as septic tank and pit latrine.

##### 2) Electricity Supply

Based on the Myanmar Census of 2014, some 32.4% of households use electricity as their main source of energy for lighting, although disparities between urban and rural areas are strikingly different. Even those who have access are suffering from frequent power outage due to mainly to the deterioration of power generation facilities, shortage of fuel gas, and limited output of hydropower stations in the hot summer season. It is a common issue that the urban areas of Myanmar, including Loikaw Town and rural villages, have limited electricity access or a poor electricity power situation. With increasing population, the electricity demand has risen gradually; insufficient amount/voltage of electricity becomes a major issue.

Table 4.10 shows the status of the electricity access of all villages. Law Pi Ta Village Tract, which is situated nearest to the Baluchaung No.1 HPP located has achieved in the range of the average electrification of 64 %. This is comparatively low rate of electrification.

In the urban areas, the priority for 24-hr electricity supply is provided to government offices, schools, hospitals and etc. The remaining residential areas are only accessible at night time, with a poor voltage. The requirement of power line extension and construction of lamp-posts are common complaints of many villages. There are a few households who use solar power for lighting while the majority use candlelight and battery lamps.

**Table 4.10 Status of Electricity Accessibility in villages of Loikaw Township**

No.	Village	Status of Household Accessibility to Electricity (HH)		Requirement of Transformer	Other Requirement
		Total HH	Accessible HH* (%)		
1	Lay Ein	95	38 (40%)	Required	Extension of power line
2	Pa Ra Hi Ta	70	42 (60%)	-	Extension of power line
3	Law Pi Ta - Shan (new)	225	138 (61%)	required	Extension of power line
4	Law Ka Htu	145	56 (39%)	Required	
5	Law Ka Htu (new)	31	23 (74%)	Combine	
6	Se Mye	26	20 (77%)	-	
7	So La Se	132	65 (49%)	required	Extension of power line
8	Koe Mye	21	13 (62%)		
9	Mite Kan	168	121 (72%)	Required	
10	No-1 quarter	18	15 (83%)		
11	Kyauk Taung	120	93 (78%)	-	
12	Law Pi Ta	189	127 (67%)	required	Extension of power line
13	Law Da Lay	196	187 (95%)		
14	Damma Set Kyar	168	135 (80%)		
15	Kan Ni and Daw Se	82	0 (0%)		Lamp post
16	Pa Daung Kone	70	34 (49%)		
<b>TOTAL</b>		<b>1,756</b>	<b>1,118 (64%)</b>		

Source: General Administrative Department, Lawpita Village Tract, Loikaw Township, 2016

### 3) Fishing Rights, Water Rights and Rights of Commons

In Myanmar there are two types of fishing rights; one is "fishing grant", which is given with specified river area and another is "license", which is a permit of fishing. In the project area, there is no commercial scale fishing resources, such as lakes and rivers and stream, no fishing grant is established. No known water rights and rights of commons are identified in the area affected by the Project.

### 4) Public Health and Sanitation

Kayah State, like most areas in the country, has poor health care facilities due to the alleged mismanagement by the previous successive government. Although government tried health care services to be less cost, in reality patients have to pay high cost for medicine and treatment even in public clinics and hospitals. Public hospitals are lack many of the basic facilities and equipment. As Kayah State was one of the most isolated state in Myanmar, it had great difficulties in addressing

health concerns in previous days. To date infrastructure for health services and health indicators recorded in 2015 are shown in Table 4.11.

There is no plan for handling of solid waste, and no collection by the Municipal service occurs but much waste is either burnt or buried at the site. For noise level, the previous data were recorded that they were lower than the standard threshold noise levels within the station and the compound. Thus, it is not significant disturbances both for staff at the Baluchaung No.1 HPP and surrounding communities. Flooding of the site is not reported as an issue since it is situated at a higher ground level. Open drains carry away excess water to the surrounding fields in the rainy season. Discharges to the surroundings are not directed to and not a particular risk to fields with fresh edible crops.

The most common disease recorded in Loikaw Township are malaria, diarrhea, tuberculosis, dysentery with the cases of 150, 1854, 473, and 761, respectively. Moreover, the HIV/AIDS (Human immunodeficiency Virus / Acquired Immune Deficiency Syndrome) are found to be 160 cases in 2015. The health indicators are shown in the following Table 4.12.

**Table 4.11 Health Facilities in Loikaw Township**

No.	Hospital	Quantity	Gov / Private
1	Township General Hospital	1	Government
2	Station Hospital	2	Government
3	Rual Health Center	3	Government
4	Sub-Center	7	Government
5	Medical Doctor	86	Government
6	Nurse	260	Government
7	Health Assistance	4	Government
<b>Total</b>		<b>363</b>	

Source: Township Peace and Development Council, 2018

**Table 4.12 Number of Sickness Reported in Loikaw Township**

No.	Disease	Case
1	Malaria	42
2	Diarrhea	2095
3	Tuberculosis	314
4	Dysentery	785
5	Liver Disease	9
6	HIV/AIDS	576

Source: Township Peace and Development Council, 2018

## 5) Educational Services

For the basic education infrastructure, the primary, middle and high school status are described in Table 4.13. The total numbers of teachers are recorded as 54 and students as 1,197 in 2015 academic year.

**Table 4.13 Education Facilities in Lawpita Village Tract in Loikaw Township**

No.	Name of School	Location	Area (acre)	No of teacher	No of student
1	State High School Lawpita	Law Pi Ta	14.45	20	355
2	State Middle School (Law Da Lay)	Law Da Lay	5.7	15	316
3	State Middle School (Shan)	Shan Ywar	7.34	14	433
4	Affiliated Primary School	So La sel		2	33
5	Affiliated Primary School	Mite Kan		2	39
6	Affiliated Primary School	Dawtacha (Pa-O)		1	21
		<b>Total</b>		<b>54</b>	<b>1,197</b>

Source: General Administrative Department, Lawpita Village Tract, Loikaw Township, 2015

*Note: Where the Data in 2018 is the same as the data 2015 has not been changed*

There are five monastic schools with 553 students, where most orphanage children and the poor from rural areas are attending to the basic education level. Table 4.14 shows the basic education facilities, which is located near the Baluchaung Hydropower Stations. There are one State High School, one Middle School, and three Affiliated Primary Schools in the project area.

**Table 4.14 Basic Education Level in Loikaw Township**

No.	Type of Educational Facility	Quantity	No. of Teachers	No. of Students	Ratio
1	High Schools	18	612	18660	1:30
2	Middle Schools	12	111	3719	1:33
3	Primary Schools	92	382	7889	1:20
4	Pre-school / Kinder Garden	35	59	905	1:15
5	Monastic Schools	5	27	553	1:20

Source: Township Peace and Development Council, 2018

There are three higher education facilities of university/college level. The number of teachers and students in 2015 were listed in Table 4.15

**Table 4.15 Universities and Colleges in Loikaw Township**

No.	Name of university/college	Location	Area (acre)	No. of teacher	No. of students
1	University of Loikaw	Naung Yar (A)	158.63	275	2,861
2	Computer university	Chi Kal	76.09	104	77
3	Technical university	Pan Tan	87.46	108	575

Source: General Administrative Department, Loikaw Township, 2015

*Note: Where the Data in 2018 is the same as the data 2015 has not been changed*

#### 4.1.8 Gender and Children's Rights

Although no specific studies are available for Myanmar, research from other countries show that environmental impacts such as forest loss, water degradation, and climate change cause significant negative impact on gender balance. In general, women are responsible for collecting forest products, for needed items and greatly increases their workload. Women are also responsible for caring for sick children and old people, and as environmental degradation leads to increased sickness, it again increases women's workloads. Women are more vulnerable to reproductive health problems.

In general, women and men experience the effects differently because of their different social role, discrimination and poverty. In poor and marginalized societies, women are less able to adapt to environmental shocks. They have less access to education, information, credit, and technologies—these factors give them less adaptive capacity. They have less of a voice, and so are less involved in planning and decision making. These situations are more prevalent in rural than urban areas, in general. Similarly, poor economy and under development during the last decades enhanced the child labor across Myanmar. In urban and rural alike, children are seen working laboriously in various workplaces, such as tea- shops, restaurants, ports, road construction, etc. The worse situation is military expansion with recruitment of children. Myanmar was very often internationally criticized for its child labor issues.

#### 4.1.9 Industrial Safety

Baluchaung No.1 HPP has operation and maintenance manuals. However, there is no regular safety training conducted and no health and safety audits have been conducted. Staff are not issued with PPE (Proper Protective Equipment). There is no first aid trained staff in the station itself. In addition, a Rural Health Center with limited facilities and staffed by a nurse is stationed at Mite Kan village, less than 2 km away from the Baluchaung No.1 HPP. The nearest hospital in Loikaw Town is 16 km away. Water supply for the staff is provided through tube wells.

No environmental monitoring process currently takes place. There is no equipment to measure noise or air pollution levels. There are no wells to measure possible groundwater pollution in or around the station.

Currently health and safety conditions at the station are unsatisfactory. No health and safety manuals exist. There is no regular safety training conducted and staff are not issued with the PPE.

There is no first aid trained staff in the station itself. The lack of safety training and equipment for staff combined with only limited management plans creates a working environment that is in urgent need of improving.

#### 4.1.10 Cultural, Historical Heritage and Religious Sites

Regarding with religious infrastructure, there are 93 pagodas in Loikaw Township. The most famous and much attractive to the tourists, local and abroad is the "Taung-kwe Sedi (Broken Hills)", which is located in the center of the town as per Fig. 4.3. Taung-thone-lone (Three mountain ranges), Shwe-letwar (Gold palm pagoda) and Mya-kalart pagodas are the most well-known pagodas located on the hill tops, with a scenic beauty of Loikaw.





**Fig. 4.3 Taung-kwe Sedi Temple in Loikawa**

There are 96 Buddhist monasteries while nun-monastery are three. The total number of monks, novices and nuns are 521, 1,373 and 202, respectively.

The Christ Church (Christ Central Roman Catholic Church) and Cathedrals are situated in Nyaungkhar quarter of Loikaw Township. It was the first Christian mission church in the Township built in 1989, stands as the largest one in Myanmar. The list of the infrastructure of other religions, besides Buddhism is noted in the following Table 4.16.

**Table 4.16 List of Infrastructure of Various Religion in in Loikaw Township**

No.	Township	Buddhist	Christian	Hindu	Islam	Others	Total
1	Loikaw	78,453	36,513	103	2,146	1,468	118,683

Source: Township Peace and Development Council, 2018

Due to the natural geographic settings, the township has a variety of recreation attractions, like Hti-se-khar waterfall, Nyaung-khar Lake, Ngwe-daung spring, etc. The most popular cultural historic tourism spot is the “Gyat Cave” situated about 2 km away in the east of the town. It is believed to be a place where evil spirits live and a number of old coffins and bats dwelling inside it.

After 2011, local and international tourism was introduced to Kayah State, which has rich natural resources ranging from scenic landforms of natural beauty to the traditional culture of indigenous people, such as “Kayan/Padaung”. These days, with the improvement of transportation and communication after the restoration of peace and tranquility, the area development, as well as economy development has been achieved in a momentum.

#### **4.1.11 Vulnerable Groups**

The poor, refugees, indigenous of ethnic people are classified as vulnerable group. Refugee, indigenous and ethnic people are also included. However, there is no vulnerable group observed in this Township. In remote villages more or less poor people are living. Some households are so poor that they cannot afford to get the power distributed by diesel engine generator, or a solar power system. These people are mostly with few acreage of crop lands. Many are relocated from the dam site, or from the old village damaged by river bank erosion. [SEP]

#### **4.1.12 Situation of Conflict or Split of the Communities relevant to the Project Area**

At present, there is no information of conflict or split of the communities relevant to the project area.

#### **4.1.13 Activities of CBO and NGOs**

Significant activities of CBO and NGOs have not been recorded in recent years. There are no LNGOs, INGOs and CBOs stationed at Madaya Township.

#### **4.1.14 Natural Hazard/Risks, Unstable Security Conditions, Existence of Land Mine**

There is no information of hazard/risk, unstable security condition, existence of land mine etc. in Madaya Township. [SEP]

#### **4.1.15 Traffic Accidents**

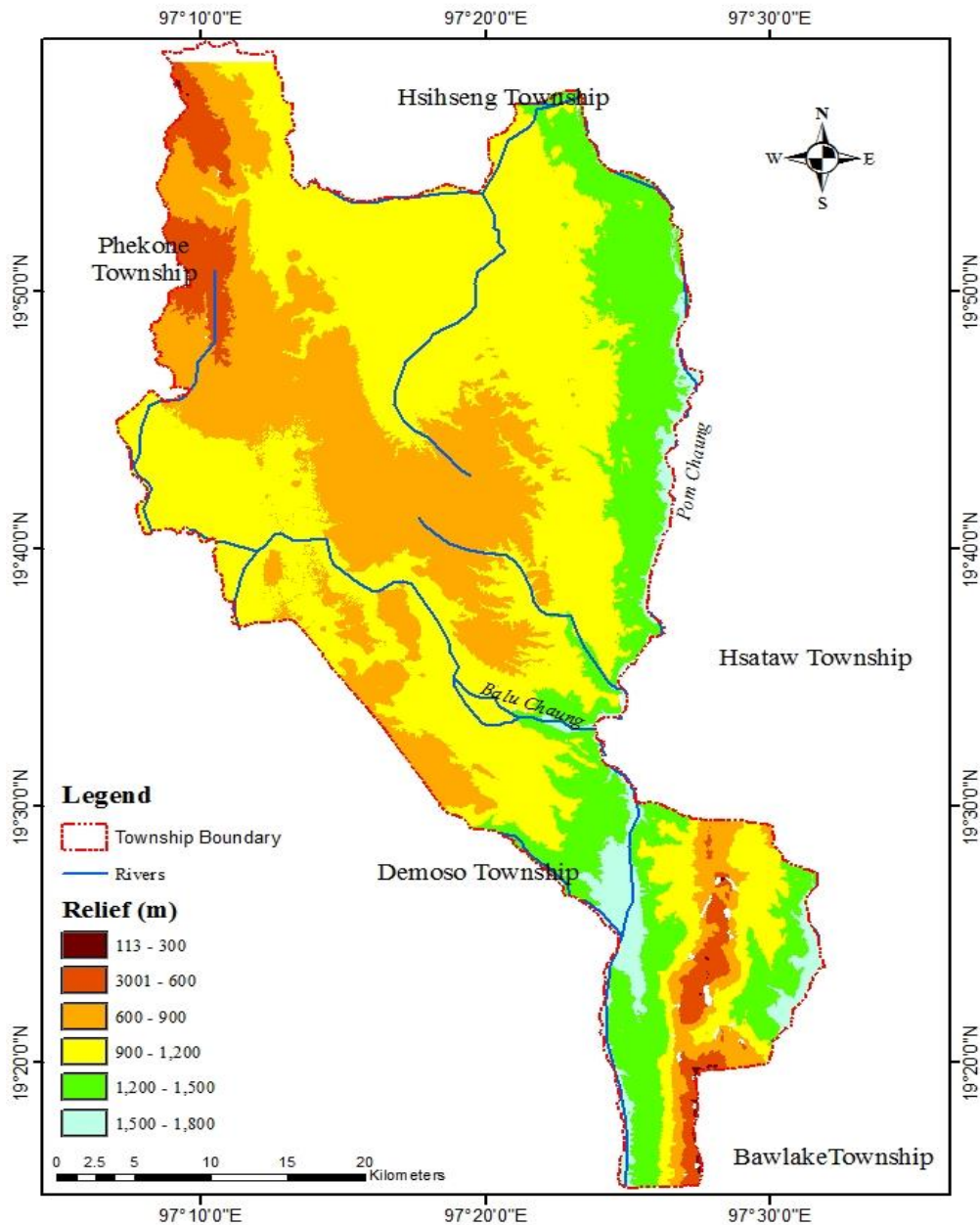
No serious area prone to traffic accidents is informed of in Madaya Township. [SEP]

### **4.2 Natural Environment**

#### **4.2.1 Topography and Hydrology**

Loikaw Township is located in Kayah State at 899 meters above sea level. Map of Loikow is shown in Fig. 4.4. Kayah State is a part of Shan Plateau, however when it stretches out southwards, it gradually loses its plateau character. In the whole township, a number of hills and mountain ranges are seen. The Kanti Mountain Range, with the highest peak about 1,565 meters lies on the east of Baluchaung River.





Source: Land Use Division, Department of Agriculture, Loikaw Township

**Fig. 4.4 Topography of Loikaw Township**

The small streams flowing into the Baluchaung River are Namphe, Namsamkha and Ngwegaung streams. Generally, water level of Baluchaung River ranges from 905 m to 875 m.

The Ngwedaung Dam was constructed particularly for irrigation to agriculture fields. The water from Moby Dam is mainly used for the hydro-electric power generation at Lawpita. The Dam also controls floods along Baluchaung River below Loikaw Township and it irrigates 4,856 ha of rice fields.

Loikaw Township is famous for its beautiful waterfalls and lakes. The Baluchaung River passes through in the centre of Loikaw and then continues about 10 km southeast ward approaching Mahtawkhu Waterfall (76.2 m height) and then continues flowing southeast, in the Lawpita village where Lawpita waterfall appears at an altitude of the 442 m. These waterfalls are now used as the site of the Baluchaung No.1 and No.2 HPPs.

### 4.2.2 Climate Conditions

Table 5.17 shows annual rainfall of Loikaw Township and a graph of rainfall is shown in Fig. 5.5. According to the latitudinal location of Loikaw Township, upland areas enjoy humid subtropical type of climate and the lower portion have tropical monsoon type of climate. From 2001 to 2010, the highest maximum temperature was 36.7°C (in April) and the minimum of 8.1°C (in January). The average maximum and minimum temperatures were 32.3°C and 13.8°C, respectively. The mean temperature was 23.11°C. As Loikaw Township is situated on the mountain slope of the highland region, it receives moderate rainfall as per Table 4.17.

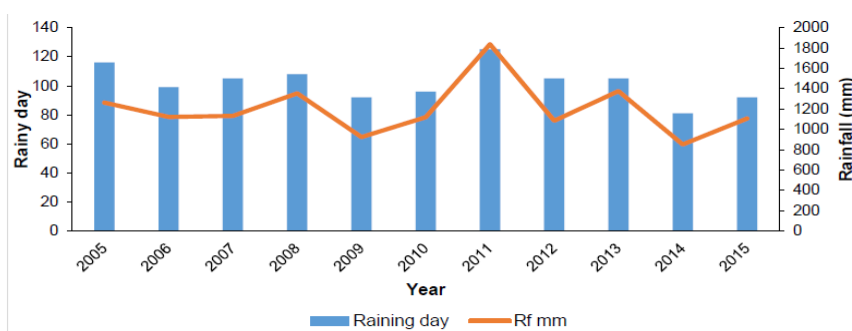
During the 10-year period (2005–2015), the highest annual rainfall of 1,837 mm with 125 rainy days was observed in 2011 while the lowest rainfall (925 mm) with 92 rainy days in 2009. The average monthly rainfall (mm) for 11-year average rainfall from 2005 to 2015 is presented in Fig. 4.5.

It was observed that rainfall starts in April with 53 mm) and higher in May with 144 mm and 12.5 rainy days. The rainfall drops in June and July, and the highest rains come in August, September and October with 264 mm, 194 mm, and 155 mm, respectively. After that it decreased abruptly in November (38 mm). As the study area lies within Dry Zone of Central Myanmar, its average annual rainfall was found to be 994 mm during this period. The natural disaster such as flood and drought often damaged the crop production of the study area.

**Table 4.17 Annual Rainfalls (mm) and Rainy Day of Loikaw Township**

Year	Monthly Rainfall (mm)													Rainfall Day Annual
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual	
2005	0	0	20	40	130	148	148	198	231	224	80	44	1262	116
2006	0	0	10	95	59	158	208	327	195	58	13	0	1122	99
2007	0	2	2	13	159	211	96	299	154	126	66	0	1132	105
2008	15	0	0	40	291	121	146	230	242	220	49	0	1355	108
2009	0	0	5	42	113	89	135	206	194	131	10	0	925	92
2010	7.1	0	0	3	82	109	209	359	153	168	22	6	1118	96
2011	18	1	77	130	370	246	150	405	197	200	31	11	1837	125
2012	11.2	0	3	51	164	79	172	235	185	135	20	29	1084	105
2013	13	0	13	62	70	124	149	264	366	226	52	38	1376	105
2014	0	0	0	15	69	10	210	191	82	84	39	0	851	81
2015	54.1	1	66	86	76	95	200	186	141	132	33	13	1106	92
Average	11	0.4	18	53	144	140	166	264	194	155	38	13	1197	102.2

Source: Department of Agriculture, Loikaw Township



Source: Department of Agriculture, Loikaw Township

Source: Land Use Division, Department of Agriculture, Loikaw Township

**Fig. 4.5 Annual Rainfall and Rainy days of Loikaw Township**

### 4.2.3 Geology and Soil Conditions

Relief, drainage, climate and natural vegetation are the principal soil forming factors. According to Land Use Division, the following soil types found in Loikaw Township can be classified as follows;

- a. Alluvial soils (*Fluvisol*): in the plains and valleys of the Baluchaung River.
- b. Meadow (Le) soils (*Fluvisol/ Gleysol*): along the narrow valleys or small streams as well as on geologically old plains and along the Baluchaung and in Nookoo and Teelon village tracts.
- c. Yellow Brown soils (*Cambisol / histic*): at an altitude between 152 m and 914 m above the sea level and along the valley of Nampown Stream.
- d. Dark Brown Yellow Soils (*Ferralsol*): at an elevation between 609.6 m and 914.4 m.
- e. Lateritic Yellow Brown Soils (*Ferralsol*): in western parts of Teelon, Lawpita, and Chikle village tracts.
- f. Red Brown Forest Soils (*Acrisol*): on the rolling topography lying above 1,524 m and in Hteetanhnya village tract and other villages.
- g. Red soils (*Acrosol P.B*) and mountainous red soils (*Cambisol*) develop on limestone within Kayah Highlands.
- h. Mountainous red soils and lateritic soils are found on the mountain ranges and rolling plain.

### 4.2.4 Forest Areas

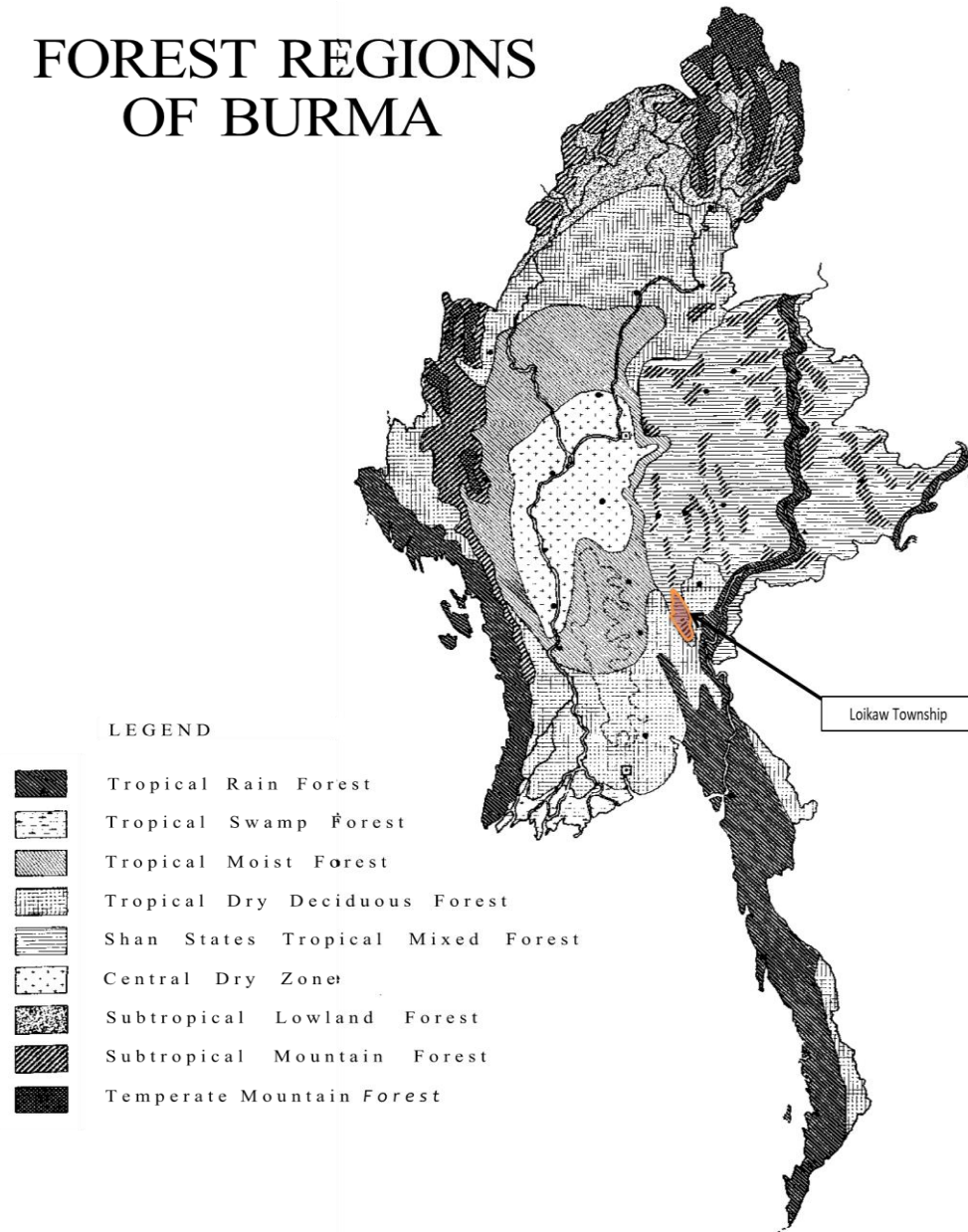
Fig. 4.6 shows forest area of Loikaw Township in respect to other areas in Myanmar. As is shown is a wide tract of Shan Highland of Tropical Moist Forest where, Loikaw Town ship is located. Altitude is on the average 870 m above sea level. Extensively developed agricultural area is the general feature of the area around project area.

As is explained in the Section 4.1.3, area of forest remaining in Loikaw Township is 89.5 %. However, forest area is quickly declining. Thus, with deforestation a major concern for most communities in Kayah, it is important to better understand current forest management practices. This analysis would aid in understanding of how to better manage the timber industry, as well as identify how community forestry practices could foster sustainable community forest use.

As is described in the Section 4.1.3, land use pattern of the project area is predominantly forest area with cultivated areas scattered in the village area of Law Pi Ta. Thus Law Pi Ta and other areas in Kayah, timber resources of teak, pyinkado, ingyin, padauk, thitkado, thitya, pyinma, pine and yingat are the majore production in the forest.

Pyinkado, padauk, and pyinma are a redish-brown hardwood shipped to India and Thailand for furniture making. Other woods are also exported for construction and building purposes.

# FOREST REGIONS OF BURMA



Source: The Forests of Burma, John H. Davis University of Mandalay and University of Florida

**Fig. 4.6 Forest Area Around Loikaw Township**

## 4.2.5 Ecosystems and Biodiversity

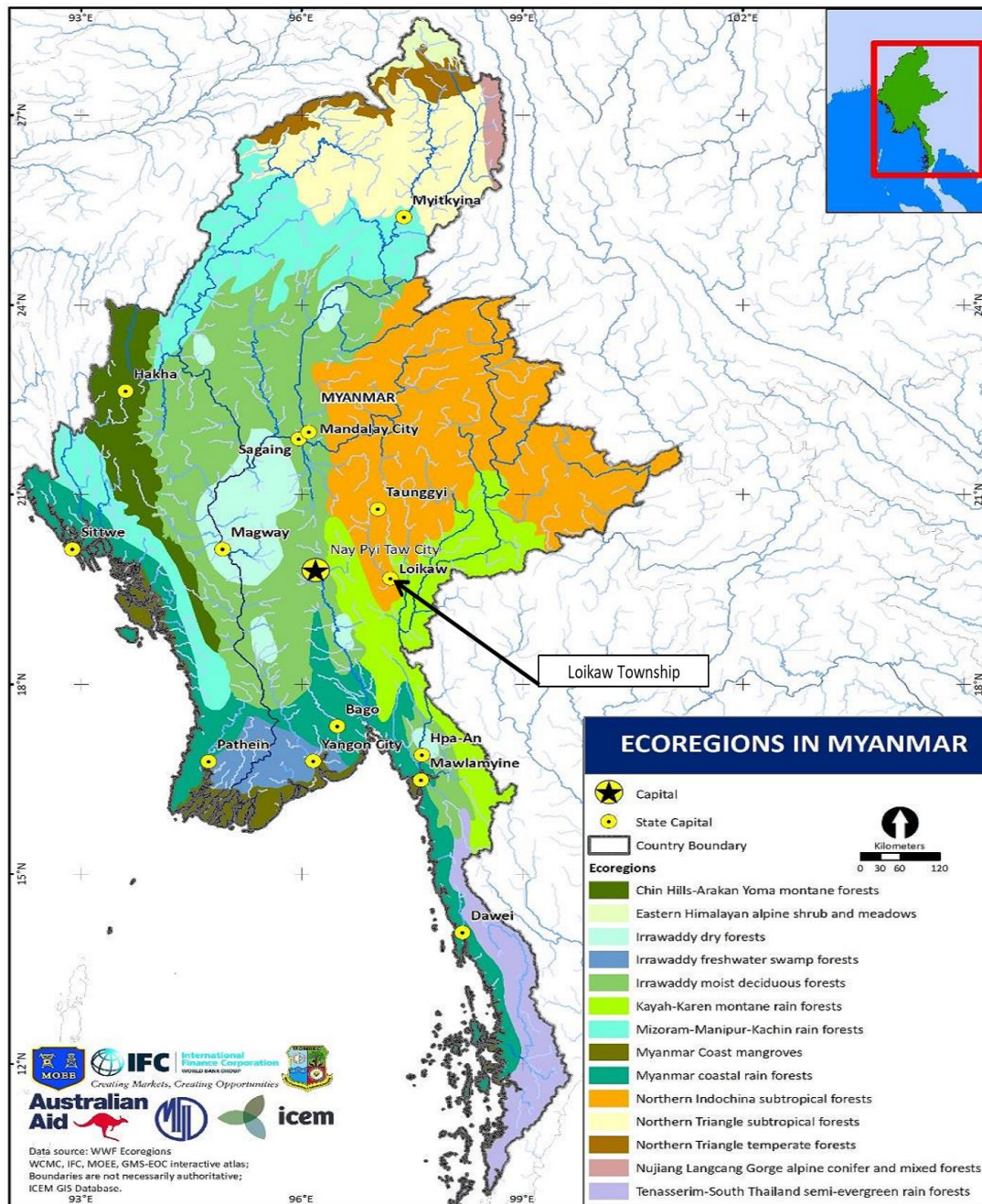
Fig. 4.7 shows eco-region of the project area in respect to other areas in Myanmar. The Government of Myanmar has taken significant measures to conserve land and biodiversity by enacting an impressive array of laws and regulations. It has joined in international efforts, notably in combating the illegal trade of biodiversity, through Convention on International Trade in Endangered Species of wild flora and fauna and related agreements. Some of the notable measures include establishing an impressive network of protected areas and parks.

By 2007, a total of 33 national parks and wildlife sanctuaries had been created. Six additional protected areas have been proposed since 1999. The protected area increased from around 1% of the country in 2004 to over 5% by 2006. NBSAP (National Biodiversity Strategy and Action Plan),



Myanmar was published in 2011 by the MONREC and United Nations Environmental Program with Global Environmental Fund. NBSAP is to develop to integrate conservation and sustainable use of biodiversity. It includes the five strategic directions and related investment priorities as follows:

- a. Strengthen conservation of Priority Sites
- b. Mainstream biodiversity into other policy sectors
- c. Implement focused conservation actions for Priority Species
- d. Support LNGOs and academic institutions to engage in biodiversity conservation



Source: SEA of the Hydropower Sector in Myanmar, IFC

**Fig. 4.7 Eco-Regions of Loikaw Township**

It should be noted that there are weaknesses associated with all measures being taken. Notably, they all require more national support and funding. In particular, prevailing weaknesses in governance makes it extremely challenging to achieve the natural resources goals. What Myanmar needs is the sufficient funding and commitment to implementing the NBSAP. There are no rare or endangered species of plant or animal recorded from the site. The environmentally sensitive areas (Protected Areas) do not exist in and surrounding area of the HPP site. There are several "Reserved Forest", such as Ma Htaw Ku, Nat Pan Mon Reserved Forests in Loikaw Township.

Forest Department has been striving for the establishment of Protected Public Forest from the unclassified forests, with the land use right of Taung-ya cultivation and fuel wood collection to the community. As a "Green Environment Campaign (Year 2016)" Kayah Regional Forest Department cultivated 2600 teak trees near the Loikaw airport at the entrance of the Loikaw Town. Forest Department also takes care of the tree plantation previously cultivated along the Loikaw - Pinlong highway for the reforestation of the surroundings areas.

Among the five villages of study sites, Mite Kan village established a "Community Forest" of 210 acres from their traditionally conserved forests in 2015. The objectives are conservation of forests and spring sources, sustainable use of forest products and to improve the socio-economy of the local community. Most tree species in the Community Forest are Inn, In-gyin, Thit-yar, Htauk-kyant trees (in Myanmar language).

#### **4.2.6 Natural Disasters and Hazards**

There are no natural disasters such as landslide, earthquake, etc. recorded near the HPP and in Loikaw Township. Floods and inundation sometimes happen in monsoon season, but the impact was not significant. Baluchaung No.1 HPP is situated at the higher ground level comparing with the surrounding. For the rural farming in the Township, because of drought, crops were often damaged. In 2015, the arrival of monsoon was late and no sufficient rains caused the maize crops reduce production. In addition, the incidence of rats and other diseases in pigeon pea cultivation occasionally takes place, which may be related with the climate change. The adaptation technologies, support and rehabilitation programs should be considered for these smallholder farmers who are the most vulnerable to the natural disasters.

Concerning with situation of reservoir side, the watershed areas are degrading due to the extensive deforestation and mining for gold. It is of much concern for siltation of the reservoir with a higher rate than the normal condition.

#### **4.2.7 Protected Areas**

There is no designated National Parks, Conservation Areas, Important Bird and Biodiversity Areas (IBAs) or habitat of protected species in the near-by areas of Baluchaung No.1 HPP.

#### **4.2.8 Landscape and Aesthetic Values**

The Karenni (Kayah) State is located in the eastern part of Myanmar. The relief of the State is mountainous with the Dawna Range and the Karen Hills also known as "Karenni-Karen" mountains separated by the Thanlwin River as it flows through Karenni (Kayah) State. Baluchaung River, called Nam Pilu in local language, flows from Inle Lake and converges with the Thanlwin in

southern part of the State. Around the project site, the landscape of typical rural area and agricultural fields spreads over the project area with topographically flat and hilly conditions.

At present the natural vegetation is seen as replaced by agricultural lands around Loikaw Township. The main contributors for the depletion of natural forests are – extensive timber extraction, fuel wood collection and the encroachment of agriculture lands.

The traditional ‘Taung-ya’ shifting cultivation (rotational cropping system) is still ongoing by the ethnic minorities on the upland areas. Burning of land clearing for taung-ya and upland crop residues of maize and pigeon pea fields is commonly seen in the summer season. The valuable landscape manifests the economy and livelihoods of ethnic upland farmers in these areas.

### **4.3 Environmental Pollution and Control Measures**

#### **4.3.1 Air Quality**

Project site is located in rural area and there are hardly found residential houses, public facilities such as schools and religious facilities such as pagodas in the vicinity. In addition, no major air pollution sources are distributed. Soot and dust emission from open burning the dead grass in a field and exhaust emission from road traffic vehicles such as trucks and motorbikes are found in some areas with some occasions. However, they are in limited scale and temporary.

#### **4.3.2 Water Pollution**

Level of pollution of turbid matter and organic matter is very low in these water bodies adjacent to the Rehabilitation Works for Baluchaung No.1 HPP.

#### **4.3.3 Noise and Vibration**

Project site is located in rural area and there are hardly found residential houses, public facilities such as schools and religious facilities such as pagodas in the vicinity. In addition, no major noise and vibration generation sources are distributed except hydropower station. However, impacts due to generation of noise and vibration are limited within existing site. Noise from road traffic vehicles such as trucks and motorbikes are found in some areas with some occasions. However, they are in limited scale and temporary.

#### **4.3.4 Soil Contamination**

There is no data about soil contamination and toxic materials in soil of the project area.

#### **4.3.5 Ground Subsidence**

There is no data about subsidence due to a large scale pumping up of groundwater, situation of foundation and pumping up of groundwater.

#### **4.3.6 Solid Waste Management**

Waste management in Myanmar falls under responsibility of the CDCs (City Development Committees) in Yangon, Mandalay, Naypyidaw and the Township Development Committees in the townships under the Department of General Affairs. Solid waste collection in Myanmar is labor

intensive and relies on manual collection with non-specialized vehicles, ranging from pushcarts to garbage trucks. In Loikaw Township similar situation is found in Loikaw Township.

There are sectoral laws and regulations related to management of toxic chemicals and legislation such as the Factories Act (1951) and Public Health Law (1972) which are related to management of hazardous waste. However, as for hazardous wastes national legislation on the management of hazardous wastes - including other categories of hazardous wastes, such as pesticides, certain industrial wastes, etc., is not clearly developed. There is no specific government institution assigned with the task of overall management of toxic chemicals and hazardous wastes.

#### 4.3.7 Offensive Odor

Offensive odor could be generated in the storage area as a result of PCB storage. It is subject to monitoring for which further management plan has to be elaborated.

#### 4.3.8 Disruption of Sunshine Area/Time

There is no disruption of the sunshine area or time for the general public as a result of the Project of Baluchaung No.1 HPP Rehabilitation Works.

#### 4.3.9 Electro-magnetic Interference and Safety for the General Public

There is no electromagnetic interference and the safety for the general public as a result of the Project of Baluchaung No.1 HPP Rehabilitation Works.

## 5 Assessment of the Environment Exposed to the Rehabilitation Works

### 5.1 Scope of the Environmental Assessment

Taking into consideration the JICA Guidelines, and relevant laws and regulations of Myanmar, together with environmental condition of the project area, three environmental components of 17 items of social environments, 9 items of the natural environment and 10 items of the environmental pollution are examined as per Table 5.1.

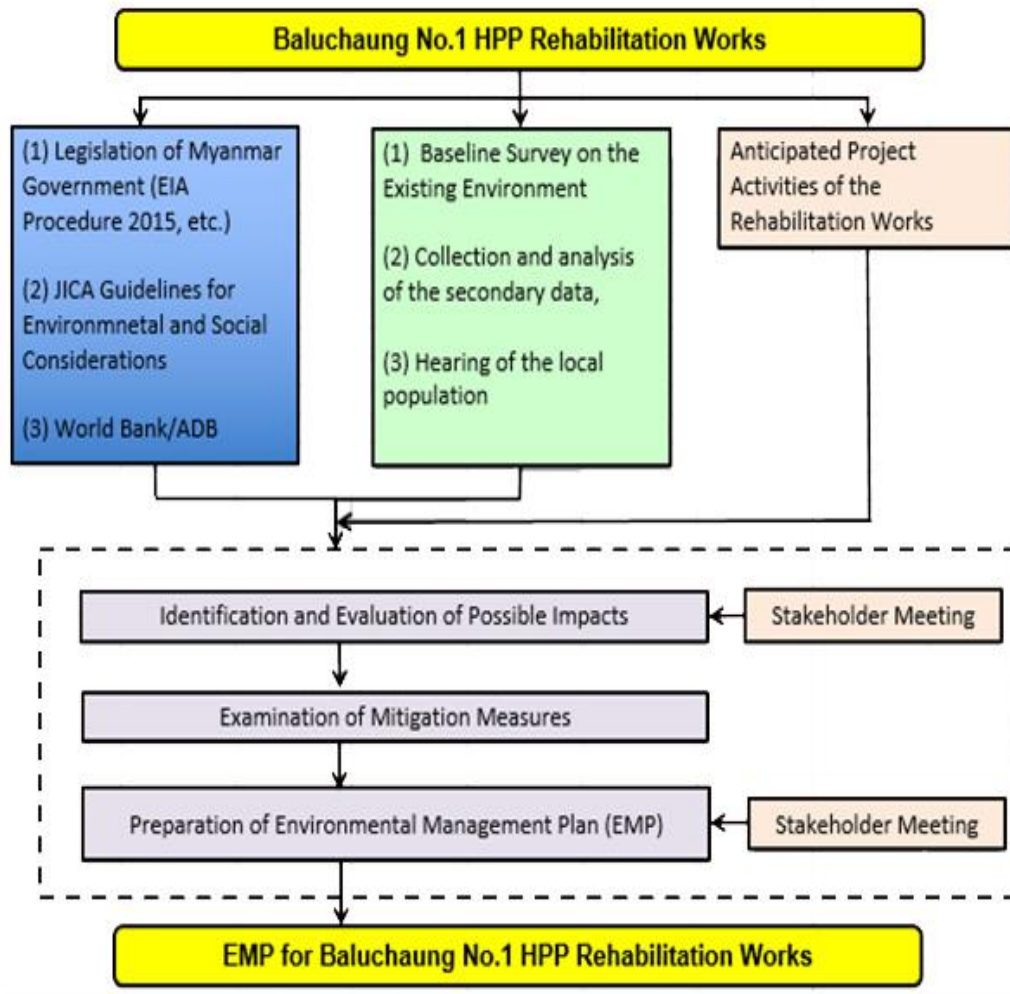
Possible impacts are identified and the extent of the impacts is also evaluated for the planned implementation stage. <sup>[1]</sup><sub>SEP</sub> In order to evaluate the following rating criteria are adopted to examine extent of possible impacts:

- a. Both positive impact (+) and negative impact (-) are expected due to the Project;
- b. Ratings are 1) A (+/-): Significant positive/negative impact is expected; 2) B (+/-): Not significant but some positive/negative impact is expected; 3) C (+/-): Extent of impact is unknown or not clear i.e. it is subject to environmental monitoring. Thus, further examination is needed; and 4) D: No impact is expected. <sup>[1]</sup><sub>SEP</sub>

### 5.2 Procedure of Impact Assessment

Procedure of preparation of EMP is shown in *Fig. 5.1*. Details of the anticipated activities of rehabilitation works for Baluchaung No.1 HPP are as previously shown in Table 1.2.





Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

**Fig. 5.1 Schematic Flow of the Preparation of EMP**

Based on the process of Preparation for EMP, including EMO<sub>P</sub>, the following stages of the rehabilitation works takes place.

### 1) Planning Stage

- a. Detailed study on the replacement and/or addition of power generation system
- b. Securing stockyard/storage area for which detailed study of the work plan is laid out.

### 2) Implementation Stage (Rehabilitation Works)

- a. Procurement of the replacing materials/parts for the rehabilitation works of power generation system.
- b. Land clearance and construction works of the stockyard/storage area.
- c. Works for renewal of dilapidated facilities/equipment and/or parts/devices.
- d. Transportation of new equipment and parts and the storage of old/replaced electric power generation equipment and parts including transformers.

### 3) Operation and Maintenance Stage

Operation of hydropower plant and other equipment upon completion of commissioning and the related EMP and EMoP is implemented by EPGE.

### 5.3 Identification and Evaluation of Possible Impacts

#### 5.3.1 Environmental Impact Analysis

Based on the results of initial environmental study in respect of the rehabilitation works, necessary survey was carried out by collection of relevant data including hearing and consultation with related central and local governmental departments and organizations as well as village and communities in the project area of Baluchaung No.1 HPP. As a result possible impacts are identified and the extent, intensity and cumulative effect of the impacts are evaluated for the listed environmental items in respect of the Rehabilitation Works for Baluchaung No.1 HPP. Results are shown together with the results of the Scoping in Table 5.1

Within the table, P denotes “Panning Stage”, I denotes “Implementation Stage” and O denotes “Operation and Maintenance Stage”.

**Table 5.1 Evaluation of Impacts Caused by Rehabilitation Works for Baluchaung No.1 HPP**

Environment		Stage			Reasons
		P	I	O	
<b>1. Social Environment</b>					
1	Involuntary Resettlement (land acquisition/ resettlement etc.), migration of population	D	D	D	All the activities for rehabilitation will be carried out within existing hydropower plant site. Thus, neither land acquisition nor resettlement is expected to take place in the surrounding areas.
2	Local economy such as employment and livelihood	D	B+	D	Temporary employment of local people as unskilled labour is anticipated during the Implementation Stage
3	Land use and utilization of local resources	D	D	D	All the activities for rehabilitation works will be carried out within existing hydropower plant site. Thus, neither change of land use nor utilization of local resources is not anticipated in the surrounding areas. Although it is out of scope of the proposed Project, former farmland of about 40 acres within the HPP site was enforced to use for EPGE staff housing during the construction works of the HPP by the Government. The land has not been reinstated to date. Thus, it is a matter of suit between farmers and local government.
4	Social institutions such as social infrastructure and local decision-making institutions, a split of communities	D	D	D	Beneficial impacts such as creation of employment opportunity and improvement living condition by upgrading power supply are identified.
5	Existing infrastructures and services such as traffic conditions	D	B-	D	Inconvenience of occasional traffic congestion to the local traffic could take place due to tracks transporting heavy equipment to hydropower plant.
6	The poor, refugees, indigenous of ethnic minority people	D	D	D	The ethnic minorities, refugees or IDPs residing in project area have a long association with the local area and these groups have generally been absorbed into the local communities. None of them are affected by the implementation of the rehabilitation works.

7	Gender	D	C	D	No part of the gender differences should be affected by implementation of the rehabilitation works. Depending on the situation and requirement of the rehabilitation works, male unskilled workers might be employed and that it could cause limited extent of which male workers could be preferred over female workers.
8	Children's Right	D	D	D	No part of children's Right is affected by the implementation of rehabilitation works since the works are confined to take place within the EPGE's land area.
9	Misdistribution of benefit and damage	D	C	D	While rehabilitation works for improvement of electric supply is attained, however, there is a possibility of misdistribution of benefit, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.
10	Local conflict of interests	D	D	D	There is a possibility of local conflict of interest and/or split of community, if increased capacity of electricity supply is not appropriately distributed. Stakeholders including communities through proper information disclosure and public participation should therefore carried out.
11	Cultural property and heritage	D	D	D	All the activities for rehabilitation will be carried out within existing hydropower plant site. There are no cultural, religious and historical heritage sites affected by the implementation of the rehabilitation works.
12	Fishing Rights, Water Rights and Rights of Commons	D	D	D	Rehabilitation works will take place within existing hydropower plant site. Thus, negative impact is not anticipated.
13	Public Health and Sanitation	D	D	D	No part of the rehabilitation works should emit NOx and PM or any pollutants affecting the public health. No discharge from the working area should affect public sanitation.
14	Infectious diseases such as HIV/AIDS	D	D	D	Because of the rehabilitation works takes place within the EPGE's land area and no workforce put up workforce camp as they commute from Mandalay city, there is no infectious disease spread over the project area as a result of the implementation of rehabilitation works.
15	Working condition	D	C	D	Adverse impacts on working condition including occupational safety could take place if safety measures are neglected by EPGE. No local area's working condition should be affected by the implementation of rehabilitation works.
16	Hazard/Public Security	D	D	D	Rehabilitation works would not trigger or cause disaster and/or jeopardize public security as a result of the implementation of rehabilitation works.
17	Accidents	D	C	D	Occurrence of traffic accidents could take place if there was inappropriate handling and management of traffic control. There is no part of the general public exposed to accidents during the implementation period of rehabilitation works.
<b>2. Natural Environment</b>					
1	Topography and Geology	D	D	D	No part of the natural environment of this nature is affected by the implementation of the rehabilitation works.
2	Soil Erosion/Sand Movement	D	D	D	No part of the natural environment of this nature is affected by the implementation of the rehabilitation works.

3	Changes of Surface Water/Hydrological Conditions	D	D	D	No part of the natural environment of this nature is affected by the implementation of the rehabilitation works.
4	Groundwater Conditions	D	D	D	No part of the natural environment of this nature is affected by the implementation of the rehabilitation works.
5	Environmentally sensitive areas (Protected Areas, IBAs etc.)	D	D	D	No part of the natural environment of this nature is affected by the implementation of the rehabilitation works.
6	Flora, Fauna, Ecosystem and Biodiversity (Terrestrial)	D	D	D	No part of the natural environment of this nature is affected by the implementation of the rehabilitation works.
7	Flora, Fauna, Ecosystem and Biodiversity (Aquatic)	D	D	D	No part of the natural environment of this nature is affected by the implementation of the rehabilitation works.
8	Landscape and Aesthetic Values	D	D	D	No part of the natural environment of this nature is affected by the implementation of the rehabilitation works.
9	Micro-climate	D	D	D	No part of the climatic conditions is affected by the implementation of the rehabilitation works.
10	Global Warming/Climate Change	D	D	D	No part of the global warming/climate change is affected by the implementation of the rehabilitation works.
<b>3. Environmental Pollution</b>					
1	Air Pollution	D	D	D	No part of air is affected by the implementation of the rehabilitation works.
2	Water Pollution	D	D	D	No part of surface water is affected by the implementation of the rehabilitation works.
3	Soil Contamination	D	D	D	No part of soil condition is affected by the implementation of the rehabilitation works.
4	Bottom Sedimentation/Contamination	D	D	D	No part of bottom sediment is affected by the implementation of the rehabilitation works.
5	Solid Waste	D	D	C	Electro-mechanical parts removed from the existing substations and power generation system should be stored in the storage area built on site within the EPGE's compound for which further industrial treatment works become available in Myanmar. Figure 2.2, 2.8 and 2.9 show the area of storage facilities constructed in the area owned by EPGE.
6	Noise and Vibration	D	D	D	No part of the general public is exposed to noise and vibrations by the implementation of the rehabilitation works.
7	Ground Subsidence	D	D	D	No part of the ground for private/public use is affected by the implementation of the rehabilitation works.
8	Offensive Odor	D	D	D	No offensive odor is generated by the implementation of the rehabilitation works.
9	Disruption of Sunshine Area/Time	D	D	D	No part of the rehabilitation works should disrupt sunshine hours/area of the surround areas.
10	Electromagnetic Interference and its Safety	D	D	D	No electromagnetic field is increased by the implementation of the rehabilitation works than the presently existing electric magnetic field.

Note 1: Environmental items are chosen based on JICA Guidelines for Environmental and Social Environment (2010.4) and relevant legislation of the Government of Myanmar as well as the project plan and environmental condition of the project area, as indicators expressing environmental and social conditions.

Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

### 5.3.2 Assessment of the Environmental Impacts

#### (1) Natural Environment

As is shown in **Error! Reference source not found.**, and because of the nature of rehabilitation works taking place within the electric generation plant and the building/yard of substation, there is no significant and direct environment affected by the implementation of the Rehabilitation Works to any part of the natural environment during the planning stage as well as the implementation stage of the rehabilitation works and the operation and maintenance stage. Thus, no environmental management plan is elaborated.

#### (2) Socio-economic Environment

As is shown in **Error! Reference source not found.**, there is no significant and direct environmental impact anticipated to take place by the implementation of the Rehabilitation Works to any part of the socio-economic environment during the planning stage. Thus, no environmental management plan is elaborated except where information dissemination meetings were held during the initial stage of environmental study.

During the implementation stage of the rehabilitation works, however, local traffic conditions could face congestions during the initial period of transporting heavy equipment to the work site. Size of vehicles and schedule of transportation in terms of frequency and other details are subject to determination by the spare parts suppliers upon completion of the bidding process of the spare parts suppliers. Details of information should be made available to the general public as soon as the spare parts suppliers submit details of the spare parts transportation plan including the size of vehicles, number of vehicles involved in the transportation operation, and other details.

There is no significant disruption of the traffic conditions during the operation and maintenance period. On the other hand, general information dissemination activities of CSR in respect to the commencement and completion of the rehabilitation works including the contents of EMP is continuously carried out by EPGE.

#### (3) Environmental Pollution and Industrial Safety

There are a number of electro-mechanical parts removed from the operating system as described above. These electro-mechanical parts could contain asbestos on the brake pad of which rotating parts might have to be stopped from time to time for maintenance purposes.

Most of the electric parts contain lead where electric wires are soldered. Thermometers manufactured 30 years or more years ago contain mercury. Because of the industrial disposal system of these chemical substance is not available yet in Myanmar, these parts are stored on site.

For the storage purposes, therefore storage buildings are constructed on site as per *Fig. 2.2, Fig. 2.10* and *Fig. 2.11*. They are built on the land in possession of EPGE at present i.e. no land acquisition is involved in the Project.

There is no significant amount of toxic chemicals, explosives or any other substance subject to strict control and regulation of the Government of Myanmar or international regulations is involved.

There is no area of earth moving, cutting and filling, excavation, and concrete placing of any major scale within the framework of the Rehabilitation Works.

Expected number of workers engaged to the Project would be approximately 50 skilled workers that are the employees of EPGE. In addition, local population of the surrounding area will be employed as unskilled labor for a limited period.

Because of the employees of EPGE who are the main workforce of the Project that are the residents of villages in the local area and commute to Baluchaung No.1 HPP daily for project implementation, there is no workforce camp created on site.

## **5.4 Environmental Management Plan (EMP)**

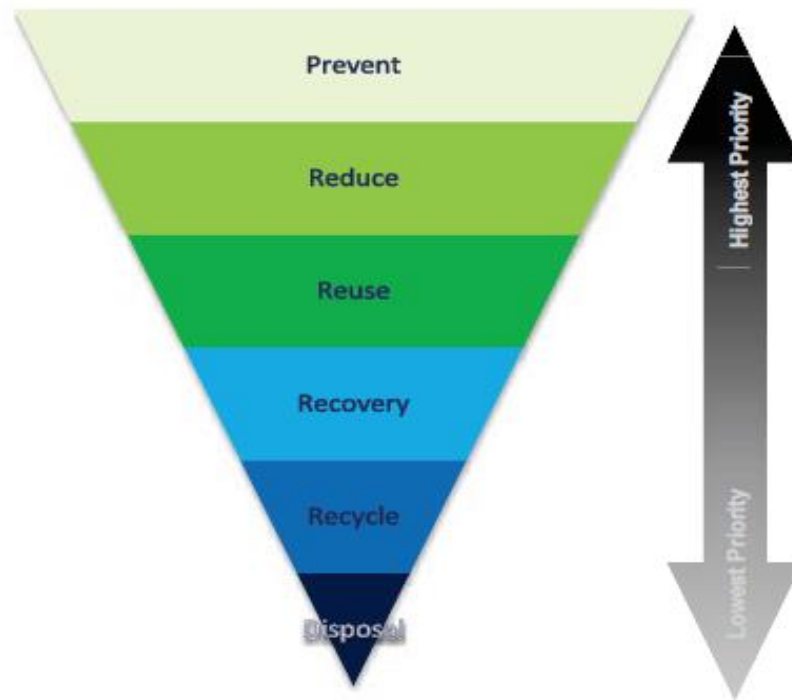
### **5.4.1 Concept of Solid/Toxic Waste Management**

Solid wastes generated during the rehabilitation work stage are non-hazardous and hazardous waste such as break compound containing Asbestos, domestic garbage, refuse, scrap, plastics, packaging materials such as papers and plastic films, and construction debris including steel and aluminum.

Waste management during the rehabilitation work period should follow the waste management hierarchy that consists of prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes as the concept is shown in schematic figure shown in Fig. 5.2. The hierarchy states that as far as practicable, the generation of waste should be avoided or minimized. Where waste generation cannot be avoided it should be reused, recycled or recovered. Where waste cannot be recovered or reused it should be stored, treated and disposed of in an environmentally sound manner.

Waste management plan for the construction and the operation phases will be prepared to minimize waste generation and ensure proper disposal methods. The plan should aim to identify and take all necessary measures, including preventive measures, to achieve appropriate waste disposal method during the construction works, and operation and maintenance period.

Particular attention must be given to the use and re-use of materials to minimize waste and, whenever practicable, using materials and products from sustainable sources.



Source: JICA Study Team for The Preparatory Survey on  
Hydropower Plants Rehabilitation Works

**Fig. 5.2 Concept of Waste Management Hierarchy**

The waste management plan shall include steps as follows:

- a. Minimize the amount of waste produced;
- b. Prepare designated waste storage areas for the wastes, which cannot be immediately disposed of. The waste storage areas should be covered and clearly signed;
- c. Educate and train staff on separation of wastes and recycling;
- d. Dispose of hazardous waste via licensed third party operator; and
- e. Encourage waste separation and recycling, and waste minimization at source.
- f. Waste should be stored so as to prevent or control accidental releases to air, soil, and water resources;
- g. Preferably store liquid wastes on impermeable surfaces with spill containment system;
- h. Spill containment system should be constructed with materials appropriate for the wastes being contained and with a drainage and collection system. The available volume of spill containment should be at least 110% of the largest storage container, or 25% of the total storage capacity whichever is greater, at the specific location;
- i. Signs should be put on all waste containers and collection areas. Each sign shall be highly visible and easily recognized by the persons using the waste container or areas. Each container or waste area sign shall be labeled as Domestic Waste, Non-Hazardous Waste or Hazardous Waste and include the responsible person with contact information and how to handle the waste. Recyclable waste bins should be designated for metal, plastic, or paper;

- j. Waste should be stored in a manner that prevents the contact between incompatible wastes. Sufficient space is needed between incompatibles or physical separation such as containment walls or curbs. For example, hazardous waste should be stored separately from other wastes and in sealed container;
- k. Hazardous wastes should be stored in a separate storage area where it is with bund and hazardous wastes must be removed for treatment and disposed from the site periodically by an approved licensed third party operator;
- l. Disposal/treatment certificates should be supplied by the third party operator to indicate how and when the hazardous wastes were treated and disposed of; and
- m. Record should be made on the amount and destination of the wastes, removed and/or disposed of off-site.

## **5.4.2 Management of the Environment During the Planning Stage**

### **(1) Natural Environment**

As is shown in *Table 5.1*, there is no significant environmental impact anticipated to affect by the implementation of the Rehabilitation Works to any part of the natural environment during the planning stage. Thus, no environmental management plan is elaborated.

### **(2) Socio-economic Environment**

As is shown in *Table 5.1*, there is no significant environmental impact anticipated to affect by the implementation of the Rehabilitation Works to any part of the natural environment during the planning stage. Thus, no environmental management plan is elaborated except where information dissemination meetings were held during the initial stage of environmental study.

### **(3) Environmental Pollution**

As is shown in *Table 5.1*, there is no significant environmental pollution or the changes of microclimate during the planning stage caused by the Rehabilitation Works for Baluchaung No.1 HPP. Thus, no environmental management plan is elaborated.

### **(4) Stakeholder Engagement**

In relation to the requirement described in Appendix 1 Corporate Social Responsibility, and also partly as per the requirement of IFC's "Environmental and Social Standard 10: Stakeholder Engagement and Information Disclosure", the project proponent shall hold at least one stakeholder meeting with in the project area prior to the commencement of the rehabilitation works.

Information on the rehabilitation works intended to carry out for Baluchaung No.1 HPP, heavy equipment transportation for replacement of the spare parts for the electric power generation system, storage of these parts on site are required to disclose and that the project proponent commit to bear the responsibility and transparency of the project implementation as a whole. It is also important to disclose, as a part of CSR, the project proponent is intending to form a team of stakeholder engagement during the period of the rehabilitation works as well as the period of operation and maintenance of Baluchaung No.1 HPP.



## (5) Establishment of Grievance Redress Unit

The project proponent requested to establish within its organization Grievance Redress Unit for which any suggestions, comments, claims and complaints made by the general public. During the stakeholder engagement session, the existence of the Grievance Redress Unit, its telephone number and e-mail address should be informed to the participants of the stakeholder meeting.

### 5.4.3 Management of the Environment During the Rehabilitation Work Stage

#### (1) Natural Environment

As is shown in *Table 5.1*, there is no significant environmental impact anticipated to affect by the implementation of the Rehabilitation Works to any part of the natural environment during the planning stage. Thus, no environmental management plan is elaborated.

#### (2) Socio-economic Environment

The following socio-economic environment could be affected by the implementation of the rehabilitation works for Baluchaung No.1 HPP:

##### 1) Social Issues

Grievance redress unit should be established with the organization of EPGE in operation as soon as the rehabilitation works begins as per information disseminated before the commencement of the works.

A few dedicated full time staff for Corporate Social Responsibility should be employed.

##### 2) Local Economic Conditions

**Contents of Management Plan:** Local economic conditions of which employing local people as unskilled labor for rehabilitation works is generally considered as positive impact for the local socio-economic environment. No specific environmental management plan is considered necessary to elaborate in relation to the implementation of the rehabilitation works.

While generation of employment opportunities is positive, dispute could occur in trying to obtain employment between male and female as well as old and young persons. However, dispute over employment for rehabilitation works is not the impact negatively affecting the general public of the local area. It is rather a matter of which project management unit (PMU) has to elaborate its organizational endeavor for which employment matter has to be put into tidy conditions.

##### 3) Local Traffic Conditions

**Contents of Management Plan:** Local traffic conditions could face congestions during the initial period of transporting heavy equipment to the work site. Size of vehicles and schedule of transportation in terms of frequency and other details are subject to determination by the spare parts suppliers upon completion of the bidding process of the spare parts suppliers.

The spare parts suppliers should distribute traffic controllers where heavy equipment transporters are entering into the local area. Where necessary, road signs and barriers including flags and portable signal units for traffic would be distributed at various locations. Traffic Police of the local government will be informed of the schedule and the way transportation of heavy equipment is carried out.

All transportations of the parts, equipment and facilities to the designated storage area is responsibility of the contractor of supplying parts of all the electric power generation equipment. Details of the transportation in terms of the number and size of the vehicles transporting all the parts, equipment and facilities as a whole are not known at this stage of the Project as it is subject to bidding. Assumption is made that a 20-ton trailer is transporting a transformer.

Main transportation route from Yangon to Baluchaung No.1 HPP of the replacing transformer and other parts and equipment is via road transportation passing through Thazi, Kalaw and arrive in Loikaw. The total distance is approximately 800 km. The contractor of supplying part of all the electric power generation facilities is responsible to survey the traffic conditions of the road, such as limitations of roads and bridges for transportation of the equipment, at its own cost prior to commencement of transportation.

The contractor of supplying parts of all the electric power generation equipment and facilities is requested to use every reasonable means to ensure that all loading limits and other limitations on roads are observed. In the event moving any load of equipment or part of the rehabilitation works, the contractor shall obtain all necessary permits and approvals from any authority and comply with all other lawful requirements before the transportation.

The contractor shall abide by all limitations, laws and regulations relating to the use of public transportation routes. The contractor shall also make any necessary repairs, improvement or replacements of the road and its ancillary structures as the case may be. Such repair or replacements shall be satisfactory to the project proponent or the appropriate government authorities.

**(3) Environmental Pollution**

**1) Outline of the Solid Waste Management**

Unless otherwise industrial technology for disposing electro-mechanical parts is available in Myanmar, these replaced parts subject to replacement that contain chemical substances toxic to human health such as PCB, Asbestos, mercury, and lead should be stored indoor storage building constructed on site with concrete floor, whose land ownership is currently in possession of EPGE.

As previously described, *Fig. 2.7*, *Fig. 2.8*, and *Fig. 2.9* in the Section 2 show storage building constructed on site. Because of insulating oil that it contains PCB, storage building has to be equipped with oil leakage prevention bund. Floor of the storage building is covered with leakage proof material.

**2) Storage of the Electro-mechanical Parts Containing Chemical Substances**

Table 5.2 shows replaced parts of the electricity generation system subject to replacement and that they contain known toxic substances. Because of the limited toxicity in terms of the quantity contained in each electric/mechanical part, and because of the facilities not available for treatment of these chemical contents, they are stored in the storage area for extended period. Warehouses are therefore built on site until such time when disposal for industrial treatment with appropriate laws and regulations for them in Myanmar becomes possible carried out.

All the electro-mechanical parts are stored in the storage area together with the steel drums containing PCB as is shown in *Fig. 2.10* to *Fig. 2.11*

**Table 5.2 Replaced Parts Containing Chemical Substances**

Equipment/Device	Chemicals
------------------	-----------

Generator	Insulator	Asbestos
	Brake	Asbestos
Measuring Devices	Thermometer	Hg
Electric Components	Soldering portions	Pb

Source: JICA Study Team for The Preparatory Survey on Hydropower Plants Rehabilitation Works

Disposal of chemical substance listed in *Table 5.2* should be so carried out based on the international guidance of the prevention of environmental pollution, except for which JICA guidelines does not specifically states particular substance in its guidelines, as follows:

- a. World Bank Good Practice Note - Asbestos: Occupational and Community Health Issues;
- b. IFC: Guidance Note 4: Community Health, Safety and Security; and
- c. IFC: Environmental Health Safety Guidelines - General EHS Guidelines: Construction and Decommissioning.

**Asbestos:** While generator is in motion, no break pad is used. When the generator in motion has to be stopped, break pad is used and it takes place very rarely. Break pad is in the generator's chamber i.e. there is no chance of asbestos inhaled by the operation staff. While the break pad has to be removed, workers have to wear appropriate working cloth and mask for safety for which no toxic substance is inhaled. Removed break pads are stored in the designated location of the storage area with appropriate seals and signs indicating the parts contained in the container are with Asbestos. Disposal of removed parts should be carried out at the time chemical disposal system in Myanmar is made available.

There are a number of laws and regulation in Japan in respect to industrial safety and public welfare including their amendments and that EPGE is obliged to observe as follows:

- a. Enforcement Order and Enforcement Regulations of the Air Pollution Control Act, 2006;
- b. The Waste Management and Public Cleansing Act 1970 amended in 1991; and
- c. The Act on Asbestos Health Damage Relief of 2006;
- d. Air Pollution Control Law of 1968.

**Mercury (Hg):** Unless the parts are broken down, no mercury should leak. Any parts removed from the electricity generation facility should be stored in the designated location of the storage area with appropriate seals and signs indicating the parts contained in the container are with mercury. Disposal of removed parts should be carried out at the time chemical disposal system in Myanmar is made available.

For the environmentally sound handling and related precautionary and safety measures, including labeling, transport and storage based on the IFC's "*Environmental, Health, and Safety Guidelines*" is applied.

**Lead (Pb):** Electric parts using led for soldering copper wires are removed from the electricity generation facility should be stored in the designated location of the storage area with appropriate seals and signs indicating the parts contained in the container are with led. Disposal of removed parts should be carried out at the time chemical disposal system in Myanmar is made available.

The Waste Management and Public Cleansing Act 1970 amended in 1991 of Japan is generally applied for the disposal of lead (Pb) contained in the replaced electro-mechanical parts.

Because of the limited toxicity in terms of the quantity contained in each electric/ mechanical parts, it is very unlikely to cause fatal accidents to the workers and the general public. However, it has to be ascertained that they are stored in the storage area for a limited period built on site until such time for which disposal of these chemical substance in Myanmar become possible to carried out.

For the environmentally sound handling and related precautionary and safety measures, including labeling, transport and storage based on the IFC's "*Environmental, Health, and Safety Guidelines*" is applied.

### 3) Warning Sign of the Contamination of the Environment with PCB

The environmental pollution and issue on the industrial safety could take place by the implementation of the rehabilitation works for Baluchaung No.1 HPP as a large number of electric parts containing toxic chemical are replaced and stored on site. While no significant quantity of toxic chemical such as PCB contained in transformer is not stored on site after the completion of the Rehabilitation Works. However, a warning sign shown in Fig. 5.3 should be put up on the storage building. Burmese language version of the warning sign should also be made and put it up next to the English sign of each drum.



*Fig. 5.3 Signboard for Hazardous Chemicals*

### 4) Industrial Safety and Occupational Health

Contents of Management Plan: International Finance Corporation (IFC), which is one of the organizations related to World Bank, puts out "Environmental, Health, and Safety Guidelines", which is widely adapted as internationally accepted guidelines for industrial safety for internationally funded projects in general.

Within the framework of the safety guidelines of "*1.5 Hazardous Materials Management*" put out by IFC, safety for the disposal of all the liquid waste such as oil, chemical, grease, cleaning fluid should stringently be applied to the Rehabilitation Works for Baluchaung No.1 HPP in particular.

### 5) Training for Industrial Safety

The basis for protecting the personnel working with potentially contaminated equipment and containers is to keep them well informed and trained about:

- a. Significance of PCB, including their health effects and their potential impacts on the environment; <sup>[[ ]]</sup><sub>[SEP]</sub>
- b. Relevant domestic and international regulations and guidelines; and <sup>[[ ]]</sup><sub>[SEP]</sub>
- c. Environmentally sound handling and related precautionary and safety measures, including labeling, transport and storage based on the IFC's "*Environmental, Health, and Safety Guidelines*".

#### 5.4.4 Management of the Environment During the Operation and Maintenance Stage

##### (1) Natural Environment

As is shown in *Table 5.1*, there is no significant environmental impact anticipated to affect any part of the natural environment during the operation and maintenance stage. Thus, no environmental management plan is elaborated.

##### (2) Socio-economic Environment

As is shown in *Table 5.1*, there is no significant and cumulative environmental impact anticipated to affect any part of the socio-economic environment during the operation and maintenance stage. Thus, no environmental management plan is elaborated. However, EPGE is response to inform of the detailed contents of the Rehabilitation Works carried out over 3 year period from time to time in order to maintain good community relationship as well as to take responses of receiving complaints made by the villagers, if any.

Unless otherwise significant accident takes place during this period, there will be no significant environmental impacts anticipated to affect any part of the socio-economic environment during the operation and maintenance stage. Thus, no detailed environmental management plan is elaborated. On the other hand, corporate social responsibility (CSR) incorporated into the business mode of EPGE would have to be developed in the light of the energy development scheme of Myanmar. Appendix 1 shows CSR in relation to the Project.

##### (3) Environmental Pollution

There is no significant environmental pollution of air, water, soil including ground subsidence and microclimate during operation and maintenance stage unless significant accident takes place during this period. However, while no specific environmental management plan is elaborated in respect of the implementation of rehabilitation works, a number of monitoring works should be carried out as elaborate in the Section 7.

##### (4) Corporate Social Responsibility

As stated before, a team of stakeholder engagement is formed for dissemination of information on the rehabilitation works of Baluchaung No.1 HPP and stakeholder engagement is periodically, at least twice a year or as deemed necessary carried out as a part of Corporate Social Responsibility.

Grievance redress unit should be established with the organization of EPGE in operation as soon as the operation and maintenance works begins as per information disseminate before the commencement of the works.

A few dedicated full time staff for Corporate Social Responsibility should be employed.

## 5.5 Environmental Monitoring Plan (EMoP)

### 5.5.1 Environment Subject to Monitoring

Considering mitigation measures are necessary against negative impacts or impacts induced by the implementation of the Rehabilitation Works for Baluchaung No.1 HPP not clearly identified should be subject to environmental monitoring and that it has to be carried out in order to support implementation of the environmental management measures any time in the future during the operation and maintenance period.

As has been elaborated in EMP, during the rehabilitation works implementation period as well as the operation and maintenance period of the Project for Baluchaung No.1 HPP, impacts induced by the Project on the natural environment and socio-economic environment as well as on the environmental pollution is summarized as follows:

- 1) No part of the natural environment;
- 2) Local employment could be positively enhanced because of the increased opportunities for casual labor;
- 3) The traffic condition is affected during the initial stage of the Project; and
- 4) Environmental pollution could be induced by the storage of electro-mechanical parts. They remains on site storage area for extended period of time. It is not clearly known if the extent of pollution is cumulative over time.

Therefore, monitoring work should be carried out during the operation and maintenance period in order to which if ambient soil or water is contaminated during the period of storage and that if it would be of cumulative nature. Socio-economic environment should also be monitored if there were no significant negative changes of the socio-economic conditions of the local population. Details are thus explained in the following section.

For each negative impact, mitigation measures were examined for respective items in planning, construction and operation stage as well as whole stages in order that the plan can achieve intended objectives with avoiding, minimizing or reducing accompanied environmental impacts at implementation. The mitigation measures are shown together with implementing organizations and responsible organizations as Environmental Management Plan (EMP) in the following section.

### 5.5.2 Monitoring Plan for the Possible Environmental Pollution

The water and soil analysis around the storage area should be carried out at least once a year until such time industrial solid waste disposal facility in Myanmar becomes available. Examination and Sequence of monitoring is as follows:

- 1) Water and Soil Contamination Analysis
  - Soil and water sampling for the analysis of chemical contamination at the storage area prior to the commencement the rehabilitation works is carried out and obtain baseline data.
  - Acquired result of the values of analysis is checked against chemical standard of soil and water within the framework of the laws and regulations of Myanmar.
  - Location of soil sampling for analysis is the area downslope of the storage area strategically selected for analysis.
  - Number of locations should be 3 locations more than 100m apart to each other.

**Monitoring parameters for soil and water quality are shown in *Table 5.3 Parameter for Soil Quality Monitoring***

Parameter		Analytical Method
1	pH	4Al: pH of 1:5 soil/water suspension at 25°C (Rayment and Higginson 1992) TPS-81 pH-conductivity meter
2	Electrical Conductivity (EC)	3Al: pH of 1:5 soil/water suspension at 25°C (Rayment and Higginson 1992) 2520-conductivity meter
3	Orthophosphate (PO <sub>3</sub> )	9G2 Acid extractable phosphase 1:200 soil/0.005M H <sub>2</sub> SO <sub>4</sub> at 25°C (Rayment and Higginson 1992) Measure using 4,500-PC Vanadomolybdophosphoric Acid Colourmetric mehod (APHA 1999)
4	Organic Matter (%)	Soil oxidised with 50% H <sub>2</sub> O <sub>2</sub> and heated to 1,300oC to burn organic matter. Weight loss difference equal to organic matter content
5	Cation Exchange Capacity (CEC)	Ammonium selective electrode method (Norden and Giese 2001) Ammonia Standards mde as per 4,500-NH3E (APHA 1999)
6	Effective Cation Exchange Capacity (ECEC)	ECEC=exchangeable cations+exchangeable acidity=(Ca+MG+Na+K)+(Al+H)
7	Exchangeable Cations (Al, Fe, Mg, Na, Ca and K)	Measured using Varian AA5 Flame Atomic Absorption Spectrophotometer Acetylene flame used to measure Fe, Propane used to measure Na and , and Nitrous oxide used to measure Ca, Mg and Al
8	Exchangeable Sodium Percentage (ESP)	ESP=(100 x Exchangeable Na)/ECEC
9	Soil Meneralogy (Clay type)	Samples prepared using method developed by Bish and Post 1989. Mineralogy determined via X-ray diffraction using Phillips PW 1050/25 vertical goniometer with a graphite diffracted beam monochrometer
10	Particle Size Distribution: Clay (%), Silt (%) and Sand (%)	Determined from soil mineralogy fractions %S=%Quartz; %C= Total % Clay fractions eg.%Kaolinite, %Illite, %Semectite) measured using X-ray Diffraction

Source: EMP Study Team: Baluchaung No.1 HPP Rehabilitation Project

***Table 5.4 Parameter for Water Quality Monitoring***

## Parameter for Water Quality Monitoring

Monitoring Date: \_\_\_\_\_

Location of Monitoring: \_\_\_\_\_

Monitoring Parameter	Method of Monitoring	Monitoring Results	Value of National Standard	Value of International Standard	Remarks
DO	Do Meter				
pH	Ph Meter				
BOD	BOD Analyzer				
COD	COD Analyzer				
Chloride	Titration by Mercuric Nitrate				
Calcium	Complexometric Titration by EDTA				
Magnesium	Complexometric Titration by EDTA				
Fe	EDTA Volumetric				
Arsenic	Arsenic Meter				

Source: EMP Study Team for Baluchaung No.1 HPP Rehabilitation Project

**and Table 5.3      *Parameter for Soil Quality Monitoring***



Parameter		Analytical Method
1	pH	4Al: pH of 1:5 soil/water suspension at 25°C (Rayment and Higginson 1992) TPS-81 pH-conductivity meter
2	Electrical Conductivity (EC)	3Al: pH of 1:5 soil/water suspension at 25°C (Rayment and Higginson 1992) 2520-conductivity meter
3	Orthophosphate (PO <sub>3</sub> )	9G2 Acid extractable phosphase 1:200 soil/0.005M H <sub>2</sub> SO <sub>4</sub> at 25°C (Rayment and Higginson 1992) Measure using 4,500-PC Vanadomolybdophosphoric Acid Colourmetric mehod (APHA 1999)
4	Organic Matter (%)	Soil oxidised with 50% H <sub>2</sub> O <sub>2</sub> and heated to 1,300oC to burn organic matter. Weight loss difference equal to organic matter content
5	Cation Exchange Capacity (CEC)	Ammonium selective electrode method (Norden and Giese 2001) Ammonia Standards mde as per 4,500-NH3E (APHA 1999)
6	Effective Cation Exchange Capacity (ECEC)	$ECEC = \text{exchangeable cations} + \text{exchangeable acidity} = (\text{Ca} + \text{MG} + \text{Na} + \text{K}) + (\text{Al} + \text{H})$
7	Exchangeable Cations (Al, Fe, Mg, Na, Ca and K)	Measured using Varian AA5 Flame Atomic Absorption Spectrophotometer Acetylene flame used to measure Fe, Propane used to measure Na and , and Nitrous oxide used to measure Ca, Mg and Al
8	Exchangeable Sodium Percentage (ESP)	$ESP = (100 \times \text{Exchangeable Na}) / ECEC$
9	Soil Meneralogy (Clay type)	Samples prepared using method developed by Bish and Post 1989. Mineralogy determined via X-ray diffraction using Phillips PW 1050/25 vertical goniometer with a graphite diffracted beam monochrometer
10	Particle Size Distribution: Clay (%), Silt (%) and Sand (%)	Determined from soil mineralogy fractions %S=%Quartz; %C= Total % Clay fractions eg.%Kaolinite, %Illite, %Semectite) measured using X-ray Diffraction

Source: EMP Study Team: Baluchaung No.1 HPP Rehabilitation Project

**Table 5.4 Parameter for Water Quality Monitoring**

## Parameter for Water Quality Monitoring

Monitoring Date: \_\_\_\_\_

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BOD	BOD Analyzer				
COD	COD Analyzer				
Chloride	Titration by Mercuric Nitrate				
Calcium	Complexometric Titration by EDTA				
Magnesium	Complexometric Titration by EDTA				
Fe	EDTA Volumetric				
Arsenic	Arsenic Meter				

Source: EMP Study Team for Baluchaung No.1 HPP Rehabilitation Project

respectively.

**Table 5.3 Parameter for Soil Quality Monitoring**

Parameter		Analytical Method
1	pH	4Al: pH of 1:5 soil/water suspension at 25°C (Rayment and Higginson 1992) TPS-81 pH-conductivity meter
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4	Organic Matter (%)	Soil oxidised with 50% H <sub>2</sub> O <sub>2</sub> and heated to 1,300oC to burn organic matter. Weight loss difference equal to organic matter content
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6	Effective Cation Exchange Capacity (ECEC)	ECEC=exchangeable cations+exchangeable acidity=(Ca+MG+Na+K)+(Al+H)
7	Exchangeable Cations (Al, Fe, Mg, Na, Ca and K)	Measured using Varian AA5 Flame Atomic Absorption Spectrophotometer Acetylene flame used to measure Fe, Propane used to measure Na and , and Nitrous oxide used to measure Ca, Mg and Al
8	Exchangeable Sodium Percentage (ESP)	ESP=(100 x Exchangeable Na)/ECEC
9	Soil Meneralogy (Clay type)	Samples prepared using method developed by Bish and Post 1989. Mineralogy determined via X-ray diffraction using Phillips PW 1050/25 vertical goniometer with a graphite diffracted beam monochrometer
10	Particle Size Distribution: Clay (%), Silt (%) and Sand (%)	Determined from soil mineralogy fractions %S=%Quartz; %C= Total % Clay fractions eg.%Kaolinite, %Illite, %Semectite) measured using X-ray Diffraction

Source: EMP Study Team: Baluchaung No.1 HPP Rehabilitation Project

**Table 5.4 Parameter for Water Quality Monitoring**

## Parameter for Water Quality Monitoring

Monitoring Date: \_\_\_\_\_

Location of Monitoring: \_\_\_\_\_

Monitoring Parameter	Method of Monitoring	Monitoring Results	Value of National Standard	Value of International Standard	Remarks
DO	Do Meter				
pH	Ph Meter				
BOD	BOD Analyzer				
COD	COD Analyzer				
Chloride	Titration by Mercuric Nitrate				
Calcium	Complexometric Titration by EDTA				
Magnesium	Complexometric Titration by EDTA				
Fe	EDTA Volumetric				
Arsenic	Arsenic Meter				

Source: EMP Study Team for Baluchaung No.1 HPP Rehabilitation Project

## 2) Storage of Replaced Equipment/Parts

Warehouse is built so that stored oils and chemicals could be prevented from entering into soil or surface and ground water and eventually enters into the human and animal food chain as follows:

- Prevent wild or domestic animals, rodents, snakes, mosquitoes and insects from entering the warehouse that might otherwise be in contact with the general public;
- Insulating oil of electro-mechanical parts are subject to storage confined in containers of rust-free material that do not deteriorate with high humidity and air temperatures of the country; and
- Warehouse's flooring should be resilient from leakages of insulating oil into soil hence no contamination is made to groundwater or surface water of the near-by area that up-land crops, vegetables and fruits are grown.

**5.5.3 Cost of the Environmental Monitoring Plan**

Cost implications of the environmental monitoring plan in respect to the Rehabilitation Works for Baluchaung No.1 HPP is shown in Table 5.5.

**Table 5.5 Cost of Monitoring Plan for the Rehabilitation Works of Baluchaung No.1 HPP**

Item	Environmental Monitoring Works		Monitoring Cost (US\$)	Responsible Organization	Supervising Organization	
	Implementation Period	Operation and Maintenance Period				
<b>1. Social Environment</b>						
1	Local economy such as employment and livelihood	Employment of the local workforce for unskilled labor	-	-	EPGE	Loikaw Township
2	Existing infrastructures and services such as traffic conditions	Local traffic conditions during the initial period	-	-	EPGE/ Contractor	Loikaw Township
3	Distribution of Wealth/Electricity	-	Increased capacity of electricity should be distributed to local area	-	EPGE	Loikaw Township
4	Corporate Social Responsibility (CSR)	Draw implementation plan of CSR and disseminate information of the rehabilitation works through stakeholder meetings, web site advertisement and other means of public communications	Carry out periodically (twice are year) and maintain any other means of CSR advertisement including stakeholder engagement. Maintain record of meeting and any grievances, suggestions, complaints, claims and comments on the project	US\$ 7,500 twice a year during and after the 2 <sup>nd</sup> year	EPGE	
<b>2. Environmental Pollution</b>						
1	Water Pollution	-	Surface and Ground Water analysis - Twice a year	US\$ 3,500/year	EPGE	Loikaw Township/ MONREC
2	Soil Contamination	-	Soil analysis for containing oil or any liquid chemicals - Twice a year	US\$ 3,500/year	EPGE	Loikaw Township/ MONREC

3	Solid Waste Disposal/Storage	Transformer's insulating oil is extracted before it is placed in the outdoor storage area where concrete oil-bund is constructed in order to prevent insulating oil from leaking/seeping into the soil of storage area. Extracted insulating oil has to be contained in the steel drums and placed in the indoor storage area whose floor is made of concrete as well as the oil-bund in order to prevent oil, which might contain oil or liquid chemicals, if any, for any volume from seeping/leaking into the soil of storage area.	Monitor periodically (once a year) for the 1) Splashing, leakage, filtration and offensive odor of oils used in the electric generation facilities; 2) Rodents, snakes, mosquitoes and flies and other animals and insects that might otherwise be in contact with the general public; 3) Insulating oil of transformer or condenser are subject to storage confined in containers of rust-free material and do not deteriorate with high air temperatures of the country; 4) Storage area's flooring should be permanently resilient from leakages of insulating oil into soil hence no contamination is made to groundwater or surface water of the near-by area.	1) US\$ 35,000 for the first year including construction of indoor and outdoor storage area  2) US\$ 7,500 twice a year during and after the 2 <sup>nd</sup> year	EPGE	Loikaw Township/ MONREC
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Source: EMP Study Team: Baluchaung No.1 HPP Rehabilitation Project

## 6 Results of Stakeholder Meetings

### 6.1 Methodology and Approach

Stakeholder meeting is held in the near-by villages of Baluchaung No.1 HPP for information dissemination. Direct notification for holding stakeholder meeting was made in-person to the head of township concerned with the rehabilitation works for Baluchaung No.1 HPP.

Because of a large gathering area is available in So Le Sel village, stakeholders are assembled in the Buddhist shrine of the village.

Upon agreement of the date and venue of the meeting, head of township informed of the meeting to the head of villages within the township. The first time meeting would be held for disseminating information on the plan of the rehabilitation works. The general public concerned with the project of rehabilitation works for Baluchaung No.1 HPP is invited for open discussions.

For the second meeting, result of environmental study in terms of Environmental management and Monitoring Plan was disclosed. The general public concerned with the project of rehabilitation works for Baluchaung No.1 HPP was invited for second time of open discussions.

### 6.2 First Stakeholder Meeting

#### (1) Meeting Time and Date

Date and Time: 2nd July, Saturday 2016 (From 9AM to 11AM)

Venue: So Le Sel village, Loikaw Township, Loikaw District, Kayah State

Participants: 66 persons (Including village chiefs and elder peoples, key informants, NGOs, Local Government Officers from several departments such as Agriculture, Forestry, Fishery, Environmental Conservation, Land Use Departments, and Baluchaung Hydropower Plants employees)

#### (2) Presentations of Information on the Rehabilitation Works

- a. The GAD township officer gave the opening speech about of the project and work for environmental and social considerations including Initial Environmental Examinations (IEE) and emphasized the importance of the participation with peoples of local communities and officers of related departments.
- b. JICA Survey Team briefly explained the purpose and scope of the JICA project, “Preparatory Survey for the Project of Hydropower Plant Rehabilitation in the Myanmar”. In addition, they mentioned the importance of information disclosure and public participation in the work for environmental and social aspects of the project.
- c. Station Manager of EPGE explained the history since 1992 and presents features of the Baluchaung No.1 Hydropower Plant. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and without increase of power generation capacity due to dilapidation by continuous operation for more than 25 years.
- d. Local Consultant emphasized that the rehabilitation works is required to comply with both the JICA Guidelines and Myanmar legislations. Then, she explained an IEE level study was

required and now the study is in progress according to the JICA Guidelines. At the same time, she also explained that any project is required to obtain prior permission, i.e. Environmental Compliance Certificate (ECC) from Ministry of Natural Resources and Environmental Conservation (MONREC) prior to implementation according to recently enacted Environmental Impact Assessment Procedure 2015 (EIA Procedure) of Myanmar. In addition, the Consultant insisted roles of community participation and information disclosure in the project by using power point and hand out paper.

**(3) Q & A Section**

- a. The village chief of So Le Sal village, mentioned that people of villages near the hydropower station have not been served sufficient electric power supply until now. According to the Vision of Myanmar Government (2020), all the peoples in the country have the right to benefit from sufficient power supply. In this regard, he requested EPGE and local government to install distribution network for more and easy access to electric power supply by the communities
- b. Station Manager answered that there are many governmental organizations relevant to electric power supply under the Ministry of Electricity and Energy (MOEE). The EPGE, which he belongs to, is in charge of power generation. Regarding power distribution, the duty is of another organization and he cannot make the decision for distribution of electric power. However, he recognized community's need, took note to inform EPGE and suggested that the community should request to local government and MOEE.
- c. A villager told the location of existing Baluchaung No.1 HPP is very close to his village. However, his village and neighboring other villages have been not provided sufficient electric power supply since operation of the Hydropower Plant. He requested EPGE and local government to make effort providing sufficient electric power supply. A villager from Kan Nyi village, expressed a welcome to the rehabilitation works. At the same time, he requested EPGE and local government to provide electric power supply to local communities, which are in insufficient supply condition.





**Question and Comment by Participant**



**Question and Comment by Participant**



**Question and Comment by Participant**

Sl. No.	Name	Address	Phone No.
1	Mr. [Name]	[Address]	[Phone No.]
2	Mr. [Name]	[Address]	[Phone No.]
3	Mr. [Name]	[Address]	[Phone No.]
4	Mr. [Name]	[Address]	[Phone No.]
5	Mr. [Name]	[Address]	[Phone No.]
6	Mr. [Name]	[Address]	[Phone No.]
7	Mr. [Name]	[Address]	[Phone No.]
8	Mr. [Name]	[Address]	[Phone No.]
9	Mr. [Name]	[Address]	[Phone No.]
10	Mr. [Name]	[Address]	[Phone No.]
11	Mr. [Name]	[Address]	[Phone No.]
12	Mr. [Name]	[Address]	[Phone No.]
13	Mr. [Name]	[Address]	[Phone No.]
14	Mr. [Name]	[Address]	[Phone No.]
15	Mr. [Name]	[Address]	[Phone No.]
16	Mr. [Name]	[Address]	[Phone No.]
17	Mr. [Name]	[Address]	[Phone No.]
18	Mr. [Name]	[Address]	[Phone No.]
19	Mr. [Name]	[Address]	[Phone No.]
20	Mr. [Name]	[Address]	[Phone No.]

**Attendants List**

**Fig. 6.1 First Stakeholder Meeting -1**



Venue – Monastery of Lopita Village



Opening speech b GAD Deputy Officer



Presentation by Hydropower Station Officer



Presentation by Hydropower Station Officer



Presentation by Local Consultant



Participants at the meeting

*Fig. 6.2 First Stakeholder Meeting – 2*

### 6.3 Second Stakeholder Meeting

#### (1) Meeting Date and Time

Date and Time: 17 September, Saturday 2016 (From 9 AM to 11 AM)

Venue: So Le Sel village, Loikaw Township, Loikaw District, Kayah State

Participants: 65 persons (Including village chiefs and elder peoples, key informants, NGOs, Local Government Officers from several departments such as Agriculture, Forestry, Fishery, Environmental Conservation, Land Use Departments, and Baluchaung Hydropower Plants employees)

#### (2) Presentation of the Information on the Rehabilitation Works

- a. The GAD township officer gave the opening speech about of the project and work for environmental and social considerations including Initial Environmental Examination and second time of stakeholder meeting. He explained the purpose of the meeting and to emphasize the importance of the participation with peoples of local communities and officers of related departments. And also, he requested to local community to be patient for the delay in sometimes of implementation of development programs by the local government and departments because of the budget situation of the Kayah State.
- b. JICA Survey Team briefly explained the purpose and scope of the JICA project, "Preparatory Survey for the Project of Hydropower Plant Rehabilitation in Myanmar by using the example of a mobile equipment and battery" Rehabilitation is necessary for the sustainable use in a longer term.
- c. Baluchaung No.1 HPP Manager explained the history since 1992 and presents features of the Baluchaung No.1 HPP. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and without increase of power generation capacity due to dilapidation by continuous operation for more than 25 years.
- d. Local Consultant emphasized that the rehabilitation works is required to comply with both the JICA Guidelines and existing Myanmar legislations. Then, she explained the summary of the IEE level study for the possible impacts of this project on the people and environment.
- e. The impacts were estimated by different project stages, such as planning (before operation), during operation and after operation. It includes environmental issues, such as land use and topography, air and water pollution, soil contamination, solid wastes problem, etc. For the social environment and social services, township level social infrastructure, local economy, livelihoods, situation of gender and children, vulnerable groups, the poor, refugees, and indigenous of ethnic people etc. were discussed. It was generally estimated that there would be no significant negative impact of the rehabilitation works on the environment and the community.

#### (3) Q & A Section

- a. A villager from the Law Ka Htuee village said that if there have some negative impact from project activities, particularly it will affect the women and children. If it is possible, women from targeted villages are willing to participate in monitoring activities of the project

- b. A villager from Sal Mile village said that "Today we receive the supplied water from dam but sometime insufficient. He wanted to know whether the Project have a plan to support water more regularly and sufficiently for target villages".
- c. HPP Manager answered that there are many governmental organizations relevant to electric power supply and distribution under the Ministry of Electricity and Energy (MOEE). The EPGE (Electric Power Generation Enterprise), which he belongs to, is in charge of power generation. Regarding with power distribution, the responsibility is of another organization and he cannot make any decision for distribution of electric power. But He agreed that the villages near the dam should receive enough power supply and irrigation water.
- d. A villager of Law Ka Hteuu, requested that location of existing Baluchaung No.1 HPP is very close to his village. Last month from the department of EPGE made a survey in their village to set up a transformer for more distribution of electricity to his village. He asked EPGE and related departments whether the program is possible to realize soon or not.
- e. HPP Manager answered that until now he cannot answer that question. Because of his duty is just for the power generation and not directly concern with this. But he hoped that it will become in reality soon.
- f. A member of NGO, asked the reason that SHM was not held in city hall of Kayah State. He suggested this project was related to the whole community and country, not only with the surrounding of the project site.
- g. Local Consultant answered as follows: SHM is mainly based on the target community and the environment, which will be affected by the project. The surrounding villages near the project site will have more interest on the project and possible impacts and they need to know about the project.
- h. Village tract administrator of Law Pi Ta Village Tract requested to related department and General Administration Department officials to consider for the local community who are residing near the power plant. The villagers are willing to participate for the rural development activities to join hands with the government. They will follow the leadership of related department personnel for implementation activities.





**Opening remarks by Loikaw Township Deputy GAD Officer**



**Question and Comment by Participant**



**Presentation by Station Manager of Hydropower Plant**



**Presentation by the Local Consultant**



**Question and Comment by Participant**



**Question and Comment by Participant**

**Fig. 6.3 Second Stakeholder Meeting - 1**



Question and Comment by Participant



Attendants came by motor bikes and cars

A handwritten table with multiple columns and rows, listing names and other details of attendees. The text is in a South Asian script, likely Nepali. The table has several columns, some of which contain names and possibly addresses or contact information.

Attendants List

Another handwritten table, similar to the one above, listing attendees. It also contains names and other details in a South Asian script. The table is filled with handwritten entries.

Attendants List

Fig. 6.4 Second Stakeholder Meeting - 2

**Annex I**

**Corporate Social Responsibility (CSR)**

**For**

**Baluchaung No.1 HPP Rehabilitation Works**

## 1 Introduction

Myanmar is an advocate of taking steps to build investor confidence and promote responsible investment, known as Corporate Social Responsibility (CSR) as it is considered to reflect the voices of the needs of the general public and civil society as a whole. Concept of CSR and adaptation of it to a part of Environmental Management and Monitoring Plan implemented for infrastructure development project such as the rehabilitation works of Baluchaung No.1 HPP is relatively new in Myanmar but its effect is known effective.

World Bank and IFC have jointly been studying on the “Public Policy for Corporate Social Responsibility” since early 2000s in relation to which local socio-economic conditions has to be presently developed in conjunction especially with national level of large scale infrastructure projects.

IFC has put out in 2012, “Guidance Notes to Performance Standards on Environmental and Social Sustainability”. However, there is no specific term referred to as CSR. JICA’ Guidelines also show no specific term of CSR.

On the other hand, a number of companies have been working on the comprehensive compliance standards and procedures (CSP) for their own company benefits. CSP aims to prevent any violations of the law that may lead to civil or criminal liability. It helps a company establish credibility with key stakeholders. It is now known as CSR and that it serves many functions of the companies. In the case of Baluchaung No.1 HPP, EPGE with demonstrable commitments to strong socio-economic and the environmental standards would reduce risks of their legal and operational risks.

Thus, a failure to address emerging standards for environmental management can leave EPGE without capacity to effectively engage stakeholders and pursue business objectives. Willingness to engage stakeholders in transparent dialogues regarding the impacts of corporate operations fosters the environment and socio-economic conditions. If successfully implemented, CSR may be amicably be able to resolve many issues involved with the stakeholders that in worst case lead to litigation, boycotts, attacks on corporate facilities and other forms of stakeholder protest.

## 2 Function of CSR

CSR should serve as risk-management guidelines for EPGE. Personnel in charge of compliance within the organization may have a few direct engagements with those in charge of CSR. With the rigorous compliance of audits, EPGE may be able to demonstrate their compliance with law. However, they may not have the same capacity to demonstrate their efforts to fulfill voluntary commitments for the stakeholders. Thus, a failure to demonstrate it is a company fulfilling its commitments to stakeholders should become further costly operation of recovering the damages. There are strong business reasons, therefore, to leverage and integrate CSR into compliance processes, in this case the Environmental Management and Monitoring Plan.

## 3 Definition of CSR

There is no single guideline of “CSR” like EIA study. It is understood to involve respect for human rights and the environment in the case of the project involving a large infrastructure development project. EU defines it as “the responsibility of business for its impacts on society” i.e. CSR is to meet the social responsibility. Thus implementation organization of a project should have in place a process to integrate social, environmental, ethical human rights and consumer concerns into their business operations.



Project implementation organization should therefore maintain strategy in close collaboration with their stakeholders and actively comply with laws, ethical standards, and international norms. This is established in the “2011 UN Guiding Principles on Business and Human Rights”. Thus, CSR is designed to implement:

- Preparation of the CSR Plan & Procedures;
- Monitoring and Evaluation of CSR Program;
- Preparation of CSR Budget with Staff Dedicated for CSR;
- Training and Capacity Building of the internal workforce;
- In-depth Understanding of the Socio-economic Impact Assessment;
- Continuous Research Study of the Project Affected Area for the Life Cycle of the project;
- Policy Development Based on the Environmental Management and Monitoring Works;
- Accumulation of Statistics through Environmental Management and Monitoring Works; and
- Elaboration of Further Local and Community Investment Development Plan

#### 4 Implementation of CSR in the Context of Baluchaung No.1 HPP Rehabilitation Works

##### 4.1 Developing CSR Strategy

Because of the absence of current guidelines of the national and international nature on the environmental and social impact assessment and its associated management plan as well as the country’s environmental protection laws and regulations, CSR is understood vaguely among the project proponents.

Myanmar’s Environmental Conservation Law of 2012 envisages prescribing environmental quality standards (EQS) including standards on emissions, effluents, solid wastes, production procedures, processes and products for conservation and enhancement of environmental quality. Thus it is extremely important to comply with the measures for maintaining EQS of Myanmar when the Environmental Management and Monitoring Plan of the Project are implemented. Therefore, the following is obliged, by EPGE, to developing CSR for the good performance of Baluchaung No.1 HPP rehabilitation works as follows:

- **Carry out Local Dialogues:** Plan to engage periodically with the local residents and civil society describing the commitment of the EQS of Myanmar. It is important to inform the performance of EPGE in terms of the rehabilitation works being carried out on Baluchaung No.1 HP. Local civil society and NGOs groups, including female members of the local area, children, disabled, and minority populations should all be informed of the project implementation.

Stakeholder engagement is a tool to avoid conflicts. Listening to communities’ desires and concerns, explaining the scope of intended works, and discussing how it could impact the community can positively enhance local understanding of the project as a whole.

- **Ensure the CSR Approach:** Project activities of Baluchaung No.1 HPP rehabilitation works including EQS of Myanmar should be reviewed if the project could meet the real needs of the local people. Creating a program designed to fit a community’s needs through the above activity of the “Local Dialogue” is important.

Setting boundaries of activities is at the same time very important; CSR activities should not supplant the government’s lack of service provision i.e. while the local communities expect to build schools and clinics, it is not the job of project implementation organization.

- **Transparency of the CSR Activity:** Transparency with the local residents in terms of the compliance with the contents of EQS of Myanmar is important. If needed disseminate information through social media, traditional print journals, TV and radio channels, and the Internet in respect of the project implementation. As has been carried out on the web site, EPGE discloses monthly data on the total amount of electricity generation. This has to be extended to the design stage, bidding and commencement of the rehabilitation works, as these are ready to disclose to the general public.

Communication barriers should be removed and work with the media to communicate the facts about the project activities of Baluchaung No.1 HPP rehabilitation works that it is in compliance with international guidelines of the environmental protection, particularly on the good practice of the employment of the local residents, protection of the environment and the socio-economic conditions of the surrounding areas. After all, consultations with the local residents concerned with the project activities processes and publishes information and that they are accepted as transparent and publicly documented project activities are disclosed.

- **Understand the Local and National Context of the Project:** Appropriate CSR approaches should work well and translate appropriately the in-depth understanding of the project activities including the compliance of the EQS of Myanmar in relation to the Baluchaung No.1 HPP rehabilitation works. It will provide necessary information on the impacts induced by the project in relation to the local and distant ethnic conflict, human rights, religious diversity, and the role of the government agencies in relation the implementation of the Project. The positive changes to the local community could probably increase over time and the project implementation organization should notice as the Environmental Management and Monitoring Plan are implemented in conjunction with the local dialogue, on which CSR is based.

## 5 CSR Program Implementation

As described in the Section 3 above, EPGE is requested to prepare “CSR Budget with Staff Dedicated”. Alternatively, outside organization such as a local NGO experienced with social communication could be employed. A group of three people for a preparation of holding local meeting, creating a set of brochure of the project for circulation as well as to post it on the web site of EPGE and other works related to public awareness could be implemented as a part of CSR.

Pursuing a CSR program is therefore viewed as an opportunity to disseminate good practice of EPGE for good reputation to come in the immediate future. It should be seen in a way as an investment in the socio-economic conditions of the local areas and for the environment in which the wide range of local residents depends. It is thus important not only limited to the original design of the Environmental Management and Monitoring Plan but also including the voices of others in respect to the project activities for successful achievement of the goal of the project activities of Baluchaung No.1 HPP rehabilitation works. Because a well-designed CSR could bring about the economic benefits of the investment for the Project, positive effect of it should be felt among the local people that it is a good practice of the project proponent for achieving the goal of the Project.

## **Annex II**

### **Letter of Commitment**

**Letter of Commitment  
for  
The Report of Environmental Management Plan (EMP)  
of  
the Rehabilitation Project of Baluchaung No. 1 Hydropower Plant**

In accordance with the Article 8, 9, 10, 11 and 23 of the Environmental Impact Assessment Procedure (2015) of the Government of Myanmar and as per the Administrative Instruction of Environmental Impact Assessment procedure of ECD, the Joint Venture of NEWJEC Inc. and NIPPON KOEI Co. Ltd as the Project Consultant duly studied for the Report of Environmental Management Plan (EMP) for the Rehabilitation Project of Baluchaung No. 1 Hydropower Plant and elaborated for submission of the said report to the Environmental Conservation Department of MONREC for approval.

The Joint Venture of NEWJEC Inc. and NIPPON KOEI Co., Ltd endorse and confirm to the Environmental Conservation Department of MONREC the following:

- The accuracy and completeness of the EMP;
- The EMP has been prepared in compliance with applicable Environmental Conservation Laws, Regulations, Rules, Procedures and relevant International Guidelines;
- The above report shall fully in compliance with the commitments and obligations including all laws and regulations as per detailed in the above EMP report that determine to be relevant with the Project, mitigation measures and plans set out in the EMP.

Yours sincerely,

高橋公雄

**Mr. Kimio Takahashi**

**Project Manager**

**The Joint Venture of NEWJEC Inc. and NIPPON KOEI Co., Ltd**