Environmental Management Plan (EMP)

for

Rehabilitation Project

of

Sedawgyi Hydropower Plant

October 2019

JOINT VENTURE OF

NEWJEC
NIPPON KOEI

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

JAPAN

ဆည်တော်ကြီး ရေအားလျှပ်စစ်စက်ရုံအား

အကြီးစားပြန်လည်ပြုပြင်မွမ်းမံခြင်းလုပ်ငန်းအတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်

အစီရင်ခံစာအကျဉ်းချုပ်

၁။ စီမံကိန်းအကျဉ်းချုပ်

စီမံကိန်းနေရာသည် ဧရာဝတီမြစ်၏မြစ်လက်တက်တခုဖြစ်သော ချောင်းမကြီးချောင်းတွင် တည်ရှိပါသည်။ ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံသည် ၁၉၈၀ ခုနှစ်တွင် အာရှဖွံ့ဖြိုးရေးဘဏ်(အေဒီဘီ) ၏ အကူအညီဖြင့်လျှပ်စစ်ဓါတ်အားထုတ်ရန် တည်ဆောက်ခဲ့သော ရေအားလျှပ်စစ်စီမံကိန်း ဖြစ်ပါသည်။ ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံသည် ဧရာဝတီမြစ်၏မြစ်လက်တက်တခုဖြစ်သောချောင်းမကြီးချောင်းပေါ်တွင်တည်ရှိပါသည်။

ချောင်းမကြီးချောင်းသည်မတ္တရမြို့နယ်၊မန္တလေးတိုင်းဒေသကြီးတွင်းဖြတ်သန်းစီးဆင်းကာဧရာဝတီမြစ်အတွင်းသို့စီးဝင်သွားပါသည်။ မန္တလေးတိုင်းသည်မြန်မာနိုင်ငံ၏ဖွံ့ဖြိုးတိုးတက်သောမြို့တော်တခုဖြစ်ပါသည်။ ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံ၏တည်နေရာသည် မန္တလေးမြို့မှ အရှေ့တောင်ဘက် (၁၃၀) ကီလိုမီတာအကွာတွင်တည်ရှိပါသည်။

ဆည်အမျိုးစား	ကျောက်ဖြည့်ဆည်၊ အမြင့် ၄၀.၆ မီတာ၊ အရှည် ၁၂၅၅.၈ မီတာ
ရေဖမ်းဧရိယာ	ချောင်းမကြီးချောင်း၊ဧရာဝတီမြစ်လက်တက်၊၃၃၈၄စတွဲယား ကီလိုမီတာ
အမြင့်ဆုံးရေထုစီးနှုန်း	၅၁.၇ မီတာကျူ/ စက္ကန့်
အကျိုးပြုရေအမြင့်	၂၈.၂ မီတာ
ရေလှောင်ကန်ရေအမှတ်	ရေပိုကျော် (၁၂၉.၅) မီတာ၊ ရေပြည့် (၁၂၇.၉) မီတာ၊ စက်မောင်း (၁၁၁.၃) မီတာ
ရေလှောင်ကန်အမြင့်ဆုံးရေအမှတ်	28.7 km2
တပ်ဆင်စက်အင်အား	၂ x ၁၂.၅ မဂ္ဂါဝပ် = ၂၅မဂ္ဂါဝပ်
လျှပ်ထုတ်စက်အမျိုးအစား	Vertical Shaft, Rotating Field totally enclosed 3 phase, 50 Cycles A.C. Synchronous Generator-semi-umbrella Type

တာဘိုင်အမျိုးစား	Vertical Shaft, Adjustable Blade Kaplan (2 No.)
ဂါဗနာအမျိုးအစား	Electro-hydraulic Governor
ပန်ကာအရေအတွက်	Guide Vanes: 20 No., Stay Vanes: 20 No.
ဓါတ်အားထိန်းတလင်း	132 kV Single Buster System
ဓါတ်အားဖြတ်ခလုပ်	132kV/33 kV Oil Minimum 3 Phase auto-recloser and also single phase auto-recloser for 132 kV Feeder
ထရန်စဖော်မာများ	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
ဓါတ်အားလိုင်း	၁၃၂ ကေဗွီ မန္တလေးလိုင်း (၃၆.၇၅ မိုင်)

ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံကို ၁၉၈၉ ခုနှစ်တွင်စတင်ကာမောင်းနှင်လည်ပတ်ခဲ့ပါသည်။ ယခုကာလအထိအကြီးစားပြန်လည်ပြုပြင်ထိန်းသိမ်းခြင်းလုပ်ငန်းများဆောင်ရွက်နိုင်ခဲ့ခြင်းမရှိခဲ့ပါ။နှစ်ကာလကြာမြင့်လာသည်နှင့်အမျှ စက်ကိရိယာများသည်ပွန်းစားခြင်းယိုယွင်းခြင်းတို့ဖြစ်လာပါသည်။ မူလတည်ဆောက်စဉ်ကာလတွင်တပ်ဆင်ခဲ့သောစက်ကိရိယာများဖြစ်သောရေထိန်းဒလက်ပွန်းစားခြင်း၊ အပူအအေးစနစ်ယိုယွင်းလာခြင်း၊ တာဗိုင်အတွင်းအနည်အနှစ်များရှိလာခြင်း၊ဂါဗနာထိန်းချုပ်ခန်းတွင်းမှဆီယိုစိမ့်မှုများ၊ အခြားသောလျှပ်စစ်ထုတ်လုပ်ခြင်းစနစ်များအားပြန်လည်အစားထိုးတပ်ဆင်ရန်လိုအပ်လာပါသည်။

မြန်မာနိုင်ငံအမျိုးသားရေးဆိုင်ရာလျှပ်စစ်ဓါတ်အားရရှိရေးစီမံချက်အား (၂၀၁၆) ခုနှစ်တွင် ရေးဆွဲခဲ့ပါသည်။ ထိုမှရရှိသောလေ့လာချက်များအရ ဆည်တော်ကြီးရေအားလျှပ်စစ်စီမံကိန်းသည် နှစ်ပေါင်း(၃၀)သက်တမ်း ကြာပြီးနောက်စက်ပစ္စည်းများအား အကြီးစားပြန်လည်ပြုပြင်ရန်လိုအပ်လာပါသည်။စက်ပစ္စည်းများအား ပြန်လည်ပြုပြင်ရာတွင် ဆည်ရေဝင်ဇရိယာနှင့် ဆည်ရေသိုလှောင်ပမာဏပါဝင်ပြောင်းလဲခြင်းမရှိပါ။

ဆည်တော်ကြီးရေအားလျှပ်စစ်စီမံကိန်းပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ရာတွင်ပါဝင်သောအဓိကလုပ်ငန်းကဏ္ဍများမှာအောက်ပါအတိုင်းဖြစ်ပါသည်။

၁) လုပ်ငန်းမျက်မြင်တိုင်းတာခြင်းနှင့်တင်ဒါပုံစံပြုစုခြင်း — ၂၀၁၈ ခုနှစ် မေလ မှ ၂၀၁၉ ခုနှစ် မေလ အထိ

၂) တင်ဒါခေါ်ယူခြင်း — ၂၀၁၉ ခုနှစ် သြဂုတ်လ မှ ၂၀၁၉ ခုနှစ် အောက်တိုဘာလ

၃) စက်ရုံကွင်းဆင်းပြုပြင်ခြင်း — ၂၀၂၀ ခုနှစ် ဇူလိုင် မှ ၂၀၂၃ ခုနှစ် ဖေဖော်ဝါရီလ ထိ

၄) ဓါတ်အားလိုင်းပြန်ဆွဲခြင်းနှင့်ခွဲရုံများပြန်လည်ပြုပြင်ခြင်း — ၂၀၂၀ခုနှစ်ဒီဇင်ဘာလ မှ ၂၀၂၁ ခုနှစ် ဒီဇင်ဘာလ အထိ

ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံအကြီးစားပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းဆောင်ရွက်မည့်အဖွဲ့အစည်းများမှာအောက်ဖော်ပြပါအဖွဲ့စည်းများဖြစ်ကြပါသည်။

၁) အကောင်ထည်ဖော်ဆောင်ရွက်မည့်အဖွဲ့အစည်း

လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန (Ministry of Electricity and Energy)
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 ရေအားလျှပ်စစ်စက်ရုံများမှအသီးသီးအရည်အသွေးပြည့်မှီစွာထုတ်လုပ်နိုင်ရေးအတွက် စက်ကိရိယာများ၏ အဓိကအစိတ်အပိုင်းများ အားပြန်လည်ပြုပြင်မွမ်းမံခြင်း လုပ်ငန်းများကိုလုပ်ဆောင်ရန် အကြံပြုထောက်ခံထားပါသည်။ အကြောင်းမှာ မူလတည်ရှိပြီးဖြစ်သော ဆည်တော်ကြီး ရေအားလျှပ်စစ်စက်ရုံ၏ အဓိက အစိတ်အပိုင်းများသည်သက်တမ်းကြာလာပြီဖြစ်သောကြောင့်စက်ပစ္စည်းကိရိယာအစိတ်အပိုင်းများအားပြန်လည်ပြုပြင်မွမ်းမံရန်လိုအပ်လာပါသည်။

အဆိုပါပြန်လည်ပြုပြင်မွမ်းမံခြင်းနှင့် လည်ပတ်ခြင်းလုပ်ငန်းတို့သည် လက်ရှိ ရေအားလျှပ်စစ်စက်ရုံ၏ဇရိယာအတွင်းတွင်လုပ်ဆောင်သွားပါမည်ဖြစ်ပါသည်။ ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံသည် မတ္တရာမြို့ တွင်တည်ရှိပြီး မန္တလေးတိုင်းဒေသကြီး၏ မြို့ပေါင်း (၃၁)မြို့နယ်တွင်အပါအဝင်ဖြစ်ပါသည်။ အစားထိုးလဲလှယ်တပ်ဆင်မည့်စက်ပစ္စည်းကိရိယာများအားစက်ရုံပိုင်မြေဇရိယာဝန်းအတွင်းသိုလှောင်ရုံများတည်ဆောက်ကာထိန်းသိမ်းထားမည်ဖြစ်ပါသည်။

ပြန်လည်ပြုပြင်မွမ်းမံခြင်းလုပ်ငန်းများအားဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံဝန်းအတွင်းကန့်သတ်ထားသောနေရာတွင်သာဆောင်ရွက်မည်ဖြစ်ပါသည်။စက်အင်အားနှင့်စက်ရုံအရွယ်အစားအားထပ်မံတိုးချဲ့တည်ဆောက်ခြင်းပြုလုပ်မည်မဟုတ်ပါ။

စီမံကိန်းစတင်အကောင်ထည်ဖော်ဆောင်ရွက်ပါကတာဗိုင်များအစားထိုးတပ်ဆင်ခြင်း၊ ရေသွင်းတံခါးပြန်လည်ပြုပြင်ခြင်း၊လိုအပ်သောစက်ပစ္စည်းကိရိယာများတပ်ဆင်ခြင်းသာဆောင်ရွက်မည်ဖြစ်ပြီးတိုးချဲ့တပ်ဆင်ခြင်းလုပ်ငန်းများတိုးချဲ့ထုတ်လုပ်ခြင်းလုပ်ငန်းများဆောင်ရွက်မည်မဟုတ်ပါ။ထိုလုပ်ငန်းများအားလျှပ်စစ်ခါတ်အားထုတ်လုပ်ရေးလုပ်ငန်းဌာနမှအကောင်ထည်ဖော်ဆောင်ရွက်မည်သာဖြစ်ပါသည်။

စီမံကိန်းလုပ်ဆောင်မည့်အစီအစဉ်များအရ ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်း ကို စီမံကိန်းအကြံပေးသူများရွေးချယ်ခြင်း၊ တင်ဒါပုံစံများရေးဆွဲခြင်း၊ တင်ဒါခေါ်ယူစီစစ်ပြင်ဆင်ခြင်းစသည်တို့ကို ၂၀၁၈ ခုနှစ်၊ မေလ မှ စတင်ဆောင်ရွက်မည်ဖြစ်ပါသည်။ စီမံကိန်းအကောင်ထည်ဖော်ခြင်းလုပ်ငန်းအား ၂၀၂၁ ခုနှစ် အလယ်ပိုင်းတွင် စတင်လုပ်ဆောင်မည်ဖြစ်ကာ ၂ နှစ် ကြာတွင် စီမံကိန်းပြီးဆုံးမည်ဖြစ်ပါသည်။

စီမံကိန်းအကောင်ထည်ဖော်ခြင်းလုပ်ငန်းဆောင်ရွက်ရာတွင်
၁) လက်ရှိမြေအသုံးချမှုမပြောင်းလဲခြင်း။
၂) စက်ရုံ၏အပြင်ပိုင်းဖွဲ့စည်းတည်ဆောက်ပုံများ၊ စက်ပစ္စည်းများမပြောင်းလဲခြင်း။
၃) ယိုယွင်းလာသည့်စက်ပစ္စည်းများတွင်လိုအပ်သောအစိတ်ပိုင်းများလဲလှယ်ခြင်းနှင့်ပြန်လည်မွမ်းမံခြင်း။
၄) လျှပ်စစ်ခါတ်အား ထုတ်လုပ်မှု ပမာဏ၊ ထုတ်လုပ်မှုအချိန်ဇယားများ၊ လုပ်ငန်းလည်ပတ်ခြင်း ပုံစံစသည်တို့ကို ပြောင်းလဲမှုမရှိစေခြင်း။
ဆည်တော်ကြီးရေအားလျှပ်စစ်စီမံကိန်း ပြန်လည်မွမ်းမံပြုပြင်ခြင်းလုပ်ငန်းဆောင်ရွက်ရာတွင်ပါဝင်သည့် လုပ်ငန်းများအားစာရင်းဇယားဖြင့်ဖော်ပြထားပါသည်။ ဖြည့်စွက်ဆောက်လုပ်ရေးလုပ်ငန်းများများပါဝင်ခြင်းမရှိပါ။

➢ 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

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ရာတွင်လဲလှယ်တပ်ဆင်မည့်ထရန်စဖော်မာများတွင် PCB ပါဝင်သောလျှပ်ကာဆီသိုလှောင်ထိန်းသိမ်းခြင်းလုပ်ငန်းဆောင်ရွက်ရမည်ဖြစ်ပါသည်။ PCB ပါဝင်သောလျှပ်ကာဆီသိုလှောင်ထိန်းသိမ်းခြင်း၊စွန့်ပစ်ခြင်းနည်းပညာမြန်မာပြည်တွင်အတွေ့အကြုံရရှိလာနိုင်တော့မည်ဖြစ်ပါသည်။

၁) ထရန်စဖော် A ၇ခု ဆီပါဝင်မှုထုထည်ပမာဏ ၃၁၅၀ ကီလိုဂရမ်
၂) ထရန်စဖော် B ၂ခု ဆီပါဝင်မှုထုထည်ပမာဏ ၂၇၅၀ ကီလိုဂရမ်

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ရာတွင် လဲလှယ်သောထရန်စဖော်မာများတွင် ထရန်စဖော်မာဆီ (၂၇) တန်ခွဲပါရှိမည်ဖြစ်ရာ သံမဏိစည်ပိုင်းစုစုပေါင်း (၁၅၀) အသုံးပြုပြီးသိုလှောင်သိမ်းဆည်းမည်ဖြစ်ပါသည်။ လျှပ်ကာဆီများထုတ်ယူပြီးပါက သိုလှောင်ရုံတွင်သေချာစွာစနစ်တကျသိမ်းဆည်းရပါမည်။ ထရန်စဖော်မာဆီများယိုဖိတ်မှုဖြစ်ကာအပေါ်ယံမြေဆီလွှာ၊ မြေအောက်ရေတို့ညစ်ညမ်းမှုမဖြစ်စေရန်အတွက်သက်မှတ်ထားသောစည်းမျဉ်းစည်းကမ်းများအတိုင်းဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။ထိုသို့သောသိုလှောင်ရုံများကိုရေအားလျှပ်စစ်ထုတ်လုပ်ရေးလုပ်ငန်းပိုင်ဇရိယာအတွင်းဆောင်ရွက်မည်ဖြစ်ပါသည်။

၃. စည်းမျဉ်းနှင့်ဥပဒေများ

ပတ်ဝန်းထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း အခန်း(၇) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အရာဘီလူးချောင်းရေအားလျှပ်စစ်စက်ရုံပြန်လည်ပြုပြင်မွမ်းမံခြင်းလုပ်ငန်း ဆောင်ရွက်ရာတွင်သဘာဝပတ်ဝန်းကျင်စီမံခန့်ခွဲ မှုအစီအစဉ်နှင့် စောင့်ကြပ်ကြည့်ရှုရမည့်အစီအစဉ်များကိုရေးဆွဲပါသည်။

ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံပြန်လည်ပြုပြင်ခြင်းစီမံကိန်းသည် ဂျပန်နိုင်ငံ(ဂျိုက်ကာ)၏ ငွေကြေးအကူ အညီဖြင့်အကောင်ထည်ဖော်ဆောင်ရွက်နေသောစီမံကိန်းဖြစ်ပါသည်။ (၂၀၁၀) ခုနှစ် လူမှုရေးနှင့်သဘာပတ်ဝန်းကျင် ထိခိုက်မှုစမ်းစစ်ခြင်း လမ်းညွှန်ချက်နှင့်အညီ ဆောင်ရွက်ခဲ့ပါသည်။ ထို့အပြင် အပြည်ပြည်ဆိုင်ရာသဘောတူညီချက် ဖြစ်သော ထရန်စဖော်မာတွင်ပါရှိသည့် စွန့်ပစ်ဆီအညစ်အကြေးများထိန်းသိမ်းခြင်းကိုလည်း IFC, UNEP, ADB, World Bank စသောအဖွဲ့စည်းများ၏ စံချိန်စံညွှန်းများနှင့်အညီထိန်းသိမ်း ဆောင်ရွက်ခဲ့ပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်းအရ ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံ အကြီးစားပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းဆောင်ရွက်ခြင်းအတွက်မြန်မာနိုင်ငံပတ်ဝန်းကျင် ထိန်းသိမ်းရေးနည်းဥပဒေအပိုဒ်ခွဲ ၅၅ (က) အရ သဘာဝပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီစဉ် (EMP) အား အသေးစိတ်ပြင်ဆင်ပေးပို့တင်ပြခဲ့ပါသည်။ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံ၏ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်အားရေးဆွဲရာတွင်စောင့်ကြပ်ကြည့်ရှုရမည့်အစီအစဉ်များကိုပါမြန်မာနိုင်ငံ၏ သဘာဝပတ်ဝန်းကျင်ဥပဒေ၊စည်းမျဉ်းစည်းကမ်းများနှင့်အညီအသေးစိတ်ထည့်သွင်းရေးဆွဲခဲ့ပါသည်။အောက်ဖော်ပြပါသက်မှတ်ချက်များအားဆောင်ရွက်ခဲ့ပါသည်။

၁။ဆည်တော်ကြီးရေအားလျှပ်စစ်စီမံကိန်းဇရိယာအတွင်းရှိတည်ရှိဆဲသဘာဝပတ်ဝန်းကျင်နှင့်လူမှုစီးပွားရေးအခြေ အနေများအားလေ့လာဆန်းစစ်ခြင်းလုပ်ငန်းအားဆောင်ရွက်ခဲ့ပါသည်။

၂။ ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများအား သတ်မှတ်ခြင်း၊ သက်ရောက်မှုများအား တခုခြင်းစီအလိုက် 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 ပတ်ဝန်းကျင်ဆိုးကျိုးထိခိုက်မှုရှိခြင်း (B) သည် ပတ်ဝန်းကျင်ဆိုးကျိုး ထိခိုက်မှု အနည်းငယ်ရှိခြင်း၊ (C) သည်ပတ်ဝန်းကျင်ထိခိုက်မှုအနည်းငယ်ရှိခြင်း (D) သည် ပတ်ဝန်းထိခိုက်မှု မရှိခြင်း စသည်တို့ဖြင့် ခွဲခြားသတ်မှတ် ထားပါသည်။ လေ့လာစမ်းစစ်အကဲဖြတ်ချက်များအရ အဖြေမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။
(က) လူမှုစီပွားရေးအပေါ်တွင်ထိခိုက်မှုလုံးဝမရှိပါ။
(ခ) စီမံကိန်းဆောင်ရွက်မှုကြောင့် သဘာဝပတ်ဝန်းကျင်ပေါ်တွင်ထိခိုက်မှုမရှိပါ။
(ဂ)စွန့်ပစ်အစိုင်အခဲများ၊ ဆီအညစ်အကြေးပါဝင်သောစက်ကိရိယာအစိတ်ပိုင်းဟောင်းများအား သေချာစွာကန့်သန့်သိမ်းထားရပါမည်။

၄. စီမံကိန်းဧရိယာ၏လက်ရှိပတ်ဝန်းကျင်အခြေအနေ
၄.၁ .လူမှုစီးပွားရေးပတ်ဝန်းကျင်

ဆည်တော်ကြီးရေအားလျှပ်စစ်စီမံကိန်းသည် မန္တလေးတိုင်းဒေသကြီး၏မြို့နယ်ပေါင်း (၃၁)မြို့တွင်းရှိ မတ္တရာမြို့တွင်ပါဝင်သည်။ မတ္တရာမြို့နယ်သည် ဧရိယာစတုရန်းကီလိုမီတာ (၁၁၇၈) ကျယ်ဝန်းပြီး ဆည်တော်ကြီးဆည်မှရေပေးဝေမှုရရှိပါသည်။ အဆိုပါဆည်မှ မတ္တရာ၊ မန္တလေး၊ ပုသိမ်ကြီး၊ အမရပူရ စသောမြို့များသို့လည်းရေပေးဝေထားရှိပါသည်။

ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံသည် မြန်မာနိုင်ငံ၏အပူပိုင်းဇုန်တွင်ကျရောက်နေပါသည်။ ထိုဒေသသည်စိုက်ပျိုးရေးလုပ်ငန်းများလုပ်ဆောင်ရာတွင် ကောင်းစွာဖြစ်ထွန်းသောနေရာဖြစ်ပါသည်။ ရှမ်းကုန်းပြင်မြင့်နှင့်ဧရာဝတီမြစ်ကြားတွင်တည်ရှိပြီးမြေဆီမြေဩဇာအလွန်ပင်ကောင်းမွန်ပါသည်။ ပင်လယ်ရေမျက်နှာပြင်အမြင့် (၇၆) မီတာတွင်တည်ရှိနေပါသည်။

မတ္တရာမြို့သည်လူဦးရေ (၂၃၄၇၈၂) ရှိပြီး ၂၀၁၅ ခုနှစ်တွင်ဗမာလူမျိုးအများဆုံးဖြစ်သည်။ စုစုပေါင်းအိမ်ထောင်စု အရေအတွက်မှာ (၅၁၀၁၅) ဖြစ်ပြီး ပျမ်းမျှ အိမ်ထောင်စုအရွယ်အစားမှာ (၄.၆)ဖြစ်ပါသည်။ ထိုအရွယ်အစားသည်တနိုင်ငံလုံးပျမ်းမျှအရွယ်အစား၏အထက်တွင်တည်ရှိပါသည်။ လူဦးရေအများစုသည်ကျေးလက်ဒေသတွင်နေထိုင်ကြပါသည်။အမျိုးသားဦးရေအချိုးအစားမှာ (၄၇.၈ %) ဖြစ်ပြီး အမျိုးသမီးဦးရေအချိုးမှာ (၅၂.၂ %) ဖြစ်ပါသည်။စုစုပေါင်းမြေဧရိယာမှာ (၄၂၆၀၁၀) ဧကဖြစ်ပြီး (၁၃၄၈၂၃) ဧကမှာစိုက်ပျိုးနိုင်သောမြေများဖြစ်ပါသည်။ ရာခိုင်နှုန်းအားဖြင့် (၃၁.၆) %မှာ စိုက်ပျိုးနိုင်သောမြေများဖြစ်ပါသည်။ ကြိုးဝိုင်းတော၊ ကြိုးပြင်ကာကွယ်တောမှာ (၃၈၁၂) ဧကရှိပြီး စုစုပေါင်းမြေဧရိယာ၏(၉.၁ %)ဖြစ်ပါသည်။ကျန်ရှိသော (၅၈%) သောမြေဧရိယာမှာ အများအားဖြင့်သစ်တောဧရိယာများသာဖြစ်ကြပါသည်။ သို့ရာတွင်သစ်တော များမှာနှစ်စဉ်လျှင်မြန်စွာ လျော့နဲ့လာပါသည်။

စိုက်ပျိုးနိုင်သောမြေဧရိယာအများစုအား လယ်နှင့်ယာလုပ်ငန်းကိုသာအဓိကလုပ်ကိုင်ကြပါသည်။ မြေအမျိုးစားမှာလည်းလယ်နှင့်ယာလုပ်ငန်းလုပ်ကိုင်ရန်အထူးသင့်လျော်ပါသည်။ ဆည်ရေရရှိမှုကြောင့် တနှစ်လျှင်နှစ်ကြိမ်စိုက်ပျိုး နိုင်ပါသည်။

မတ္တရာမြို့နယ်သည်သီးနှံမျိုးစုံထွက်ရှိရာတွင်အလွန်ကြော်ကြားသောမြို့တော်ဖြစ်သည်။ စပါးစိုက်ပျိုးပြီး နောက်ပဲတီစိမ်း၊ပဲလွန်း၊ပဲစင်းငုံ၊နှမ်း၊ပြောင်းစသည်တို့ကိုလည်းထပ်မံစိုက်ပျိုးကြပါသည်။ပဲစင်းငုံနှင့်ပဲတီစိမ်းတို့သည်မတ္တရာမြို့နယ်၏အဓိကထွက်ကုန်များဖြစ်ကြပြီး နှမ်း၊ မြေပဲ၊ နေကြာ စသောယာလုပ်ငန်း များစွာလည်းစိုက်ပျိုးကြပါသည်။ ဆည်ရေရရှိမှုအကျိုးဖြင့်လယ်လုပ်ကိုင်သူအများစုသည် တနှစ်လျှင် ၃ကြိမ် ထိစိုက်ပျိုးရေးလုပ်ငန်းကိုလုပ်ကိုင်နိုင်ကြပါသည်။

မတ္တရာမြို့နယ်တွင်စုစုပေါင်းလူဦးရေ၏ (၅၇%) မှာစိုက်ပျိုးရေးလုပ်ငန်းလုပ်ကိုင်ကြပြီး (၁၆%) မှာ နေ့စားအလုပ်လုပ်ကိုင်ကြပါသည်။ (၉.၂%) မှာအစိုးရဝန်ထမ်းများဖြစ်ကြပါသည်။ ကုန်ရောင်း ကုန်သွယ်နှင့်အခြားသောလုပ်ငန်းဆောင်ရွက်သူများမှာ (၃.၅%) ရှိပါသည်။
သစ်လုပ်ငန်း၊ မွေးမြူရေးလုပ်ငန်း၊ ရေချိုးငါးမွေးလုပ်ငန်းစသည်တို့အားဒေသတွင်းစီးပွားလုပ်ငန်းအဖြစ် လုပ်ကိုင် ကြပါသည်။

လျှပ်စစ်မီးရရှိမှုတွင်အချို့သောကျေးရွာများမှာလုံလောက်စွာမရရှိသေးပါ။ကိုယ်ပိုင်မီးစက်များဖြင့်ညနေပိုင်း တွင်ဒုနာရီမှဌနာရီအထိအသုံးပြုကြပါသည်။မြို့ပေါ်ပိုင်းအားလျှပ်စစ်မီးလုံလောက်စွာပံ့ပိုးထားပြီးဖြစ်ပါသည်။

၄.၂။ သဘာဝပတ်ဝန်းကျင်

မြေမျက်နှာသွင်ပြင်အနေအထားအရမတ္တရာမြို့သည် ပင်လယ်ရေမျက်နှာပြင်အမြင့် (၇၆) မီတာ တွင်တည်ရှိပါသည်။ရှမ်းကုန်းပြင်မြင့်၏အစိတ်အပိုင်းတခုဆက်ဆက်တည်ရှိနေပါသည်။လွိုင်ကော်ကုန်းမြင့် လွင်ပြင်ဒေသတွင်မြေဆီမြေဩဇာကောင်းမွန်သောမြေအမျိုးစား(၆)မျိုးကိုတွေ့ရပါသည်။
(၁) နုန်းဆန်သောမြေန (၂)ကောက်ရိုးဆွေးမြေ (၃)စနယ်မြေ (၄)စနယ်မြေဆန်သောမြေနီသဲဝန်း (၅)ဝါညိုရောင်သစ်ဆွေးမြေ (၆)နီညိုရောင်တောင်တန်းမြေ တို့ဖြစ်ပါသည်။

မတ္တရာမြို့၏ရာသီဥတုပတ်ဝန်းကျင်အခြေအနေမှာ မြန်မာနိုင်ငံအလယ်ပိုင်းတွင်တည်ရှိသောကြောင့် အပူပိုင်းဇုန်အတွင်းကျရောက်ပါသည်။ အမြင့်ဆုံး အပူချိန်သည် (၃၄) ဒီဂရီစင်တီဂရိတ်ရှိပြီး အနိမ့်ဆုံးအပူချိန်မှာ (၂၂) ဒီဂရီစင်တီဂရိတ်ဖြစ်ပါသည်။ တနှစ်ပါတ်လုံးပျမ်းမျှအပူချိန်မှာ ၂၈ စင်တီဂရိတ်ဖြစ်ပါသည်။

ဖွန်လ မှ အောက်တိုဘာလထိသည်မိုးရာသီဥတုဖြစ်ပါသည်။ မိုးရာတွင်ရရှိသောမိုးရေချိန်ပမာဏများသည် ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံလျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးအတွက်အလွန်ပင်အရေးကြီးပါသည်။ ဒီဇင်ဘာလ မှဖေဖော်ဝါရီလအထိသည် မိုးရွာသွန်းမှုအနဲဆုံးကာလဖြစ်ပြီး တခါတရံမရွာသွန်းပေ။ ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံတည်ရှိသောမတ္တရာမြို့သည်တောင်တန်းများနှင့်နှင့်နီးကပ်ပြီးဆည်ဇရိ ယာနှင့်လည်းနီးကပ်နေသောကြောင့်အခြားသောမြို့နယ်အစိတ်ပိုင်းများထက်မိုးရွာသွန်းမှုပိုများသည်။

ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံတည်ရှိသောနေရာသည် မြောက်အင်ဒိုချိုင်းနားနွေးသမသစ်တော ဇရိယာနှင့်နီးသောကြောင့် ဂေဟစနစ်ကောင်းမွန်ပါသည်။ ၁၉၉၉ - ၂၀၀၀ စစ်တမ်းကောက်ချက်များအရ လွိုင်ကော်မြို့နယ်၏သဘာဝသစ်တောဇရိယာသည် ကယားပြည်သစ်တော ဇရိယာ၏ (၉.၁ %)ရှိပါသည်။

လွိုင်ကော်မြို့သစ်တောဇရိယာအတွင်း တားမြစ်ထိန်းသိမ်းထားသော စာရင်းဝင်သစ်မျိုးမရှိပါ။

၅။ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုထိန်းသိမ်းရေးနှင့်စောင့်ကြည့်လေ့လာရေးအစီအစဉ်

၅.၁။ ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများမှဖြစ်ပေါ်လာနိုင်သောအကျိုးသက်ရောက်မှုများ

ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံ အကြီးစားပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ရာတွင် ဖြစ်ပေါ်လာနိုင်သောအကျိုးသက်ရောက်မှုများအားလေ့လာတိုင်းတာပြီးနောက်ဆိုးကျိုးသက်ရောက်မှုမရှိနိုင်သည်ကိုလေ့လာမှတ်တမ်းတင်ထားပါသည်။ အသေးစိတ်လေ့လာမှုများပြုလုပ်ရာတွင်လျှပ်စစ်ဓါတ်အားထုတ်လုပ်မည့်အင်ဂျင်အတွက် လိုအပ်သောပြန်လည်အစားထိုးတပ်ဆင်ရမည့်အစိတ်အပိုင်းများလေ့လာခြင်း၊သိုလှောင်မည့်ဇရိယာသတ်မှတ်ပြင်ဆင်ခြင်း၊ ဒေသသခံပြည်သူများနှင့်တွေ့ဆုံခြင်းလုပ်ငန်းများလုပ်ဆောင်ခဲ့ပါသည်။

တည်ဆောက်ခြင်းလုပ်ငန်းဆောင်ရွက်သည့်အဆင့်တွင်အစားထိုးတပ်ဆင်မည့်ပစ္စည်းကိရိယာများတင်သွင်းမည့်အဖွဲ့အားရွေးချယ်ပြီးနောက်လုပ်ငန်းအကောင်ထည်ဖော်ဆောင်ရွက်ခြင်းကိုလျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၊ ရေအားလျှပ်စစ်ထုတ်လုပ်ရေးလုပ်ငန်းဌာနမှဆောင်ရွက်မည်ဖြစ်ပါသည်။

(က) လူမှုစီးပွားရေးပတ်ဝန်းကျင်

စီမံကိန်းဇရိယာအတွင်းသို့စက်များသယ်ဆောင်ခြင်းနှင့်လိုအပ်သောကိရိယာများသယ်ဆောင်ခြင်းလုပ်ငန်းဆောင်ရွက်ရာတွင်လုပ်ငန်းသုံးကားကြီးများအသုံးပြုရမည်ဖြစ်ပါသည်။ ထိုကားကြီးများအားဖြေးညှင်းစွာမောင်းနှင်မည်ဖြစ်ပါသည်။ ၄ မီတာမှ ၆ မီတာကျယ်သောလမ်းများအတွင်းသို့ဝင်ရောက်ရမည်ဖြစ်ပါသဖြင့်ယာဉ်ကြောကျပ်တောက်မှုအနေငယ်ဖြစ်ပွားနိုင်ပါသည်။ စီမံကိန်းလုပ်ငန်းများမှဒေသခံအချို့အလုပ်အကိုင်ကာလတခုထိရရှိမည်ဖြစ်သောကြောင့် ဝင်ငွေတိုးလာမည်ဖြစ်ပါသည်။

(ခ) သဘာဝပတ်ဝန်းကျင်

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းအား ဆောင်ရွက်ရာတွင် ရေအားလျှပ်စစ်ထုတ်လုပ်ရေးလုပ်ငန်းပိုင်ဆည်တော်ကြီး စက်ရုံဇရိယာဝန်းအတွင်းသာဆောင်ရွက်မည်ဖြစ်သောကြောင့်သဘာဝပတ်ဝန်းကျင်ထိခိုက်မှုမရှိပါ။

(ဂ) ပတ်ဝန်းကျင်ညစ်ညမ်းခြင်း

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းဆောင်ရွက်ရာတွင်ထရန်စဖော်မာများတွင်ပါဝင်သောလျှပ်တားဆီ PCB ပါဝင်နေပါသည်။၄င်းတို့ကိုသေချာစွာပြုပြင်ထားသောသိုလှောင်မည့်ဇရိယာတွင်စနစ်တကျသိမ်းဆည်းရပါမည်။

ပြန်လည်ပြင်ဆင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ရာတွင်ဂရုစိုက်ရမည့် သဘာဝပတ်ဝန်းကျင်ထိခိုက်မှုများမှာအကောင်ထည်ဖော်ဆောင်ရွက်မည့်ကာလတွင်ပေါ်ထွက်လာမည့်စွန့်ပစ်အစိုင်အခဲများ၊လဲလှယ်တပ်ဆင်မည့်လျှပ်စစ်ကိရိယာများတွင်ပါဝင်သည့်လျှပ်ကာဆီတို့ကို သေချာစွာစနစ်တကျသိမ်းဆည်းရန်ပင်ဖြစ်ပါသည်။ မြန်မာနိုင်ငံတွင် PCB ပြန်လည်ပြုပြင်သည့်နည်းပညာကောင်းစွာမဖွံ့ဖြိုးသေးပါ။

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ရာတွင် အစားထိုးလဲလှယ်တပ်ဆင်ရာမှထွက်ပေါ်လာမည့်

အနဲငယ်သောကျောက်ဂွမ်းမှုန့်၊ မာကျူရီ၊ ခဲ အစရှိသည်တို့အားသေချာစွာသိုလှောင်သိမ်းဆည်းမည် ဖြစ်ပါသည်။ စီမံကိန်းစက်ရုံဧရိယာအတွင်းရှိ သိုလှောင်သောဧရိယာတွင်သာသေချာစွာသိမ်းဆည်းမည် ဖြစ်သဖြင့် ပတ်ဝန်းကျင်ညစ် ညမ်းမှုမဖြစ်ပေါ်စေပါ။

၅.၂။ သဘာဝပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်

- **ကြိုတင်ပြင်ဆင်ခြင်းနှင့်စီစဉ်ခြင်းအဆင့်**

ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းဆောင်ရွက်ရာတွင် လုပ်ငန်းပြင်ဆင်ခြင်း နှင့်အစီအစဉ်ရေးဆွဲခြင်းအဆင့်တွင်သဘာဝပတ်ဝန်းကျင်ထိခိုက်မှုမရှိသဖြင့်အထူးဂရုစိုက်လုပ်ဆောင်ရန်မ ရှိပါ။

- **ပြန်လည်ပြုပြင်ခြင်းအကောင်ထည်ဖော်ဆောင်ရွက်မည့်အဆင့်**

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းအကောင်ထည်ဖော်ဆောင်ရွက်သည့်အဆင့်တွင် အစားထိုးလဲလှယ်တပ်ဆင် မည့်လျှပ်စစ်ကိရိယာအများအပြားအားစနစ်တကျသိုလှောင်သိမ်းဆည်းရန်လိုအပ်ပါသည်။ PCB လျှပ်ကာဆီပါဝင်သောကိရိယာအစိတ်အပိုင်းများလဲလှယ်ရာတွင်အထူးဂရုပြုဆောင်ရွက်ရမည့်ဖြစ်ပါသည်။

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းတွင် အစားထိုးလဲလှယ်တပ်ဆင်မည့်ထရန်စဖော်မာများတွင် လျှပ်ကာဆီ PCB ပါဝင်သောဒရမ်များပါဝင်ပါသည်။ ၎င်းတို့အားသေချာစွာပြုလုပ်ထားသောသိုလှောင်မည့်နေရာတွင် ထိန်းသိမ်းထားရှိရမည်ဖြစ်ပါသည်။၎င်းအရာတို့အားအပြင်သို့သယ်ဆောင်ခြင်းမပြုရပါ။သိုလှောင်ထိန်းသိမ်း ထားရှိရမည့်နေရာသည်လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၊ရေအားလျှပ်စစ်ထုတ်လုပ်ရေးဌာနပိုင်မြေနေရာဖြစ် ပါသည်။

စီမံကိန်းအကောင်ထည်ဖော်ဆောင်ရွက်ရာတွင် လုပ်ငန်းခွင်ဘေးအန္တရာယ်ကင်းရှင်းရေးသင်တန်းပေးရာ တွင်အဆိပ်တောက်ဖြစ်စေသောဓါတုဗေဒဆိုင်အညစ်အကြေးနှင့်သက်ဆိုင်သောသင်တန်းပါဝင်ရမည်ဖြစ်ပါ သည်။ ထိုသင်တန်းများကိုလည်း IFC's "***Environmental, Health, and Safety Guidelines*** နှင့်အညီဆောင်ရွက်သွားရမည်ဖြစ်ပါသည်။

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ရာတွင် အစားထိုလဲလှယ်တပ်ဆင်ရာမှထွက်ပေါ်လာမည့် အနဲငယ်သောကျောက်ဂွမ်းမှုန့်၊ မာကျူရီ၊ ခဲ အစရှိသည်တို့အားသေချာစွာသိုလှောင်သိမ်းဆည်းမည် ဖြစ်ပါသည်။၎င်းတို့အာလုံခြုံစိတ်ချစွာသိုလှောင်သိမ်းဆည်းနိုင်သည့်နည်းပညာများမြန်မာနိုင်ငံတွင်ရရှိနေပြီ ဖြစ်ပါသည်။

စီမံကိန်းလုပ်ဆောင်ချက်သတင်းအချက်အလက်များအားရေအားလျှပ်စစ်ထုတ်လုပ်ရေးဌာနမှဒေသခံပြည် သူများသို့သတင်းပေးခြင်း၊အင်တာနက်စာမျက်နှာတွင်တင်ကာသတင်းပေးခြင်းတို့ကိုဆောင်ရွက်ရပါမည်။

- **စက်ပြန်လည်မောင်းနှင်ခြင်းနှင့်ထိန်းသိမ်းခြင်းအဆင့်**

ပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းပြီးစီးသွားပါကပြန်လည်မောင်းနှင်ခြင်းနှင့်ထိန်းသိမ်းခြင်းလုပ်ငန်းအားလုပ်ကိုင်ဆောင်ရွက်မည်ဖြစ်ပါသည်။ စီမံကိန်းအတွင်း ပြုပြင်ခြင်းလုပ်ငန်းများဆောင်ရွက်ခြင်းအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှုမရှိခြင်းအခြေအနေအားလျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၊လျှပ်စစ်ထုတ်လုပ်ရေးဌာနမှ

သတင်းထုတ်ပြန်ဖြန့်ဝေရပါမည်။

၅.၃။ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးစောင့်ကြည့်လေ့လာရေးအစီအစဉ်

ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးစောင့်ကြည့်လေ့လာရေးအစီအစဉ်အား ထရန်စဖော်မာများတွင်ပါဝင်သောလျှပ်တားဆီ (PCB) သိုလှောင်သိမ်းဆည်းမှုနှင့်အညီဆောင်ရွက်ရပါမည်။ လေထုအရည်အသွေး၊ မြေအရည်အသွေး၊ရေအရည်အသွေးတို့မသိမသာပြောင်းလည်းခြင်းရှိမရှိကိုသေချာစွာစောင့်ကြည့်ရမည်ဖြစ်သည်။

ဆည်တော်ကြီးရေအားလျှပ်စစ်စက်ရုံပြန်လည်ပြုပြင်ခြင်းလုပ်ငန်းဆောင်ရွက်ရာတွင်လုပ်ငန်းအကောင်ထည်ဖော်ဆောင်ရွက်ခြင်းအဆင့်နှင့် လုပ်ငန်းပြီးဆုံးခြင်းအဆင့်တို့ထိ လျှပ်ကာဆီ (PCB) စနစ်တကျထိန်းသိမ်းသိုလှောင်ထားရှိမှုမှတမ်းအားသေချာစွာထားရှိရမည်ဖြစ်ပါသည်။ထိုသို့လုပ်ငန်းများဆောင်ရွက်ရာတွင် အပြည်ပြည်ဆိုင်ရာလမ်းညွှန်ချက်များနှင့်အညီဆောင်ရွက်ရမည်။ လမ်းညွှန်ချက်များမှာ

IFC's "***Environmental, Health, and Safety Guidelines***

1.5 Hazardous Materials Management

ဒေသခံများနှင့်တွေ့ဆုံကာစီမံကိန်းလုပ်ငန်းများရှင်းလင်းတင်ပြခြင်းကို ၂၀၁၆ ခုနှစ်၊ ဇွန်လ နှင့် စက်တင်ဘာလတို့တွင်ပြုလုပ်ခဲ့ပါသည်။စီမံကိန်းလုပ်ငန်းဆောင်ရွက်ခြင်းကိုဒေသခံပြည်သူများလက်ခံသဘောတူပါသည်။ သို့သော်ဒေသခံအချို့တောင်းဆိုသောနှုန်းအနည်များဖယ်ရှားပေးရန်အချက်မှာစီမံကိန်းလုပ်ငန်းနှင့်တိုက်ရိုက်သက်ဆိုင်ခြင်းမရှိပဲဆည်မြောင်းဦးစီးဌာနနှင့်သက်ဆိုင်ကြောင်းကိုပြန်လည်ရှင်းလင်းခဲ့ပါသည်။

Environmental Management Plan (EMP)

for

Rehabilitation Project of Sedawgyi Hydropower Plant

Executive Summary

1 Outline of the Project

- Sedawgyi Hydropower Plant (HPP) is of multi-purpose nature for which water supply for irrigation system as well as for power generation constructed by ADB's finance in late 1980s.It is located at the Chaungmagyi River, one of the tributaries of Ayeyarwady river and it flows in Madaya Township of Mandalay Region, which is one of the most developed regions of Myanmar. Location of Sedawgyi HPP is some 130km to southeast of Mandalay city, which is one of the most developed urban centers in Myanmar.

- Sedawgyi HPP began its operation in May 1989. 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.

- Salient features of Sedawgyi HPP is shown in the table below:

Dam	Rock-fill Dam, Height: 40.6m, Length: 1,255.8m
Catchment Area	3,384 km2 (Chaunmagyi River of Aheyarwady River System)
Max. Discharge	51.7 m3/Sec.
Effective Head	28.2 m
Reservoir Level	Max.: 129.5 m (AMSL) Full Reservoir Level: 127.9 m (AMSL) Min. Operation Level: 111.3m (AMSL)
Reservoir Area at Full Reservoir Level	28.7 km2
Installed Capacity	25 MW (12.5 MW x 2 No.)
Generator	Vertical Shaft, Rotating Field totally enclosed 3 phase, 50 Cycles A.C. Synchronous Generator-semi-umbrella Type
Type of Turbine	Vertical Shaft, Adjustable Blade Kaplan (2 No.)
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 line for 65 km long to Mandalay primary substation

- It is during the 2016 survey of the National Electricity Master Plan, for which assessment of natural wear and tear of Myanmar's power generation system, including weathering conditions of the Sedawgyi HPP was carried out and that the survey concluded that rehabilitation works for Sedawgyi HPP has to be carried out on time.

- Because of the natural wear and tear during the past 30 years, and because of the scheduled maintenance works, Sedawgyi 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.

- **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 Electromechanical supplier: August 2018-October 2019
  3) Rehabilitation Works: December2019-February 2023
  4) Transmission Line and Substation: December 2020-December 2021

- The following organizations are involved in executing the rehabilitation works of the Sedawgyi 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 for Rehabilitation Works

- In the scheme of the National Electricity Master Plan, 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 Sedawgyi Hydropower Plant (HPP) is one of them.

- The rehabilitation works is carried out within the existing Sedawgyi HPP and its working area. The site is in on the northeastern corner of Madaya Township, which is one of the 31 townships of Mandalay Region. Replaced electric parts and equipment are subject to store in the storage buildings constructed on the land owned by EPGE.

- The Project for Sedawgyi HPP, which 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 Sedawgyi 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 4) replace parts of power generation system without stoppage of the power generation operation.

- Contents of the rehabilitation works on Sedawgyi 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 rehabilitation 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 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	R	2 sets	-

	system			
	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

- Actual project area that the rehabilitation works for the electric power generators and transformers of sub-stations as well as other electro-mechanical parts are replaced is approximately 75 m x 77.5 m of the portion of sub-station and 55 m x 37.5 m of the portion of powerhouse i.e. 7,875 m2 of land area owned by EPGE.

- Within the framework of the rehabilitation works, there are a number of electro-mechanical parts subject to replacement including transformers. These transformers contain insulating oil, which contains PCB and that it has to be extracted from each transformer unit and stored on site until such time technology for disposal of insulating oil becomes available in Myanmar. Number of transformers containing PCB are as follows:

  1) Transformer A: 7 Sets Volume of Insulating Oil - 3,150kg/unit
  2) Transformer B: 2 Sets Volume of Insulating Oil - 2,750kg/unit

- In total, 27,550 kg of insulating oil extracted from transformers and contained into some 150 steel drums for storage of extended period. Transformers after the extraction of insulting oil should also be placed in the warehouse.

- In order to prevent insulating oil, which contains PCB from leaking and contaminating soil and groundwater, and third parties from entering into the warehouse, leakage proof device such as oil bund, leakage-proof flowing, etc. on the storage building has to be constructed. These storage facilities are constructed within the area currently in the possession of EPGE.

3 Laws and Regulations Applied to the Rehabilitation Works of Sedawgyi 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 Sedawgyi 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 Sedawgyi HPP requires elaboration of EMP according to the Article 55 (a) of the Rules or Article 24 of the Procedure, EPGE 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 Sedawgyi 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 Sedawgyi 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

- Sedawgyi HPP is located in Madaya Township, which is one of the 31 townships of Mandalay Region. Madaya Township covers an area of 1,178.4 sq.km and it is one of the townships irrigated by Sedawgyi Dam. The irrigated areas are located at the northern part of Mandalay Region, comprising four Township of Madaya, Mandalay, Patheingyi, and Amarapura.

- Although Sedawgyi area is located in dry zone in Myanmar, it is an agriculturally well-developed area because of the irrigation development over fertile soils of alluvial plain, which lies between the Shan Highland in the east and the Ayeyarwady River in the west at the altitude of 76 meters above sea level.

- Madaya Township's population is 234,782 in 2015. In terms of ethnicity, Bamar is the dominant group of people. Total number of household is 51,015 and this gives average household size of 4.6. This is the above average of the national size of household, which is 4.4. Most people of Madaya Township are living in the rural area as their percentage of the total population is 91.1% while 8.9% are in urban area of Madaya Township. The male and female ratio of 47.8% vs. 52.2% respectively.

- Among the total land area of 426,010 acre, cultivable lands are 134,823 acre (31.6% of the total land area) and reserved and non-reserved forests are 38,812 acre (9.1% of the total land area). The rest of nearly 60 % of land is forest in general. However, forest area appears to be reduced rapidly in recent years.

- Among the cultivable lands Le lands area is the largest, followed by alluvial lands, which is suitable for rice, pulses and oil seed. Le lands is designated for paddy cultivation, possible for double cropping with irrigation system.

- Because of the large area of these productive lands, Madaya Township is famous for its large production of various crops. After rice, various pulses are widely grown and among them are black gram, green gram and pigeon pea that are the largest agricultural products of Madaya Township. Oil seeds such as sesame, peanut and sunflower are also grown after rice or as single crop in Ya land during post- monsoon season. Where the irrigation access is favorable, many farmers are practicing triple cropping system such as "Monsoon rice – pulses - summer rice" cropping patters.

- As the land use patterns indicates, workforce in Madaya Township contains a large portion of agricultural workers which is 57% of the total population, followed by casual labor of 16.3%, local services of 9.2 %, Trading of 3.5% and others.

- Other industry in Maday Township is forestry, livestock rearing, freshwater fishery that are no at all significant portion of the local economy.

- Electricity supply in Madaya Province is extremely limited. Thus, private generators for 3-4 hours in the evening is a common practice.

- Water supply is also extremely limited. Majority of villagers are fetching irrigation water if near-by, or use small streams. Because of the lack of water supply system in the urban areas, there is a lack of sewage system.

4.2 Natural Environment

- Geographically, mountains and hill ranges of Shan Plateaux, Chaungmagyi river valley and alluvial plain spread over the area north to east and to some extent to south along Ayeyarwady river are the

main features of in Madaya Township. It is about 76 m above sea level and the most land area lies within the flood plain formed by the Ayeyarwady River and Chaungmagyi River.

- There are two groups of rock units found in Madaya Township: 1) sedimentary rock units; and 2) metamorphic rock units. Alluvium deposits are widely distributed in the western part of Maday Township and it also covers the areas near Chaungmagyi River and its tributaries i.e. it is the predominant ground conditions of Sedawgyi HPP project area. Main soil types of Madaya Township can be grouped into the following:

  a. Alluvial Soil
  b. Meadow and Meadow Alluvial Soil
  c. Dark Compact Savanna Soil
  d. Dark Compact Irrigated Savanna Soil
  e. Yellow Brown Savanna Soil
  f. Mountainous Red Brown Forest Soil

- Hydrologically, Ayeyarwady River flows on the west of township and it is forming the western boundary of township. Chaungmagyi River passes through the Township, flowing from northeast to west, and then entering into the Ayeyarwady River. The River that originates from the Eastern Highlands passes through the Sedawgyi area. It enters the township at its northeast corner and it flows southward and that it forms as boundary between alluvial plain and Shan Highland. It is a perennial stream and navigable by boats in rainy season.

  Because of Chaungmagyi River flowing generally from north to south of Madaya Township, and Sedawgyi Dam controls the flow regime of the river, as well as irrigation canals, alluvial plain of the Ayeyarwady River has been put into the area of which development of rich agricultural area has become possible.

- Climatically, Madaya Township is in Dry Zone of Central Myanmar, climate of Madaya Township is a hot and dry. The mean annual temperature of Madaya Township is 28°C, maximum mean temperature of 34°C and minimum mean temperature of 22°C.

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

- Ecologically, Sedawgyi HPP is located right on the border between "Northern Indochina Subtropical Forest" and "Irrawaddy (Ayeyarwady) Moist Deciduous Forest". Because of the easy-to- access of these eco-system area, natural forest area of the Madaya Township has become 9.1 % of the total land area based on the 1999-2000 survey record.

  There is no known wildlife/plant protected area within the boundaries Madaya Township. There is also no known landscape of tourism value in Madaya Township.

5 Environmental Management and Monitoring Plan

5.1 Environmental Impacts Induced by the Rehabilitation Works

- Based on the current operation of Sedawgyi 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 Sedawgyi 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:
     - Replaced electric equipment/parts including transformers after extraction of insulating oil that contains PCB are stored on site as solid waste;
     - Insulating oil that contains PCB has to be removed from transformers and stored in the storage area for extended period of time.
- The most significant environmental impact that Rehabilitation Works should induce during the implementation period is to generate various types of solid waste ranging from replaced electric equipment and parts including insulating oil of trans formers that contains PCB. Measures to store them for extended period of time is inevitable because of industrial treatment system for PCB has not been developed to date within the boundaries of Myanmar and transportation of PCB outside Myanmar is internationally restricted.
- Other chemicals possibly generated as a result of the rehabilitation works would be nominated amount of Asbestos, Mercury (Hg) and Led (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:** During the preparation and planning period of the Project i.e. rehabilitation works of the Sedawgyi HPP, no significant environment necessary to endeavor management effort.
- **Implementation Period of the Rehabilitation Works:** During the implementation period of the rehabilitation works, there are a large number of electric parts subjects to replacement for disposal. One of the most significant electric parts are the transformers containing PCB in the insulating oil.

  As described before, insulation oil is extracted from each unit of transformer and stored in steel drums and that these drums are subject to placement in the storage building with leakage proof constructed on site. No PCB drum is transported outside the storage area of which it is in the possession of EPGE because of the toxicity. At present, PCB is not allowed to transport domestically or internationally unless technology for disposal of PCB is made available in Myanmar.

During the implementation period of the rehabilitation works, training for industrial safety for treating PCB and other toxic chemical components are implemented. Training program is based on the "PCB Transformers and Capacitors - From Management to Reclassification and Disposal, UNEP, 2002" in conjunction with IFC's "***Environmental, Health, and Safety Guidelines***".

Other spare parts containing Asbestos, Mercury (Hg) and Lead (Pb) are all stored on site although quantities of them are very small unless technology for safe disposable of them is readily available in Myanmar.

EPGE is responsible for dissemination of information to the stakeholders among the villages within the Madaya Township. Since EPGE has web site in operation, it is appropriate to disseminate information on the contents of rehabilitation works being carried out every month.

- **Operation and Maintenance Period:** Upon completion of the rehabilitation works, Sedawgyi HPP is put into regular operation and maintenance period. No part of the operation of hydropower generation is subject to 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.

5.3 Environmental Monitoring Plan

- Environmental Monitoring Plan (EMoP) has been prepared in order to conceal PCB containing transformer oil and stored on site for extended period of time. Further monitoring works for which if insulating oil is infiltrated into soil thence contaminate groundwater is planned to carry out periodically during the operation and maintenance period.

1) EPGE is responsible to keep record of PCB storage during the implementation period of the rehabilitation works as well as the operation and maintenance period. International Finance Corporation (IFC), which is one of the organizations related to World Bank, puts out "***Environmental, Health, and Safety Guidelines***". The guidelines is widely adapted as internationally accepted guidelines for industrial safety of the MDB-funded projects in general.

   Within the safety guidelines, "***1.5 Hazardous Materials Management***" should stringently be applied for the Rehabilitation Works of the Sedawgyi HPP in particular for the storage of PCB containing insulation oil of the transformers.

   Reporting and monitoring system for PCB, "PCB Transformers and Capacitors - From Management to Reclassification and Disposal, UNEP, 2002" should be applied in compliance with the IFC's "***Environmental, Health, and Safety Guidelines***".

2) Stakeholder meetings held two times in June and September 2016 for information disclosure and public participation is followed up for further monitoring of the social environment in relation to the project. While the local people made a demand for which mining activities should be brought to a halt because of excessive sedimentation to the reservoir, it not directly related to the Rehabilitation Works of Sedawgyi HPP.

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.

Table of Contents ..... **Page**

List of Figures

List Of Tables

Abbreviations

ADB	:	Asian Development Bank
PAPs	:	Project Affected Persons
BAP	:	Biodiversity Action Plan
Cu.m	:	Cubic meter
CSR	:	Corporate Social Responsibility
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
EMoP	:	Environmental Monitoring Plan
EPGE	:	Electric Power Generation Enterprise
ESIA	:	Environmental and Social Impact Assessment
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	:	Moulded Case Circuit Breaker
MDB	:	Multinational Development Bank
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
UNFCC	:	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 development is considered to be the top priority of economic and social development in Myanmar. In the scheme of the National Electricity Master Plan studied 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 them. Since deterioration of the power generation system for Sedawgyi HPP, Sedawgyi HPP, and other hydropower development projects are progressing, 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.

In Myanmar, there are 18 HPPs are of run-of-river type out of total 24 existing one, 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 capacity. The run-of-river type HPPs especially which started commercial operation 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.

On the other hand, overall poverty indicator of 27 % in 2010 (14% urban and 32 % in rural areas) is slightly above the national average of 26 %. This indicates that there is intra-regional imbalance of economic development. It is Mandalay Region that historically significant contribution to the national economy of Myanmar is made. It also attracts migrant workers mainly from China. Historically,

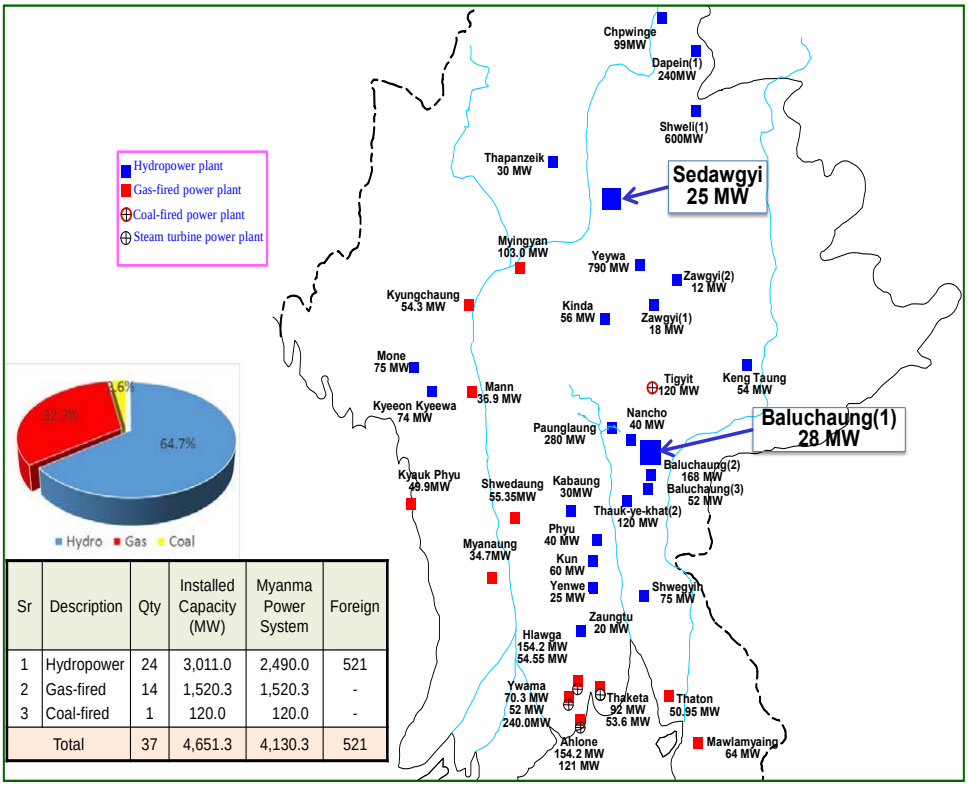
Mandalay Region has been playing an important role in as it has been in the center of political, economical and cultural interests. Thus, after Yangon, Mandalay Region maintains important economic center of the country.

It is this reason that the construction works of Sedawgyi HPP began in 1978 as multi-purpose dam for irrigation, which covers 46,939 ha of irrigation area and power generation of the installed capacity of 25 MW that it would contribute in terms of reducing the level of poverty and that Ministry of Agriculture, Livelihood and Irrigation has jurisdiction over the dam body and controls operation of the reservoir setting for appropriate water utilization.

Sedawgyi HPP began its operation in May 1989. 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. It is thus during the 2016 preparatory survey for which assessment of natural wear and tear including damages on Sedawgyi HPP was carried out and that it concluded that rehabilitation works has to be carried out on time.

1.2 Preparatory Survey on Hydropower Plants for Rehabilitation Works

The Preparatory Survey on Hydropower Plants Rehabilitation Works 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 Sedawgyi HPP and Sedawgyi HPP as one package of feasibility study. **Error! eference source not found.** shows the study area of Sedawgyi HPP and Sedawgyi HPP.



Sr	Description	Qty	Installed Capacity (MW)	Myanma Power System	Foreign
1	Hydropower	24	3,011.0	2,490.0	521
2	Gas-fired	14	1,520.3	1,520.3	-
3	Coal-fired	1	120.0	120.0	-
Total		37	4,651.3	4,130.3	521

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

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 Sedawgyi HPP and Sedawgyi HPP rehabilitation works for validation of the feasibility of project.

1.3 Outline of the Preparatory Survey for Rehabilitation Works

Table 1.1 shows the result of Preparatory Survey on Hydropower Plants Rehabilitation Works for Sedawgyi HPP. While rehabilitation works for "Sedawgyi HPP" in the table, it is separately dealt with. 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.

Sedawgyi Hydropower Plant (HPP) is located at the Chaungmagyi River, one of the tributaries of Ayeyarwady River. It is in Madaya Township of Mandalay Region, which is one of the most developed regions of Myanmar. Location of Sedawgyi HPP is some 130km to southeast of Mandalay city, which is one of the most developed urban centers in Myanmar.

It is Mandalay Region that historically significant contribution to the national economy of Myanmar is made. It also attracts migrant workers mainly from China. Historically, Mandalay Region has been playing an important role in as it has been in the center of political, economical and cultural interests. Thus, after Yangon, Mandalay Region maintains important economic center of the country.

On the other hand, overall poverty indicator of 27 % in 2010 (14% urban and 32 % in rural areas) is slightly above the national average of 26 %. This indicates that there is intra-regional imbalance of economic development.

It is this reason that the construction works of Sedawgyi HPP began in 1978 as multi-purpose dam for irrigation, which covers 46,939 ha of irrigation area and power generation of the installed capacity of 25 MW that it would contribute in terms of reducing the level of poverty and that Ministry of Agriculture, Livelihood and Irrigation has jurisdiction over the dam body and controls operation of the reservoir setting for appropriate water utilization.

On the other hand, the electricity generated by Sedawgyi HPP is transmitted to Belin Substation (S/S) by 132 kV transmission line (T/L), where it is located 60 km to east of Mandalay city and that electricity is distributed to Mandalay city and surrounding areas.

Sedawgyi HPP began its operation in May 1989. Since then, 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. It is thus during the 2016 survey for which assessment of natural wear and tear including damages on Sedawgyi HPP was carried out and that it concluded that rehabilitation works has to be carried out on time.

Table 1.1 Outline of the Study for Rehabilitation of Sedawgyi 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[*1]) EPGE (Electric Power Generation Enterprise, former HPGE[*2])	Correspondence to institutional reforms of MOEE Consideration for participation of MEPE[*3] 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 Organization

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 on 9th 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 for Rehabilitation Works

2.1 Objectives of the Project

In the scheme of the National Electricity Master Plan (NEMP), it is suggested that rehabilitation of hydropower plants in Myanmar is recommended from a broadly assessed viewpoints of preventive measures against failures caused by progressive deterioration of major equipment in general. One of the hydropower plants subject to rehabilitation is Sedawgyi HPP, which various parts of the existing Sedawgyi HPP are considered necessary in order to maintain efficiency of power generation in particular.

Rehabilitation of Sedawgyi HPP is considered as one of the highly significant measure from the viewpoints of maintaining good economic performance in Mandalay Region. 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 Sedawgyi 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 Mandalay Region in general.

2.2 Scope of the Project

The Project of Rehabilitation Works for Sedawgyi 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 Sedawgyi HPP, which has shown significant wear and tear over the past decades 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 DPGE 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 Sedawgyi 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 Operation of Hydropower Generation

There will be no change in conditions of operation for electric power generation such as power

generation capacity, pattern and schedule of operation.

e. Change in the Existing Internal Electric Generation Facilities, Equipment or Devices

The preliminary inspection and records of the failure of existing SedawgyiHPP 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 are expected to improve such equipment.

2.3 Outline of the Project Area

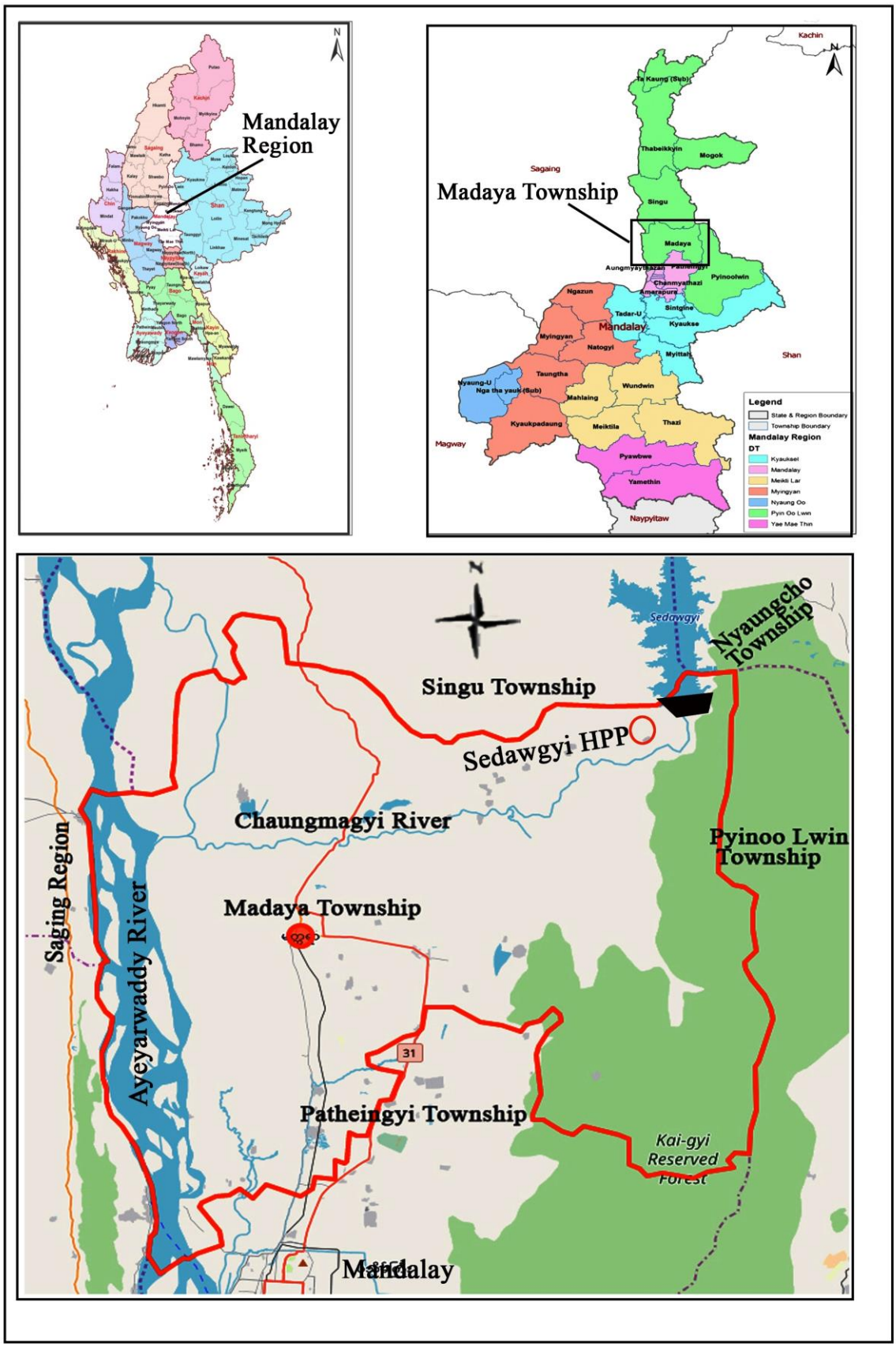
Sedawgyi HPP is located in Madaya Township, which is one of the 31 townships of Mandalay Region. Madaya Township covers an area of 1,178.4 sq.km and it is one of the townships irrigated by Sedawgyi Dam. Sedawgyi HPP is located on the Chaungmagyi River, which is one of the tributaries of the Ayeyarwady River flowing through Mandalay Region.

Sedawgyi HPP is a multi-purpose dam irrigating the area to the north of the city area of Manday on the left bank of Ayeyarwady River. Therefore, Ministry of Agriculture, Livelihood (MOALI) and Irrigation has jurisdiction over the dam body and controls water utilization i.e. MOALI operates the reservoir setting priority for the use of water in the reservoir. Maximum water level of the reservoir is 129.5 m and effective head is 28.2 m. The river water then flows through irrigation areas and drains into Ayeyarwady River to the west arround the altitude of 76 m above sea level.

Electricity generated by Sedawgyi HPP is transmitted to Belin Substation by 132 kV transmission line. It then connected to 230 kV bulk system for further distribution. Fig. 2.1 and

Source: EMP Study Team for the Project of Sedawgyi HPP Rehabilitation Works

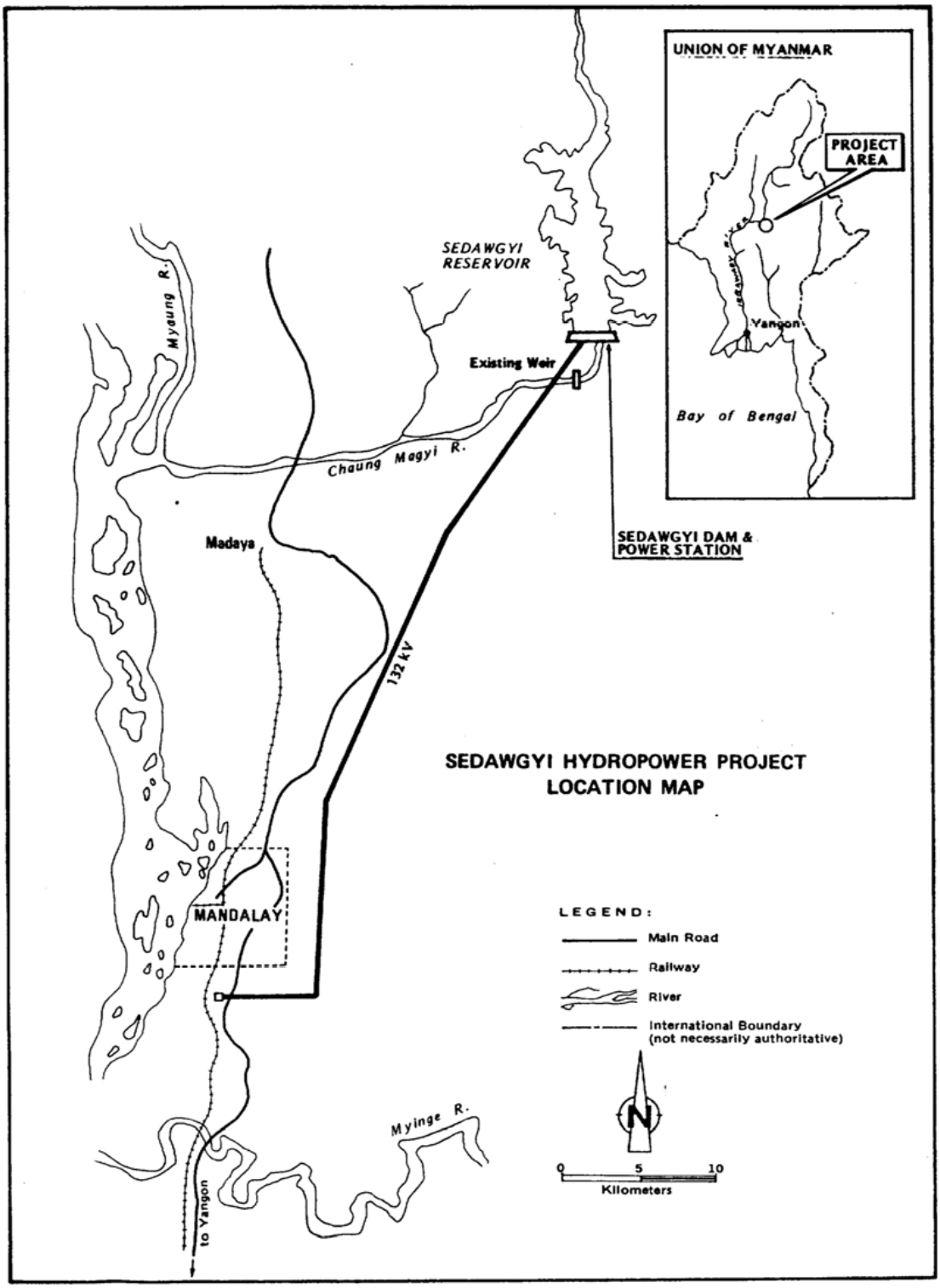
Fig. 2.3 shows the location of Madaya Town Ship and Sedawgyi HPP within Madaya Township respectively.



Source: https://reliefweb.int/map/myanmar/myanmar-district-map-mandalay-region-23-oct-2017

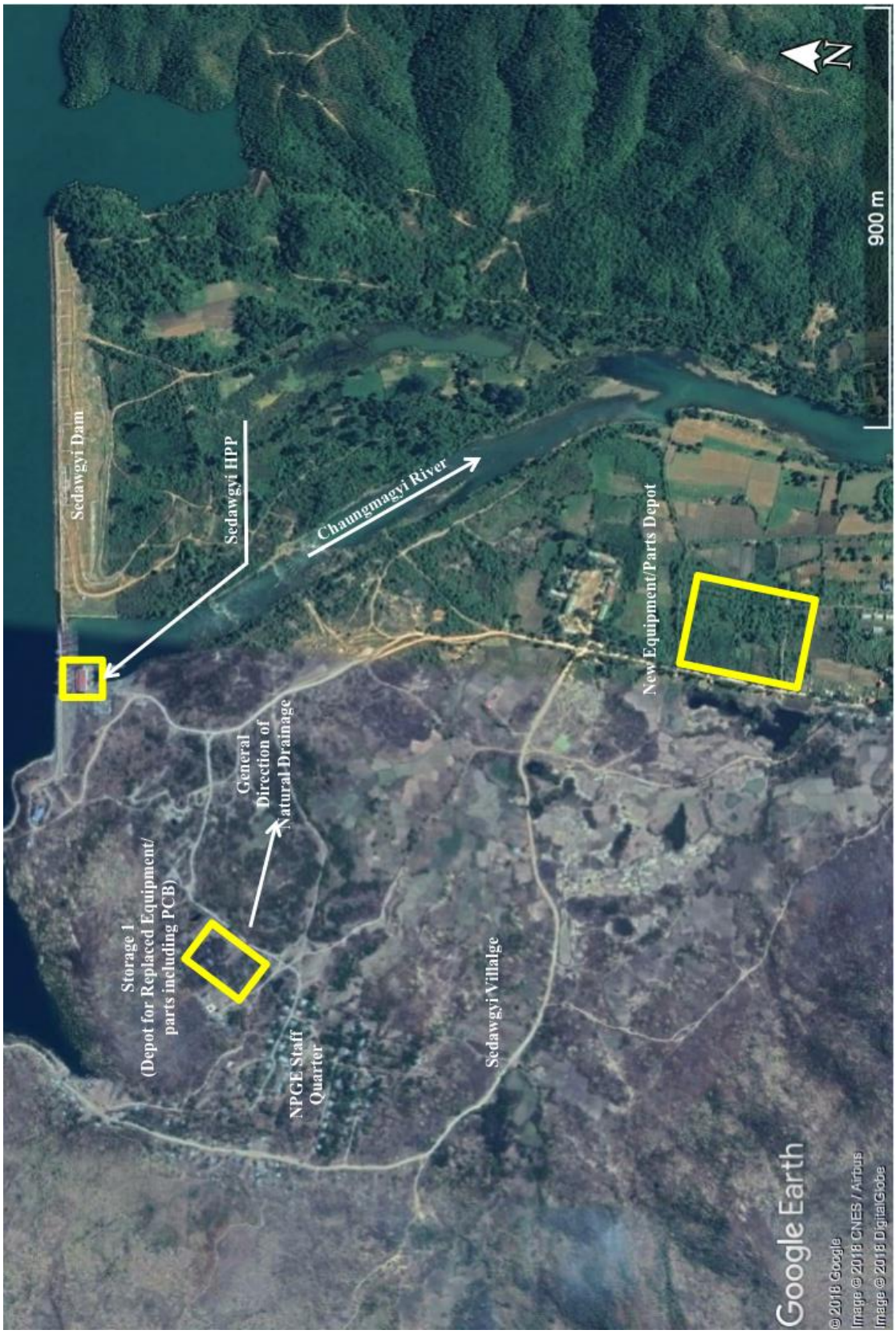
Fig. 2.1 Location Map of Madaya Township, Mandalay Region

As per the list, major electric equipment and other ancillary parts are subject replacement. No major construction works on any part of the dam, substation, or any other major structural works involving major earth moving operation is subject to implementation. Fig. 2.2 and Fig. 2.3 shows the location of Sedawgyi HPP including storage areas of replaced electro-mechanical parts. Fig. 2.4 shows actual project area that the rehabilitation works for the electric power generators and transformers of sub-stations as well as other electro- mechanical parts are replaced. Approximately 75 m x 77.5 m of sub-station portion and 55 m x 37.5 m of the powerhouse portion i.e. 7,875 m2 of land area is the area that the project activities take place.



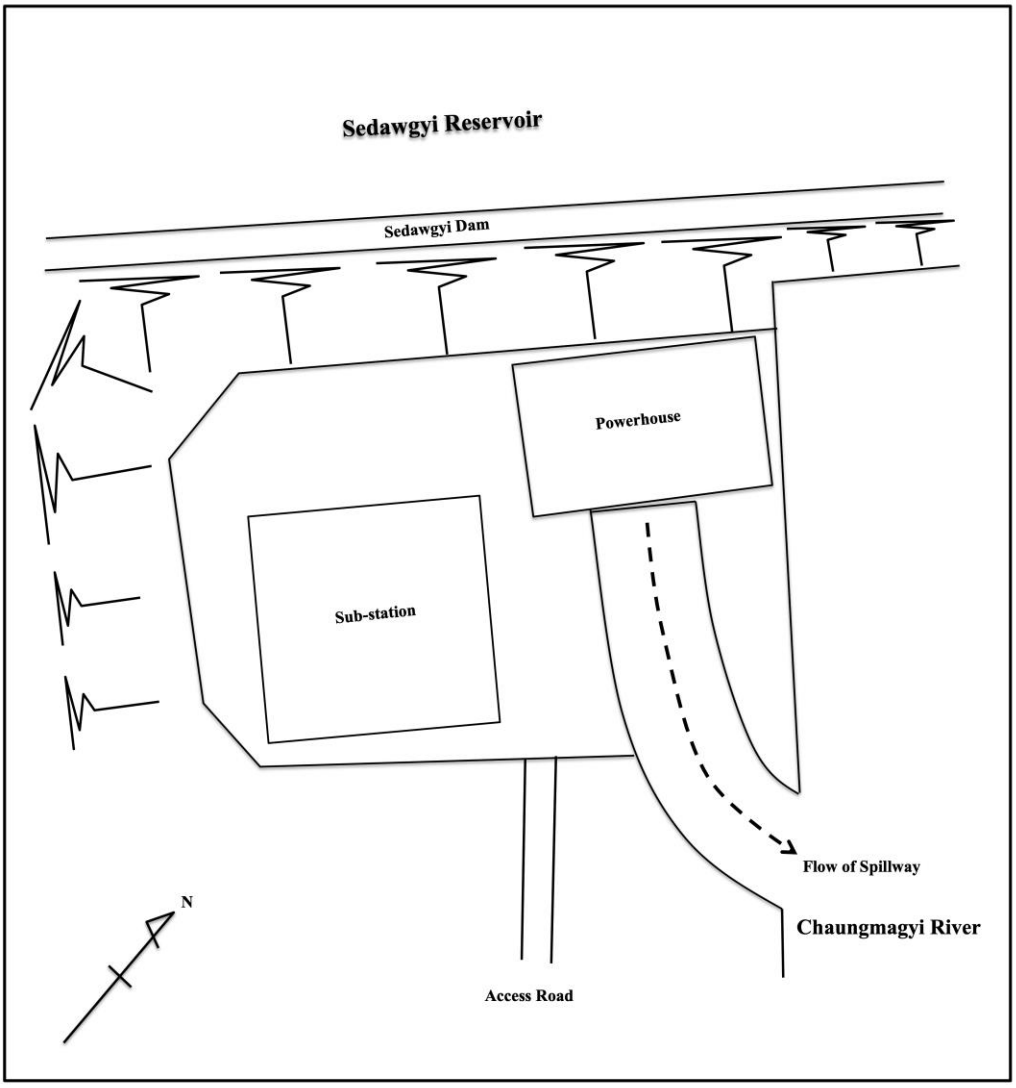
Source: JICA Study Team based on the Land Resources Department, Madaya Township

Fig. 2.2 Location Map of Sedawgyi HPP



Source: EMP Study Team for the Project of Sedawgyi HPP Rehabilitation Works

Fig. 2.3 Location Map of Sedawgyi Dam and the Areas Related to Rehabilitation Works



Source: EMP Study Team for the Project of Sedawgyi HPP Rehabilitation Works

Fig. 2.4 Project Area of the Sedawgyi HPP Rehabilitation Works

2.4 Salient Features of the Sedawgyi HPP

As described before, Sedawgyi HPP is located in the Chaunmagyi River of the Ayeyarwady River system. It is located approximately 60 km north by northeast of Mandalay and that it is hydropower plant attached to the multi-purpose dam that serves for irrigation area in Mandalay Region. Electric power generated by Sedawgyi HPP is transmitted to Belin substation by 132 kV transmission line, which then connected to 230 kV bulk system. Table 2.1 shows salient features of Sadawgyi HPP.

Table 2.1 Salient Features of Sedawgyi HPP

Dam	Rock-fill Dam, Height: 40.6m, Length: 1,255.8m
Catchment Area	3,384 km2 (Chaunmagyi River of Aheyarwady River System)
Max. Discharge	51.7 m3/Sec.
Effective Head	28.2 m
Reservoir Level	Max.: 129.5 m (AMSL) Full Reservoir Level: 127.9 m (AMSL) Min. Operation Level: 111.3m (AMSL)

Reservoir Area at Full Reservoir Level	28.7 km2
Installed Capacity	25 MW (12.5 MW x 2 No.)
Generator	Vertical Shaft, Rotating Field totally enclosed 3 phase, 50 Cycles A.C. Synchronous Generator-semi-umbrella Type
Type of Turbine	Vertical Shaft, Adjustable Blade Kaplan (2 No.)
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 line for 65 km long to Mandalay primary substation

Source: Project Completion Report of the Sedawgyi Hydropower Project, August 1989, ADB

2.5 Details of the Rehabilitation Works

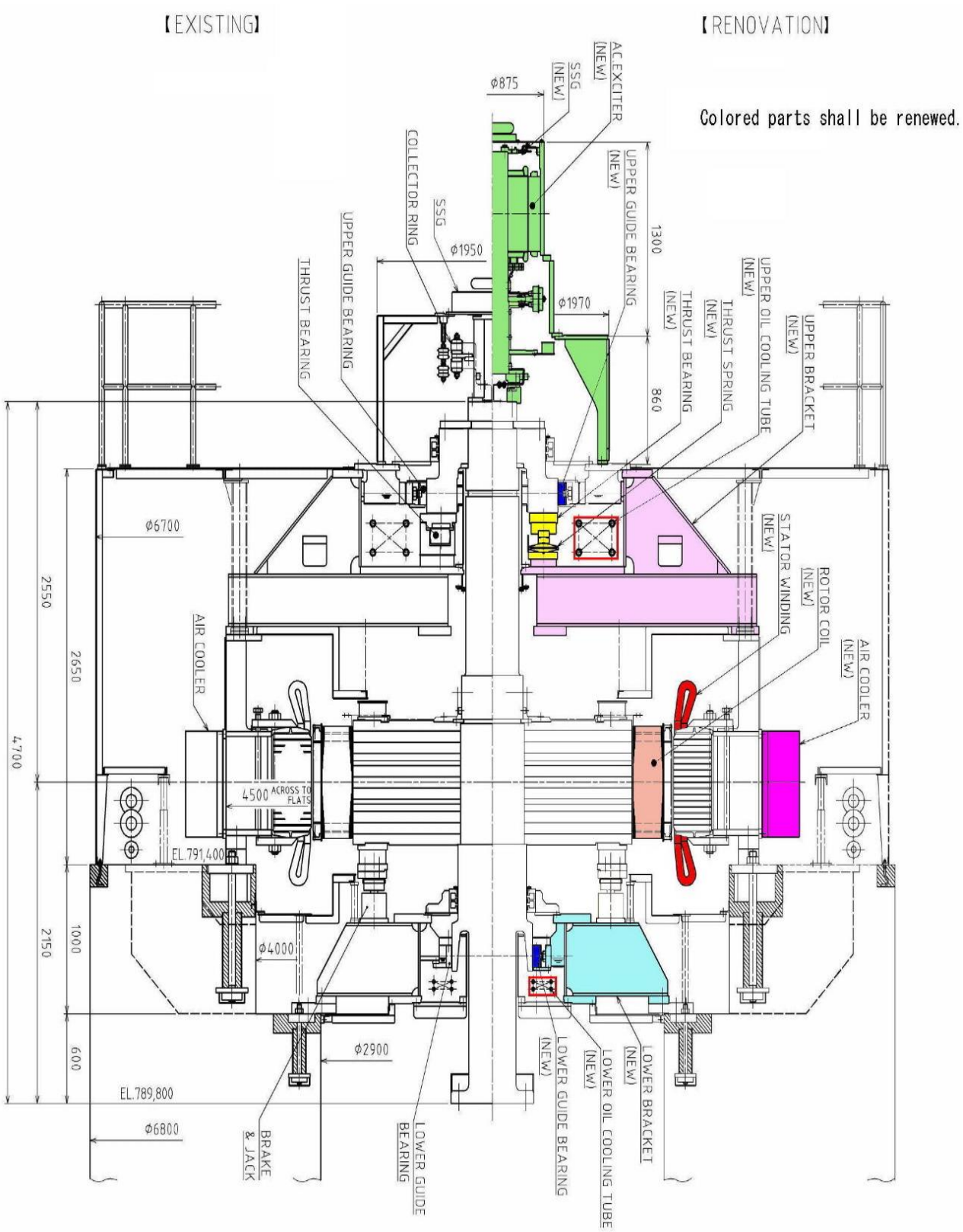
Detailed contents of the Project of Rehabilitation Works for the existing Sedawgyi HPP is shown in Table 2.2. Fig. 2.5 and Fig. 2.6 shows major parts of electric components subject to replacement.

Table 2.2 Summary of The Project Activities for Sedawgyi HPP 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 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.
and Protection	Total digital system（SCADA）	R	1 set	Updated to total digital system including SCADA function

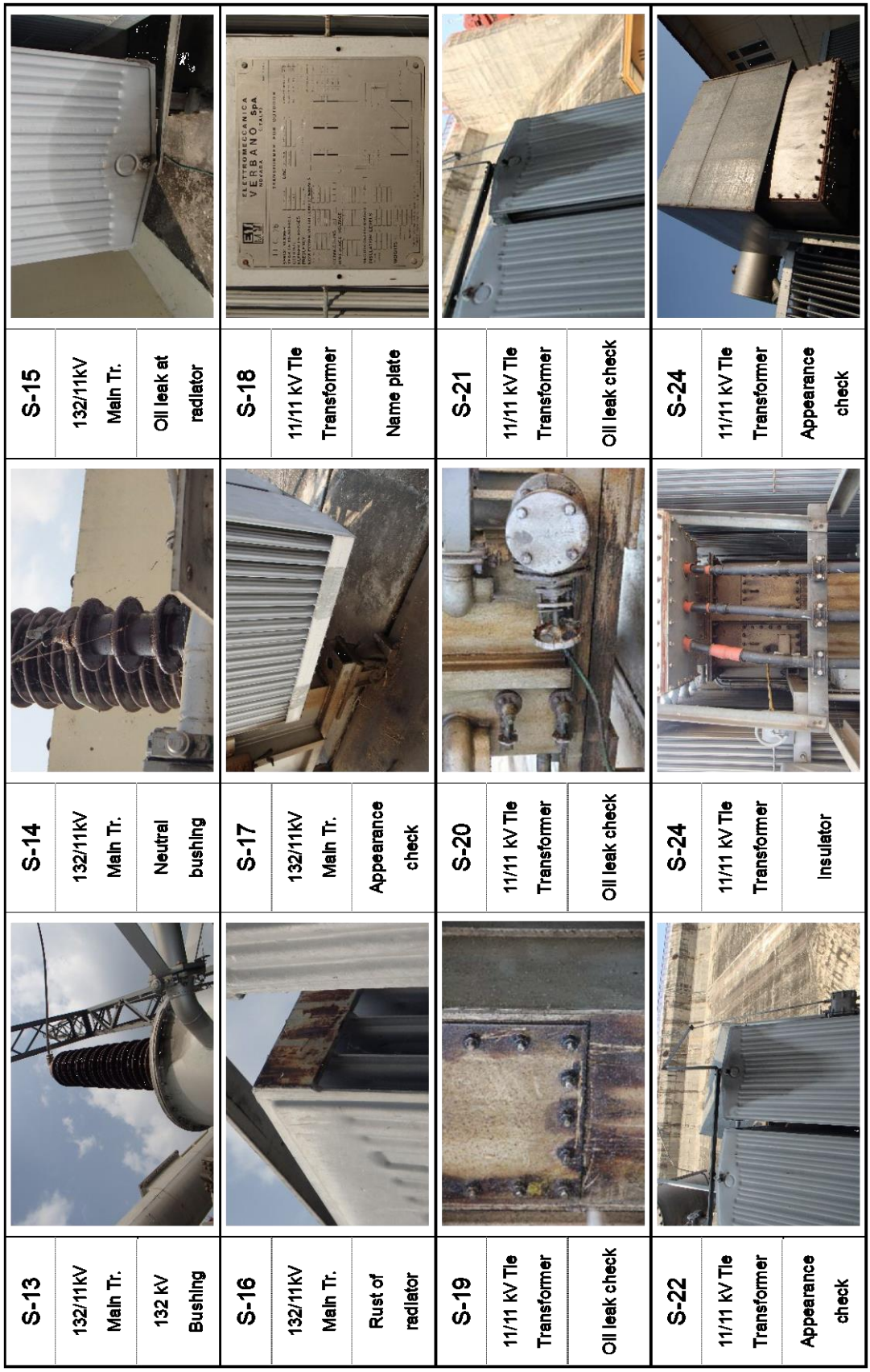
	Automatic Voltage Regulator	R	1 set	Updated to all-in-one protective control unit and exciter control panel
	Generator Vibration Monitor	R	1 set	Replaced with new components
	Control Cable	R	1 set	Replaced with new cables
	Ventilation System	R	1 set	3 air-intake units, 3 air-exhaust units (roof-mounted), 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
S/S 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



Source: Preparatory Survey on Hydropower Plants Rehabilitation Project, JICA Study Team, Nov. 2016

Fig. 2.5 Cross Section of the Electric Generator for Sedawgyi HPP Subject to Replacement



Source: Preparatory Survey on Hydropower Plants Rehabilitation Project, JICA Study Team, Nov. 2016

Fig. 2.6 Transformers Subject to Replacement for Sedawgyi HPP

2.6 Waste Generated by the Project Activities

There are a number of electro-mechanical parts removed from the operating system as well as the transformers subject to replacement. These transformers contain insulating oil of PCB, which is extracted from each unit and stored on site as follows:

1)	Transformer A:	7 Sets	Volume of Insulating Oil - 3,150kg/unit
2)	Transformer B:	2 Sets	Volume of Insulating Oil - 2,750kg/unit

In total, 27,550 kg of insulating oil extracted from transformers and contained into some 150 steel drums for storage of extended period. Transformers after the extraction of insulting oil should also be placed in the warehouse.

In order to prevent insulating oil, which contains PCB, rust of steel materials from contaminating soil and water, and third parties from entering into the warehouse, warehouse with walls and concrete bund would be constructed for storage purposes. Insulating oil that contains PCB is stored in "Storage 1" created as a depot for which replaced electro- mechanical parts and equipment of the operation system and other ancillary parts are storage areas as is previously shown in Fig. 2.3.

Further, details of the storage area including warehouses for storage of replaced equipment/ parts and steel drums containing PCB are shown in Fig. 2.7 to Fig. 2.9.

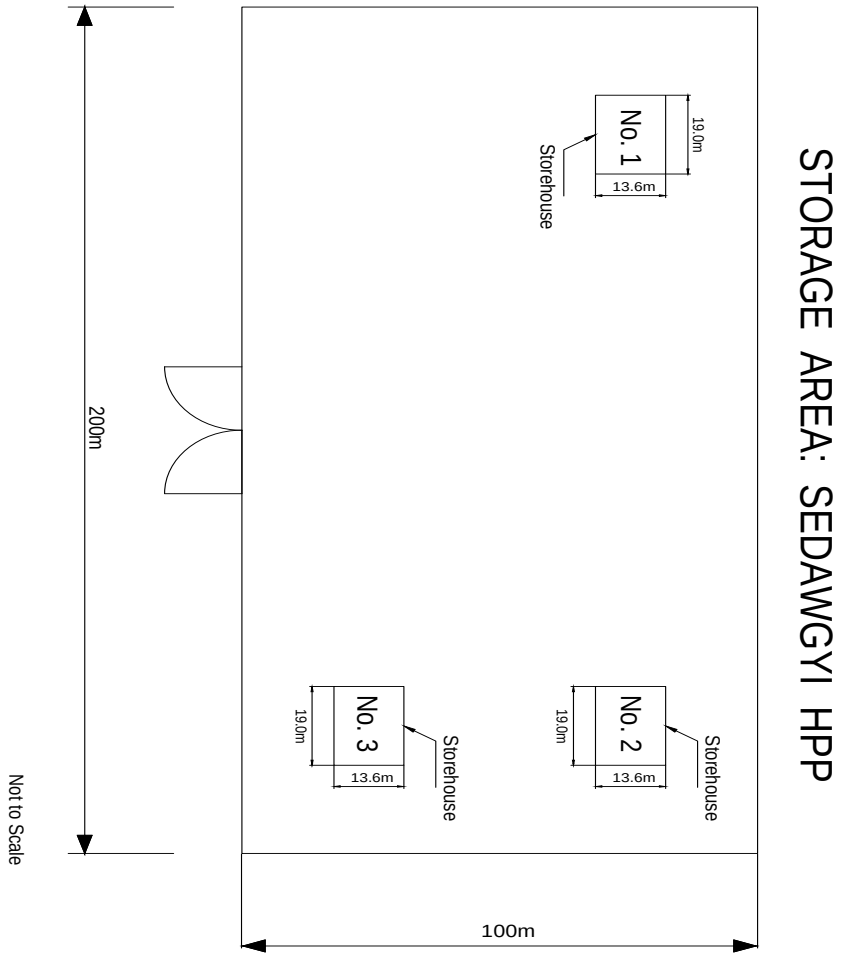


Fig. 2.7 Distribution of the Warehouses in the Storage Area

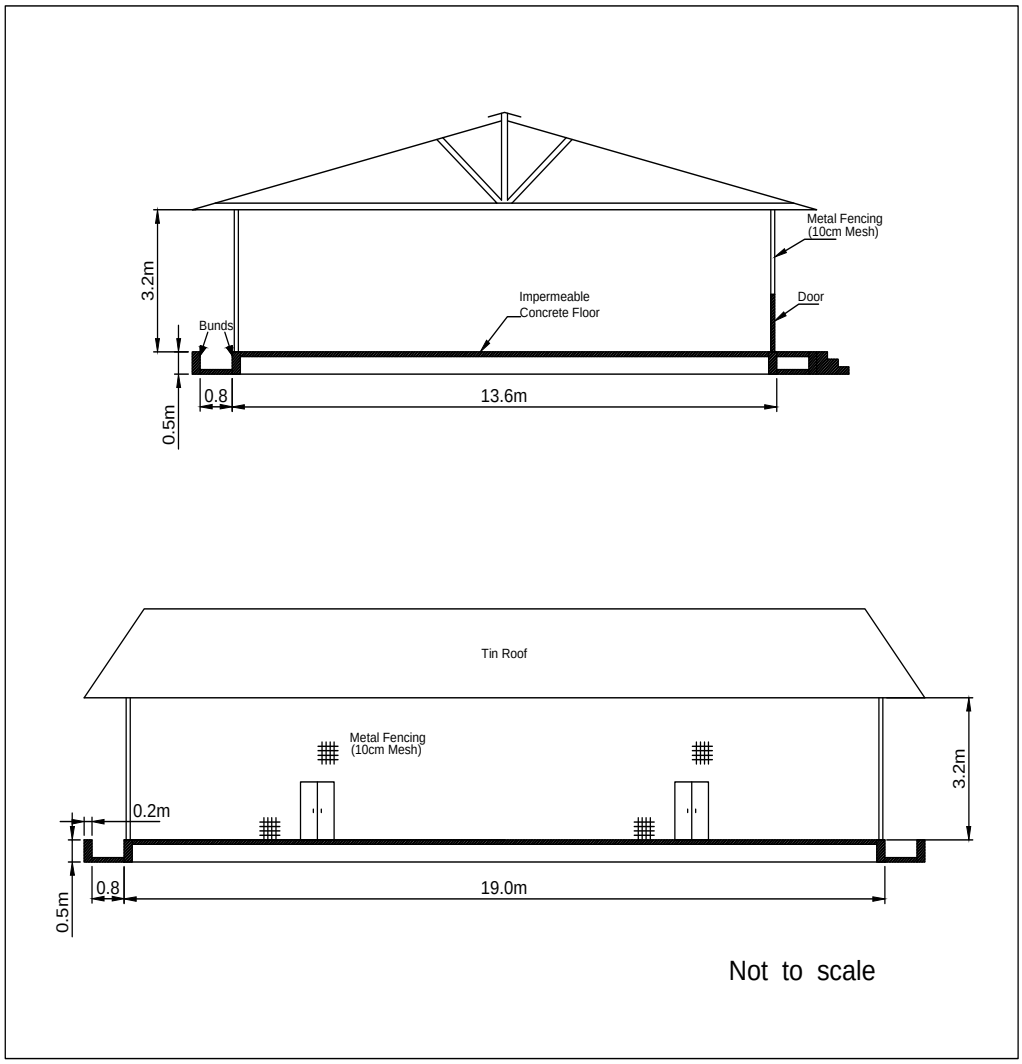


Fig. 2.8 Elevation of the Warehouse in the Storage Area

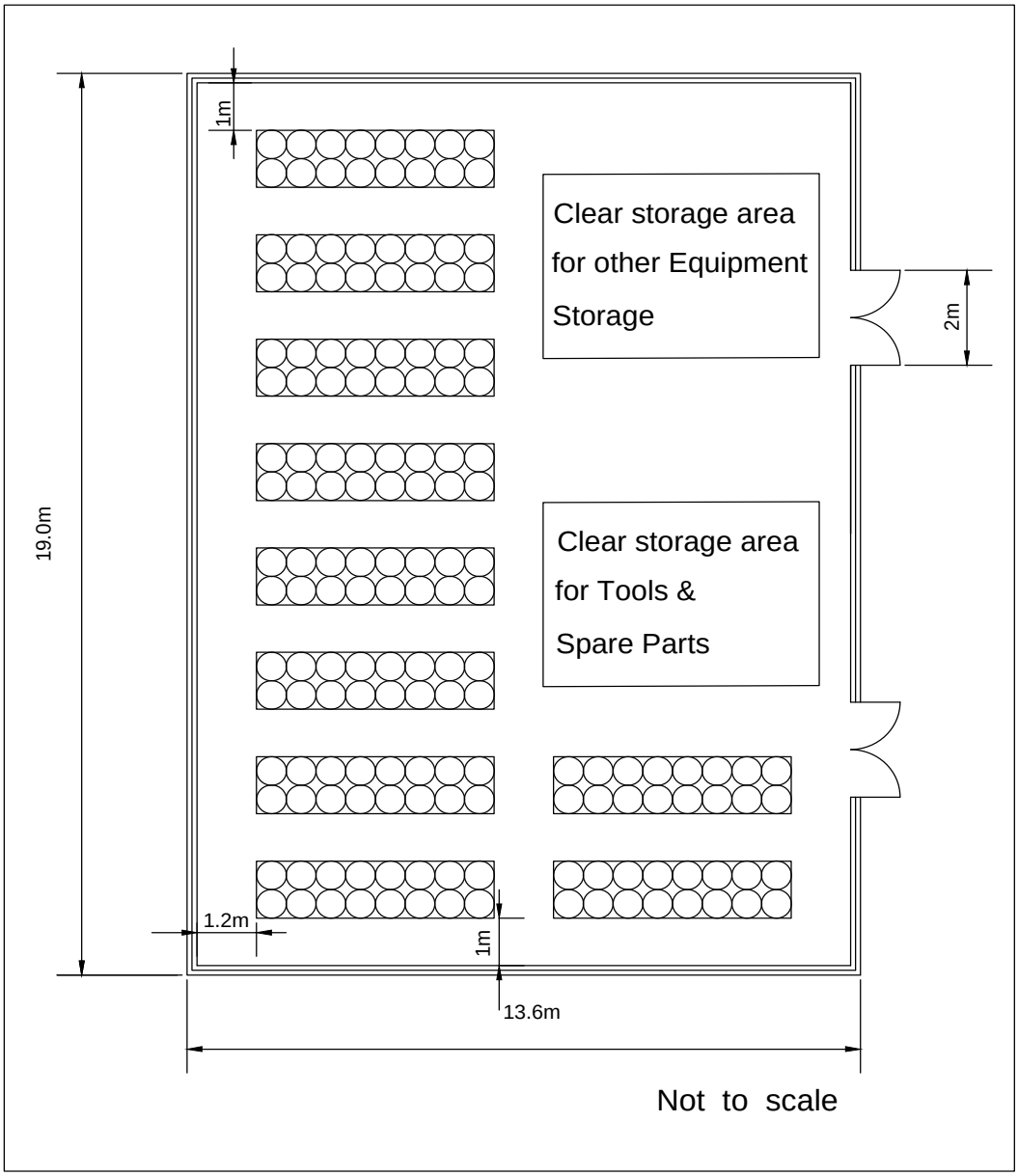


Fig. 2.9 Plan of the Warehouse for Steel Drums in the Storage Area

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. 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 are residents of villages in the local area and commute to Sedawgyi HPP daily for project implementation, there is no workforce camp created on site.

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. 2.10.

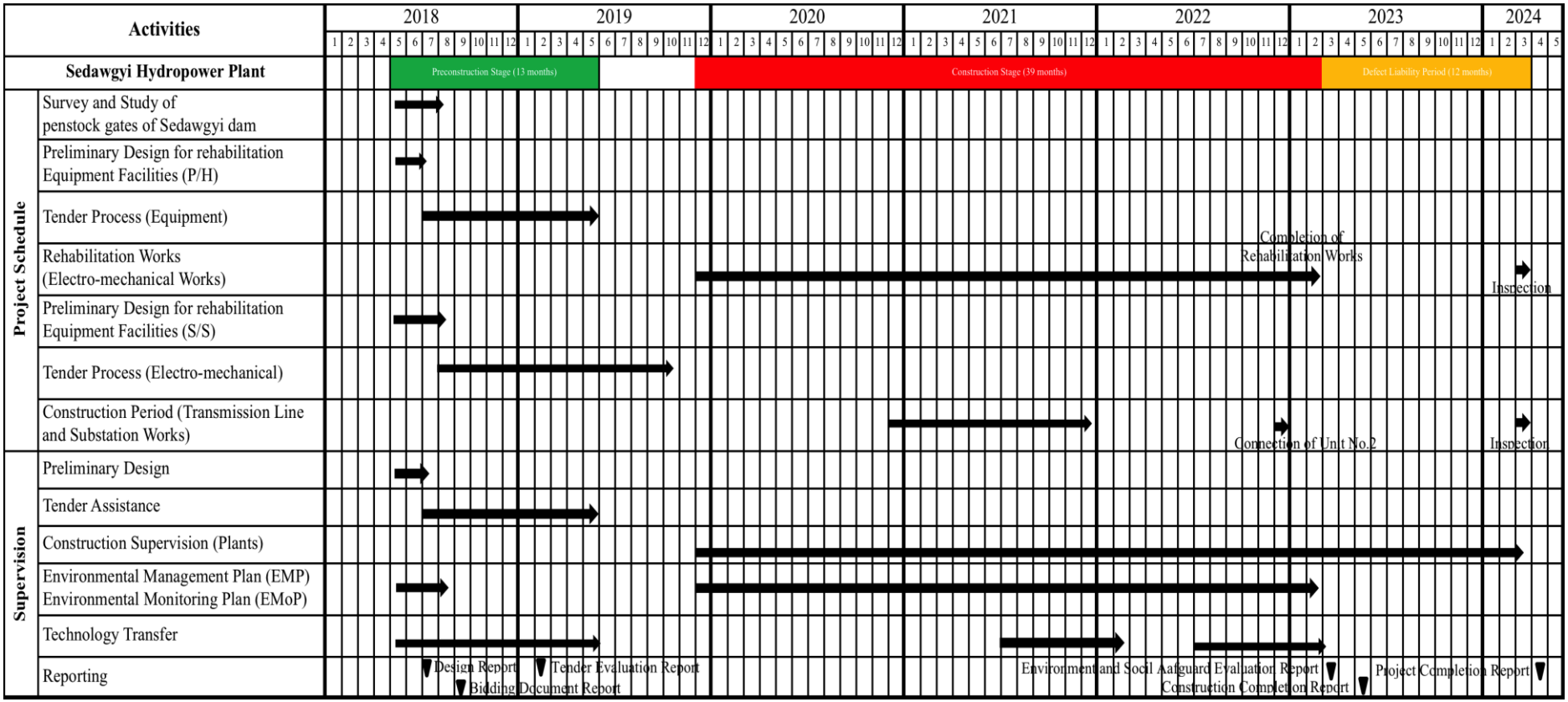


Fig. 2.10 Implementation Schedule of the Project for Sedawgyi HPP

3 Laws and Regulations Related to 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 Sedawgyi HPP in 1980s as well as the implementation of the Rehabilitation Works are shown in Table 3.1.

Within the framework of the Project for Rehabilitation Works of Sedawgyi HPP, where applicable, these laws are generally applied since the beginning of the project implementation of Sedawgyi 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**
Environmental Framework	
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)
Conservation/Forestry/Biodiversity	
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)
Water Environment	
16	The Underground Water Act (1930)
17	Irrigation Laws and Regulations (1982)
Cultural Heritage	
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

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 Sedawgyi HPP.

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.

The Chapter 7 of the Environmental Conservation 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).

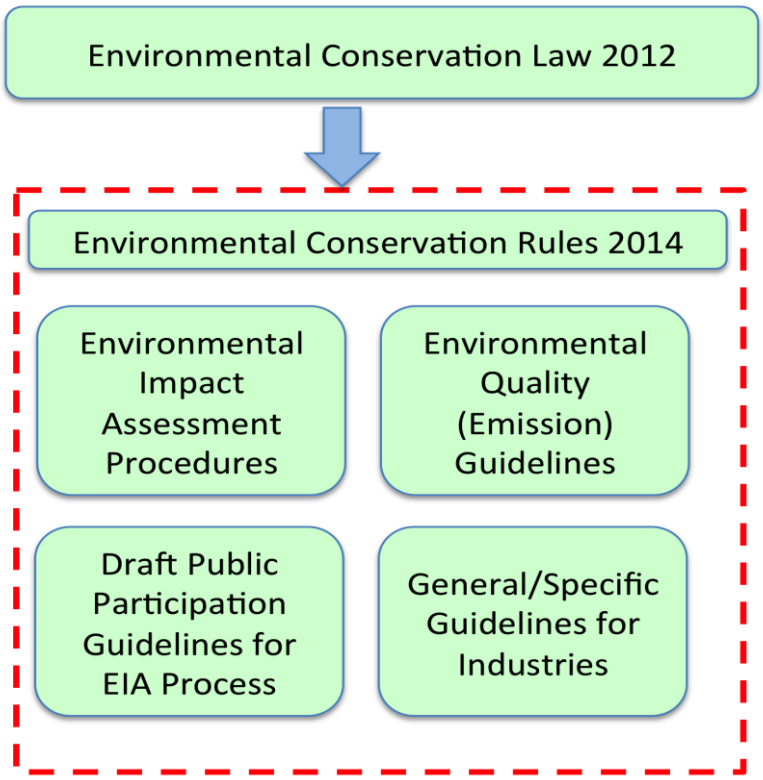


Fig. 3.1 Relevant Laws Related to Environmental Protection

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

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 de

partment, 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 Impact Assessment (EIA) Procedure, 2015

In December 2015 Environmental Assessment (EIA) Procedure was enacted by MONREC. Major statements stipulated are as follows:

(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 organizations.

i. EIA procedures describe types of categories of development intervention, 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, activities relating to schemes of hydropower development are shown and it is reproduced in Table 3.2.

Table 3.2 Categorization of Hydropower Development Schemes - Energy Sector

Type of Economic Activity	Type of Economic Activities that requires IEE	Type of Economic Activities that requires EIA
Hydro Power Plants	a) Installed capacity ≥ 1 MW but < 15 MW	a) Installed capacity ≥ 15 MW
	b) Reservoir volume (full supply level) <20,000,000 m^3	b) Reservoir volume (full supply level) ≥20,000,000 m^3
	c) Reservoir area (full supply level) < 400 ha	c) Reservoir area (full supply level) ≥ 400 ha
Electrical Power Transmission Lines (≥ 115 kV but < 230 kV)	≥ 50 km	All activities where the Ministry requires that the Project shall undergo EIA
Electrical Power Transmission Lines (≥ 230 kV)	All sizes	All activities where the Ministry requires that the Project shall undergo EIA
High Voltage (230 kV and 500 kV) Transformer Substations	≥ 4 ha	All activities where the Ministry requires that the Project shall undergo EIA

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 Law, the Rules, and other applicable laws.

(2) Chapter III - Screening

Section 23

a. 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.

b. The Ministry will send the Project Proposal to the Department to determine the need for environmental assessment.

c. 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:

i. EIA Type Project; or

ii. IEE Type Project; or

iii. Non IEE or EIA Type Project, and therefore not required to undertake any environmental assessment.

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

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 EMP by itself or may appoint a person or organization who/which is registered according to the Article 18.

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.

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.

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.

Section 80

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

i. approve the EMP, subject to any conditions it may prescribe, and issue an ECC; or

ii. require 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 disclose its decision.

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.

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 22nd 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's (IFC's) 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 tofurther 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 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 tofully 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

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.

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 km2 of land, representing 6.2% of the total land area of the country[1]. 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

[1] Myanmar Protected Areas 2011.

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:

- 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 Table 3.3.

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)

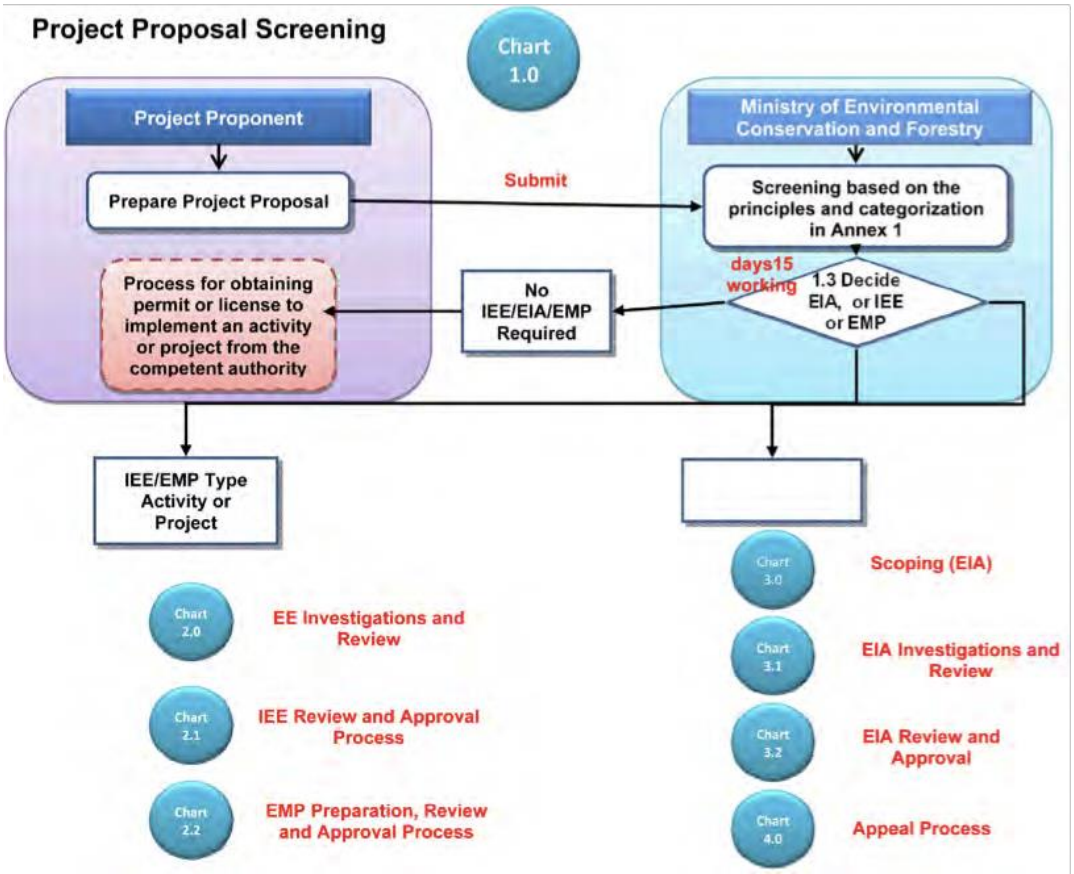
Source: The Republic of the Union of Myanmar, National Biodiversity Strategy and Action Plan (2011)**;** Basel Convention - http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/ tabid/4499/ Default.aspx) (As of May 2016)

3.1.13 Procedures of Environmental Assessment in Myanmar

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.

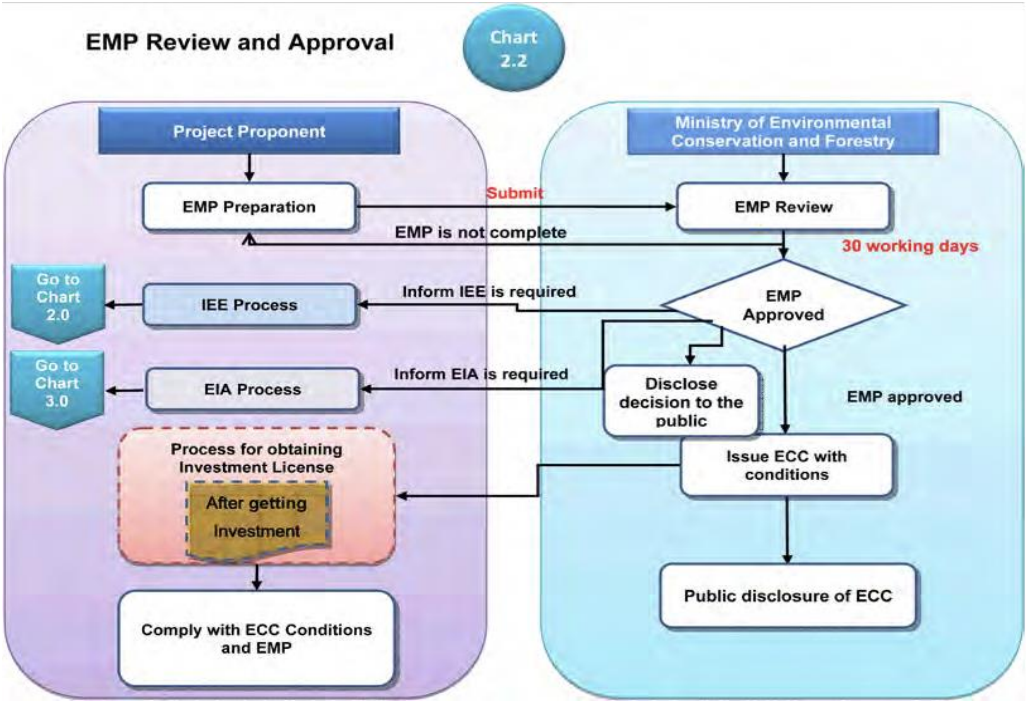
EIA includes an environmental management plan and a social impact assessment report. The Procedures may also include a clause for public participation in implementing the Initial Environmental Examination (IEE), EIA, and Environmental Management Plan (EMP), yet only if deemed necessary by the Ministry.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



Source: ICA Study Team Based on EIA Rules, MONREC

Fig. 3.2 Screening of Project Proposal



Source: ICA Study Team Based on EIA Rules, MONREC

Fig. 3.3 EMP Review and Approval

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.

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. Further, JICA's Guidelines for Environmental and Social Considerations, April 2010 is generally referred to from time to time.

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 standard 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 cost4 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

a. To protect cultural heritage from the adverse impacts of project activities and support its preservation; and

b. 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 III 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.

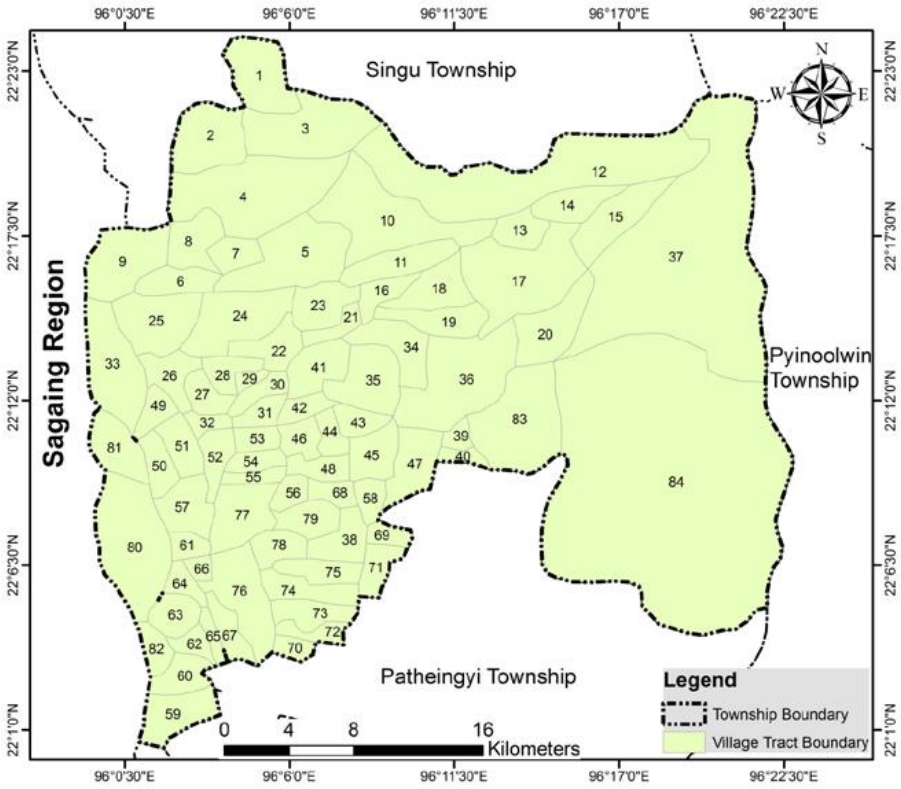
4 Existing Environmental Conditions of the Project Area

4.1 Socio-economic Environment

4.1.1 Administrative Division

Sedawgyi HPP is located in Madaya Township, which is one of the 31 townships of Mandalay Region. Madaya Township covers an area of 1,178.4 sq.km and it is one of the townships irrigated by Sedawgyi Dam. The irrigated areas are located at the northern part of Mandalay Region, comprising four Township of Madaya, Mandalay, Patheingyi, and Amarapura. Although Sedawgyi area is located in dry zone in Myanmar, it is an agriculturally well-developed area because of the irrigation development over fertile soils alluvial plain, which lies between the Shan Highland in the east and the Ayeyarwady River in the west at the altitude of 76 meters above sea level.

Madaya Township is bounded on the north by Singu Township, on the east by Pyin Oo Lwin Township, on the northeast by Naungcho Township, on the south by Patheingyi Township. Total length of land boundary is about 66 miles and water boundary is about 18 miles. Fig. 4.1 shows the location of Madaya Township and its Village Tracts. Name of villages and their corresponding location numbers are shown in Table 4.1



Source: General Administrative Department, Madaya Township 2015

Fig. 4.1 Village Boundaries of Madaya Township

Table 4.1 List of Villages of Madaya Township

No.	Village Name	No.	Village Name	No.	Village Name	No.	Village Name
1	Ea Mhat (1)	23	Kyaung Kone	45	Si Tine Kan	67	Shwe Chaung
2	Ea Mhat (2)	24	Seik Thar	46	Taung Kan	68	Thone Sal Pyay
3	Ea Mhat (3)	25	Tha Phan king	47	Htan Pin Kone	69	Sin Kyune
4	Ea Mhat (4)	26	Kwe Taw	48	Tha Min Twin	70	Nyaung Kone
5	Ea Mhat (5)	27	Taw Pu	49	Te Kone	71	Kywe Khan Kone
6	Pat Le Inn	28	Pan Ya	50	Byay Me	72	Suu Kar
7	Kauk Yoe Pone	29	Tha Yet Taw	51	Myit Kauk	73	Shwe Baung
8	Nyaung Oak	30	The Kaw	52	Shan Taw	74	Nan Taw Kyune
9	Mhwe Pone Kan	31	Thu Ye Zet	53	Wat Khe	75	Kone Tan Gyi
10	Kyauk Sayit Kone	32	Halin	54	Sat Seik	76	Khaung Pauk
11	Mhwe Hin Thar	33	Eu Dein	55	Wa Yin Doke	77	Pauk Wae
12	Sakyin	34	Kyauk Seyit Kone (Ta)	56	Kan Be	78	Hling Kyune
13	Mhwe Shwe Khe	35	Wun Su	57	Kyone	79	Linn Mhwe Chaung
14	Myay Zun	36	Po Wa	58	Thein Kone	80	Tha Yet Kan (Myauk)
15	Yay Nanthar	37	Wai Hin Ga Ma	59	Kan Ta Bat	81	Thalon Phyu
16	Tha Pyay Thar	38	The Kyune	60	Nge Toe	82	Tha Yet Kan (Taung)
17	Myit Kan	39	Yway Su	61	Hin Thar Kone	83	Taung Pyone
18	Gywe Pin	40	Lat Kaung Gyi	62	Shin Hla	84	Lone Taung
19	Sakyar Pin	41	Le Mine	63	Pyin Kar	85	Htee Taw Moe
20	Salay	42	Kyar Pin	64	Ouk King Taw	86	Ka Ping
21	Zee Phyu Kone	43	Yay Kyi	65	Eai Dai	87	Yadana Bumi
22	Upper Taung King	44	Kyar Ywar	66	Shwe Bo Gyi	88	Wa Thone Ya

Source: General Administrative Department, Madaya Township 2018

4.1.2 Demography of the Project Area

1) Population

There is only one urban area and 83 villages in Madaya Township. Population of Madaya Township is not evenly distributed as "Eastern Hilly" region of Madaya Township has a rugged terrain and therefore has sparse population. In the central area, where the land is flat and agriculture is the main economic activity, population density is relatively high. In the western lowland area, population density is comparatively moderate. Demography of Madaya Township in 2015 is shown in

Table 4.2. Total population is 234,782.

Table 4.2 Population of Madaya Township

No.	Area	No. of Houses	No. of Household	Population	No. of Ward	No. of Village Tract	No. of Villages
1	Urban	4,668	4,600	22,239	5	-	-
2	Rural	45,989	46,727	221,553	-	83	286
Total		50,657	51,015	243,792	5	83	286

Source: General Administrative Department, Madaya Township 2018

2) Workforce of Madaya Township

Since urban area of Madaya is 32 km away from Mandalay city, urbanization is taking place. Regarding to rural livelihoods, several business and cottage industries exist in Madaya Town, as well as in large villages, like Yae Nant Thar village. The rural people are also working as government staff in Madaya or Mandalay as is shown in Table 4.6. Because of irrigated agricultural area produces various crops and that Mandalay city is a good market, agricultural population is the largest, being 57.4% of the total workforce in Madaya Township followed by casual labor, services, and livestock rearing.

- ***Table 4.3 Workforce of Madaya Township***

No.	Type of Job	No. of Working Population
1	Government Staff	3,078
2	Services	18,088
3	Agriculture	112,998
4	Livestock	13,844
5	Trading	6,966
6	Small Industry	5,644
7	Casual Labor	32,142
8	Others	3,457
Total		196,217

Source: General Administrative Department, Madaya Township 2018

3) Ethnicity

In terms of ethnicity as is shown in

Table 4.4, majority of the population is Bamar. Total number of household is 51,015 and most people are living in the rural area as their percentage of the total population is 91.1% while 8.9% are in urban area of Madaya Township. The male and female ratio is 47.8% vs. 52.2% respectively.

Table 4.4 Ethnicity of Madaya Township

No.	Ethnic Group	Population	Percent of the Total Population
1	Kachin	5	0.002
2	Kayah	1	0.0004
3	Kayin	25	0.0103
4	Chin	18	0.0074
5	Mon	-	-
6	Bamar	243298	99.79
7	Rakhine	5	0.002
8	Shan	54	0.0223
9	Pao	-	-
10	Danu	-	-
11	Taung Yoe	-	-
12	Pa Laung	-	-
13	Foreigners	153	0.1046
14	Others	133	0.055
Grand Total		243792	100%

Source: General Administrative Department, Madaya Township 2018

4) Population by Religion

Population by religion as is shown in

Table 4.5 is that the Buddhist are the largest followed by Christians and Muslims.

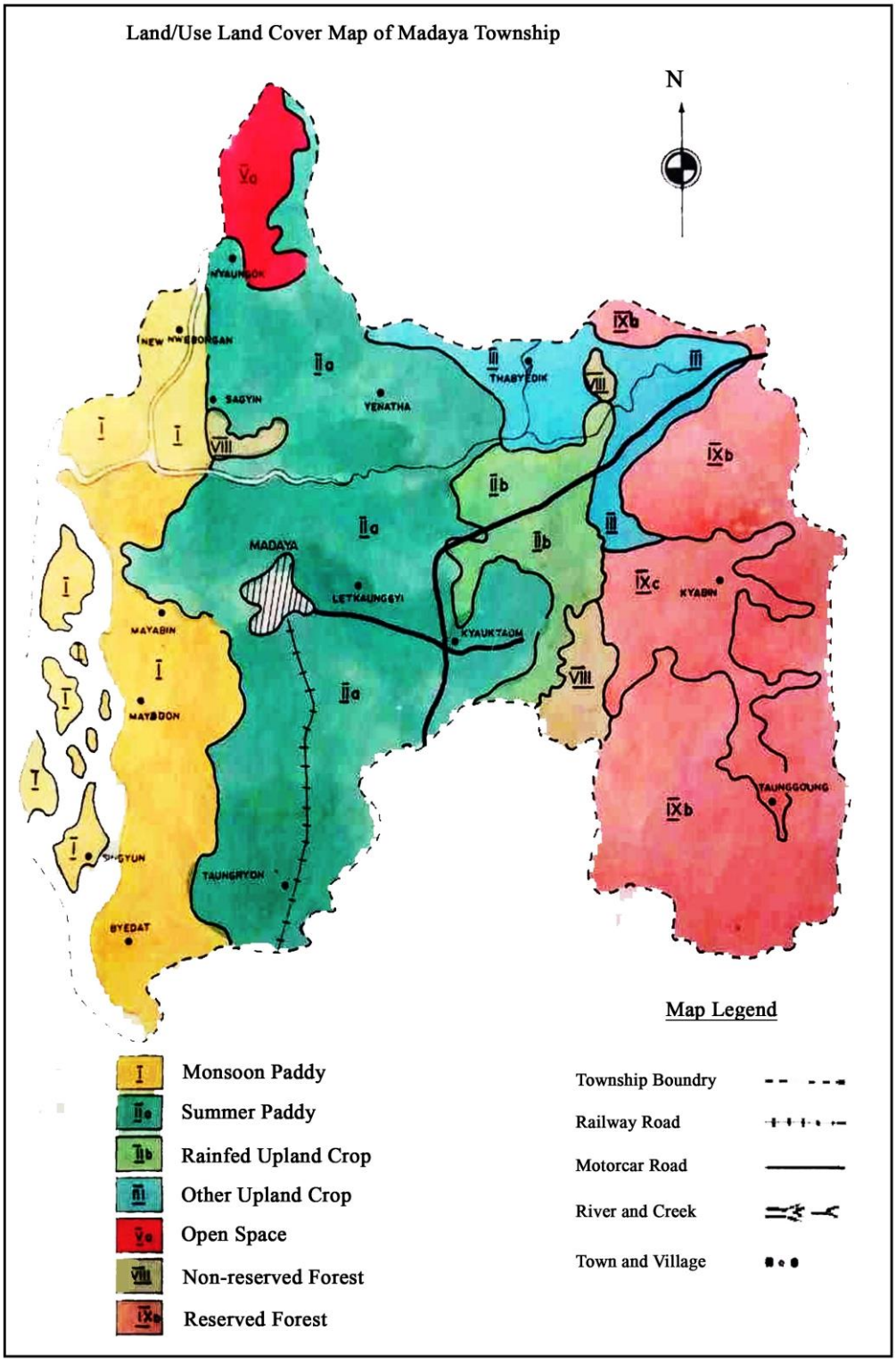
Table 4.5 Population by Religion in Madaya Township

No.	Township	Buddist	Christian	Hindu	Islam	Others	Total
1	Madaya	243,312	148	19	313	-	243,792

Source: General Administrative Department, Madaya Township 2018

4.1.3 Land Use

Fig. 4.2 shows land use patterns of Madaya Township. As is shown, the area toward west is lower flat area where agriculture is active while toward east hilly areas with forest are noticed.



Source: Department of Agricultural Land Management and Statistics

Fig. 4.2 Land Use of Madaya Township

Table 4.6 shows type of land utilization in Madaya Township. Among the total land area of 426,010 acre, cultivable lands are 134,823 acre (31.6%) and reserved and non-reserved forest are 38,812 acre (9.1%). Under the cultivate areas, Le (irrigated rice paddy), and Ya (rain-fed upland crop area) are 53,421 acre and 32,916 acre respectively. Alluvial soils are formed the bank of Ayeyarwady and Chaungmagyi River, totaling 45,283 acre.

of the cultivable lands Le lands area is the largest, followed by alluvial lands, which is suitable for rice, pulses and oil seed. Le lands is designated for paddy cultivation, possible for double cropping with irrigation system. Because of the large area of these productive lands, Madaya Township is famous for its large production of various crops. After rice, various pulses are widely grown and among them black gram, green gram and pigeon pea are the largest products of Madaya Township. Oil seeds such as sesame, peanut and sunflower are also grown after rice or as single crop in Ya land during post-monsoon season. Where the irrigation access is favorable, many farmers are practicing triple cropping system such as "Monsoon rice – pulses - summer rice" cropping patters.

Table 4.6 Land Use of Madaya Township

No.	Particular	Area (acre)
1	Cultivated Land	137,565
	Le	53,423
	Ya	35,656
	Alluvial	45,283
	Orchard	3,203
2	Fallow Land	12
3	Habitat	636
4	Industrial	432
5	City	544
6	Village	6,608
7	Other	52,380
8	Reserve/ Non Reserve Land	38,806
9	Wild forest	12,281
10	Uncultivated Land	41,923

Source: General Administrative Department, Madaya Township 2018

Note: *Le* (irrigated rice paddy); and *Ya* (rain-fed upland crops)

4.1.4 Utilization of Forest Resources

Villages in Maday Township are interested in growing trees as well as the forest conservation activities. For example, Gwe Pin village has their own conserved forest of about 200 acre. Most villagers are actively participated in the village tree growing programs supported by the forest department.

In several villages, most houses have Tha-na-kha tree (Chinese box tree: *Limonia acidssima;*

Family: *Rutaceae*) functioning as fencing of their homestead. These trees can be sold at a good price and many villages keep their tradition of growing these trees for cash income.

In the township as a whole, teak and other hardwoods are produced annually. Energy for cooking of the low-income households is entirely by fuel wood while relatively well-off families use charcoal.

Various forest products of Madaya Township in 2017-2018 are recorded in Table 4.7 and
Table 4.8 Bat guano are widely used as natural fertilizers for agriculture while bamboo, tree barks and thatching materials are also obtained from the forest area.

Table 4.7 Timber Production of Madaya Township in 2018

No.	Species	Production (Ton)	
		Government	Private
1	Teak		64.7814
2	Teak Plank		19.715
3	Hard Wood		4.5558
4	Hard Wood Plank		28.723
5	Other		9.8764
6	Other Plank		21.015
Total			148.6666

Source: Department of Forest, Madaya Township, 2018

Table 4.8 Use of Timber Production of Madaya Township in 2017-2018

No.	Particular	Unit	Production
1	Fuel Wood	Cubie Feet	1803.3696
2	Charcol	Cubie Feet	35.36
3	Bamboo	Number	863.35
4	Cane	Number	
5	Catechu	Viss	
6	Barks	Viss	8000
7	Orchid	Viss	
8	Thanet Khar	Viss	
9	Honey	Viss	
10	Bat Guano	Viss	23400
11	Thatch/ Roofing	Unit	45

Source: Department of Forest, Madaya Township, 2018
Note: *Viss -Myanmar weighing unit i.e. 1kg = 0.6 Viss.<

4.1.5 Livestock Rearing and Freshwater Fishery

The number of buffalo, cow, pig and other domestic animals rearing in Madaya Township are listed in Table 4.9. Rural households are traditionally familiar with breeding of cattle or small livestock. They are maintained for extra cash income, or occasional home consumption. These domestic

animals are kept in conjunction with agricultural activities at most of the families in Madaya Township.

Table 4.9 Number of Livestock in Madaya Township in 2018

No.	Year	Buffalo	Cow	Pig	Goat	Chicken	Duck	Quail
1	2015 – 2016	2,768	77,910	29,731	2,921	445,567	49,768	12,000
2	2016 – 2017	1,292	63,456	10,355	3,900	531,917	6,735	12,200
3	2017 – 2018	1,287	63,665	10,06	4,131	544,030	7,390	18,000

Source: Department of Agriculture, Madaya Township, 2018

The status of fish breeding is recorded in Table 4.10. There are two types of freshwater fishery 1) fish breeding in artificial ponds; and 2) fish catching in natural ponds. Number of artificial ponds are 2,640 in the Year 2014-15 period in Madaya Township while fishing in natural pond under fishing license is 51.

Table 4.10 Fish Breeding Status in Madaya Township in 2018

No.	Year	Fish Breeding			Fish Catch from Natural Pond		
		No. of Pond	Area (acre)	Production Viss	No. of License	No. of Business	Production Viss
1	2016 - 2017	2,695	5268.36	6,618	51	51	9,248.4
2	2017 - 2018	2,688	5261.48	6,611	51	51	9,248.4

Source: Department of Agriculture, Madaya Township, 2018
Note: 1kg = 0.65 Viss

In Myanmar there are two types of fishing rights: 1) one is "Fishing Grant", whose license is valid for specified river area; and 2) the another is "License", which is a permit of fishing in general. In the project area there is no commercial scale fishing resources such as lakes and rivers. Thus, nofishing grant is established. Fishing activities, aquaculture of various fish species observed in a small scale and mostly applying traditional fishing methods in the ponds and rivers.

4.1.6 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, nofishing grant is established. No known water rights and rights of commons are not identified in the Project area.

4.1.7 Social Services

(1) Electricity Supply

In many villages, no transformer for distribution of electricity is installed for the local supply of electricity. Depending on the locations, local communities cannot afford a transformer. In case villages are far from the national grid, price of cables is also not affordable. Thus at present

electricity is obtained from private engine at night for 3-4 hours at various location of Madaya Township.

(2) Water Supply and Sewage System

Villages in Madaya Township generally have good access of irrigation water. Majority of rice fields are irrigated in this township. Some areas can grow only summer rice where irrigation water is not distributed to the location where ground level is higher than the irrigation canal.

Majority of local households use irrigation water for drinking. Other villages where not irrigation water is used for drinking, underground water extracted from shallow tube wells. However, villagers prefer irrigation water for drinking to the groundwater, as the quality of canal water is more tasty and purer for drinking.

In Madaya Township, modern sewerage service is not available. Each household is equipped in-situ disposal systems such as septic tank and pit latrine. The existing legislation does not adequately address issues of health care management and sanitation in relation to sewage system.

(3) Educational Services

The social services such as educational, health, public facilities and religious facilities are shown in Table 4.11. Both statistics indicates that they are extremely poor in terms of quantity.

Table 4.11 Educational Facilities in Madaya Township in 2018

No.	Type of Educational Facility	Quantity	No. of Teachers	No. of Students	Ratio
1	High Schools	13	452	12,825	1:28
2	Middle Schools	27	357	10,295	1:28
3	Primary Schools	165	1,080	18,810	1:17
4	Pre-school/Kinder Garden	11	11	170	1:15
5	Monastic Schools	12	71	1,833	1:16

Source: General Administrative Department, Madaya Township 2018

(4) Public Health

Coordination and supervision of medical wastes at all levels in the country is not clearly developed and needs further strengthening while a National Action Plan should be implemented to manage practices at all levels in an integrated health care system.

Health facilities in Maday Township are shown in Table 4.13 and common diseases recorded in Madaya Township are shown in Table 4.12. Diarrhea is the highest cases followed by Malaria cases. Seventeen cases of HIV/AIDS cases were recorded.

Table 4.12 Common Diseases in Madaya Township in 2018

No.	Disease	Case
1	Malaria	177
2	Diarrhea	2,489
3	Tuberculosis	213
4	Dysentery	947

5	Liver Disease	9
6	HIV/AIDS	15

Source: General Administrative Department, Madaya Township 2018

Table 4.13 Health Facilities in Madaya Township in 2018

No.	Hospital	Quantity	Gov / Private	No. of bed
1	Leproscy Hospital	1	Government	200
2	Township General Hospital	1	Government	50
3	Mhwe Station Hospital	1	Government	16
4	Tha Hpan Dauk Hospital	1	Government	16
5	Eu Mhin Station Hospital	1	Government	16
6	Taung Yar Gyi Station Hospital	1	Government	16
7	Sedaw Station Hospital	1	Government	16
8	Dr. Than Oo (Chit Oo Mon)	1	Private	16
Total		8		346

Source: General Administrative Department, Madaya Township 2018

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

Sedawgyi 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 issued with minimal 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 in the remote area in Madaya, the urban center of Madaya Township.

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

In Madaya Township, most residents are Buddhists, and thus a large number of pagodas and monasteries exist as is indicated in Table 4.14. Total number of monks is recorded at 1,528 while the numbers of novice monks and nun are 766 and 118 respectively. One church and one mosque also exist in the urban area of Maday Township.

Besides the pagodas and monasteries, there are two significant cultural, historical and religious sites in the Township. One of the famous pagodas is Yet-kan-sin-taung Pagoda situated in Pat Le Inn village in Madaya Township. Another famous pagoda is Ku-tho-daw Pagoda located in Taung Byone village built by King Anawrehta in 11th century. Every year in August a 7-day festival is held to celebrate and worship Buddhist spirits. The festival is called “Taungbyone Pwe” and it is famous nationwide.

Table 4.14 Number of Religious Facilities in Madaya Township in 2018

No.	Particular	Number
1	Pagoda	1570
2	Temple	360
3	Monastery	412
4	Dha-ma-yone	140
5	Nun monastery	11
6	Church	1
7	Mosque	1

Source: General Administrative Department, Madaya Township 2018

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 a few acreage of crop lands. Many are relocated from the dam site, or from the old village damaged by river-bank erosion.

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.

4.1.15 Traffic Accidents

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

4.2 Natural Environment

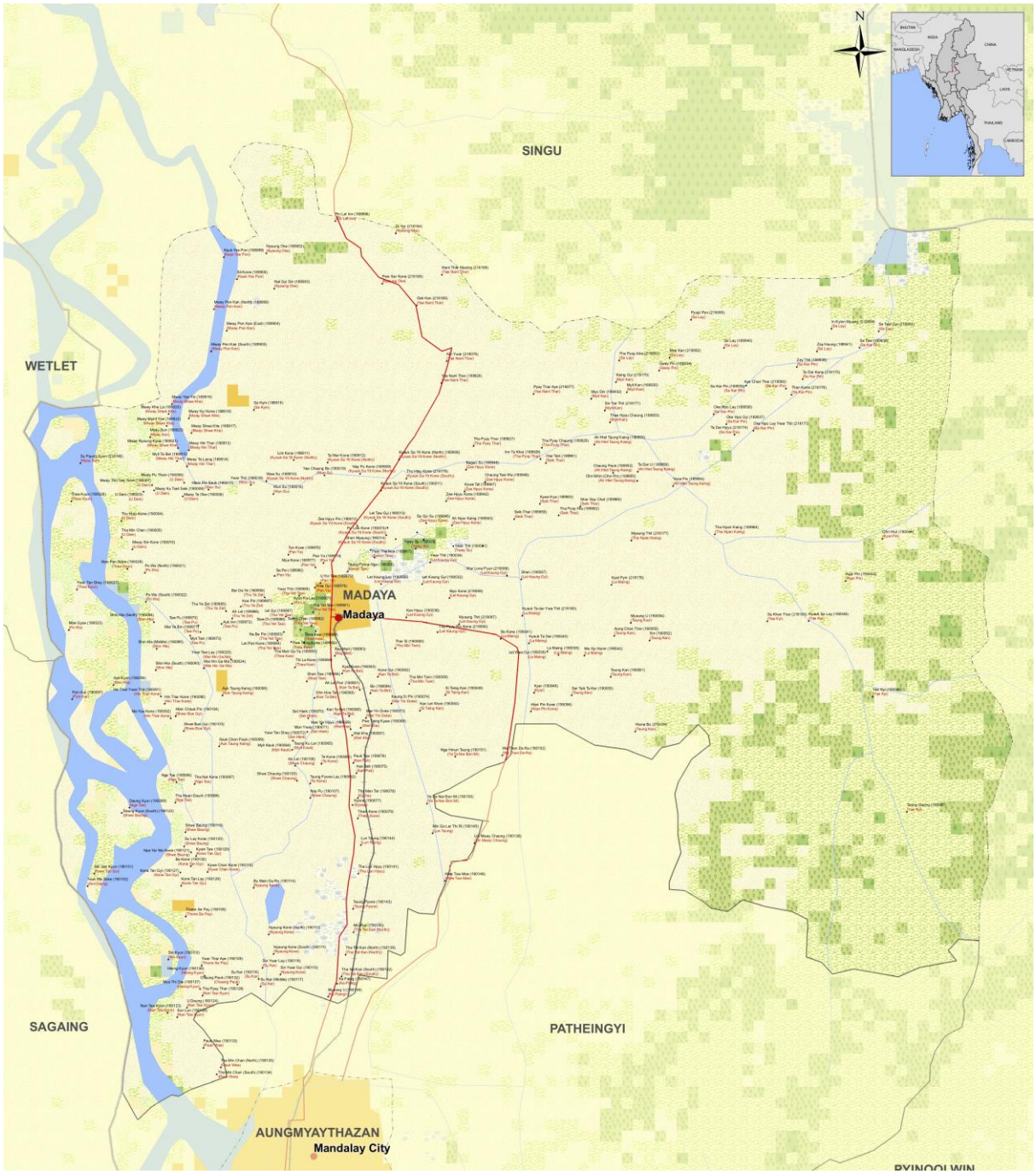
4.2.1 Topography

The mountains and hill ranges, river valley and plain mark topography of Madaya Township. It is about 76 m above sea level and the most area lies within the flood plain of the Ayeyarwady River and Chaungmagyi River. Ayeyarwady River flows in the west of township forming the western boundary of township. Chaungmagyi River passes through the Township, flowing from northeast to west, and then entering into the Ayeyarwady River. The River that originates from the Eastern Highlands passes through the Sedawgyi area. It enters the township at its northeast corner and it flows southward and that it forms as boundary between alluvial plain and Shan Highland. It is a perennial stream and navigable by boats in rainy season. Fig. 4.3 shows topographical features of Madaya Township.

Generally, the study area is an alluvial plain, which consist of deposition of Ayeyarwady River and Chaungmagyi River. Topographically, the township can be divided into the "Western Plain" and the "Eastern Highland". The "Western Plain" has an area of 945 km^2 and occupies 80 % of the total area of the Township. This plain is sub-divided into three parts, namely "Recent Alluvial Plain", "Old Alluvial Plain" and "Foothill Alluvial Plain". The "Eastern Highland" is the western continuation of Shan Plateau and it covers about 233 km2 between the contour line of 150 m and 600 m. It rises gradually eastward and composed of limestone, forming the watershed for Chaungmagyi and Shwelaung River.

Ayeyarwady River flows from north to south about 26 km as the western water boundary of the township. The river forms rich alluvial deposits every year on the eastern bank, and its alluvial plain is the most important for the local method of "Kaing" cultivation. However, its deposition is not useful for irrigation in the study area.

Chaungmagyi River, about 37 km, takes its source from the Shan Plateau. It is this area that Sedawgyi Dam was built at upper Chaungmagyi near Sedawgyi village, which is an important source for the irrigation networks of Madaya Township.



Source: Myanmar Information Management Unit, 2016

Fig. 4.3 Topographical Map of Madaya Township

Sedawgyi Dam was constructed in 1976 and completed in 1987, across the Chaungmagyi River for multi-purposes of irrigation and hydropower generation. It stands as one of the vital water resources for crop cultivation in Mandalay Region. Yaenantthar Irrigation Canal of 21 km long was constructed on the right bank of the Chaungmagyi River. During 1985-86 the total irrigated area of the region was 268,471 acres and it was increased to 278,087 acres in 1999-2000.

Historically, in 1875, King Mindon built Shwetachaung and Shwelaung canals. Then a weir was built across the Chaungmagyi River with stones to create catchment area of about 3,425 km2. In 1902, for backing of the reservoir that has been supplying water to Mandalay canal system, a stone, or rock-fill dam was built at the former site of weir.

4.2.2 Geology and Soil Conditions

There are two groups of rock units found in Madaya Township: 1) sedimentary rock units; and 2) metamorphic rock units. Alluvium deposits are widely distributed in the western part of Maday Township and it also covers the areas near Chaungmagyi River and its tributaries. Main soil types of Madaya Township can be grouped into the following:

a. Alluvial Soil
b. Meadow and Meadow Alluvial Soil
c. Dark Compact Savanna Soil
d. Dark Compact Irrigated Savanna Soil
e. Yellow Brown Savanna Soil
f. Mountainous Red Brown Forest Soil

Dark Compact Savanna Soils and Dark Compact Irrigated Savanna Soils occupy about 50 % of total township area, mainly in the central part of the township. Due to their high clay content, they have high plasticity and are very sticky and heavy for cultivation whereas they are very hard when dry and are very difficult for cultivation. They are the major soils for paddy, gram, and various kinds of pulses, chili, cotton and sesame.

Yellow Brown Savanna Soils occupy the eastern part of Mandalay Canal and the foothill areas of eastern highland area. They cover about 10 % of the total area. These are loamy soils, which are formed as a result of deposition of sediments of water erosion. Mountainous red brown forest soils are found under the forest areas in the northeastern part of the township. They occupy about 25 % of the total area. They are suitable for "Ya" crops and garden crops.

4.2.3 Climate Conditions

Being located in the Dry Zone of Central Myanmar, climate of Madaya Township is a hot and dry. It was recorded that during the period in 1983-2006, the mean annual temperature of Madaya Township was 28°C, maximum mean temperature of 34°C and minimum mean temperature of 22°C.

As is shown in Table 4.15, durng the monsoon season, rainy months are from June to October generally. The amount of rainfall during the monsoon season is an important source of the inflow for electricity generation of Sedawgyi dam. Generally, January, February and December are months with fewer rain or sometimes no rains. Since Sedawgyi Dam site is located in Madaya Township and it is very close to the “Eastern Highland”, the area around dam site receives more rains than the other parts of Madaya Township.

Eleven year average rainfall recorded in 2005 - 2015 is described in Table 4.15. As is shown, in average, rainfall starts in April (35 mm) and higher in May (162 mm) which is sufficient for crop cultivation. The rainfall drops in July (83 mm), known as July drought in dry zone in Myanmar. Highest amount of rainfall comes in August, September and October with 213 mm, 179 mm, and 170 mm, respectively.

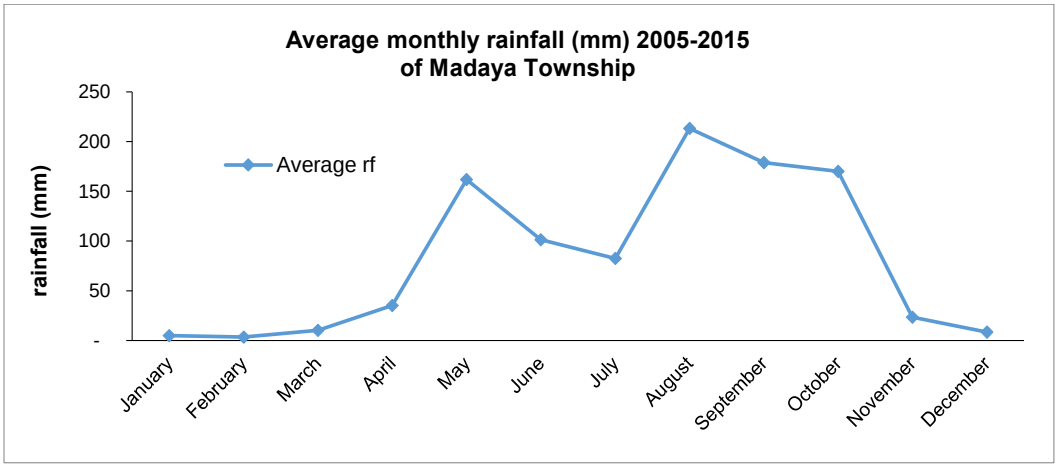
After that it decreased abruptly in November (23 mm). As the study area lies within Dry Zone of Central Myanmar, its average annual rainfall was found to be 994 mm during the eleven-year period.

Table 4.15 Rainfall in Madaya Township: 2005 - 2015

Year	Monthly Rainfall (mm)												Annual (mm)	No. of Rainy Day/ Year
		Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec		
2009	0	0	0	28	165	113	32	186	159	64	3	0	750	44
2010	0	0	5	7	101	170	102	186	140	334	0	42	1,087	69
2011	3	0	60	78	285	33	142	408	82	267	8	15	1,381	71
2012	0	0	3	23	70	91	49	86	181	51	49	0	603	40
2013	0	0	0	3	174	166	27	301	194	275	0	0	1,140	44
2014	0	14	0	31	121	44	34	220	284	75	31	0	854	50
2015	21	0	18	18	253	11	196	214	117	106	28	6	988	67
2016	0	0	0	87	62	98	28	68	29	22	0	0	394	69
2017	0	0	13	21	61	3	49	30	46	131	27	0	381	71
2018	0	0	0	39	55	44	40	50	42	35	11	0	316	44
Average	2.4	1.4	9.9	33.5	135	77.3	69.9	175	127	136	15.7	6.3	789.4	56.9

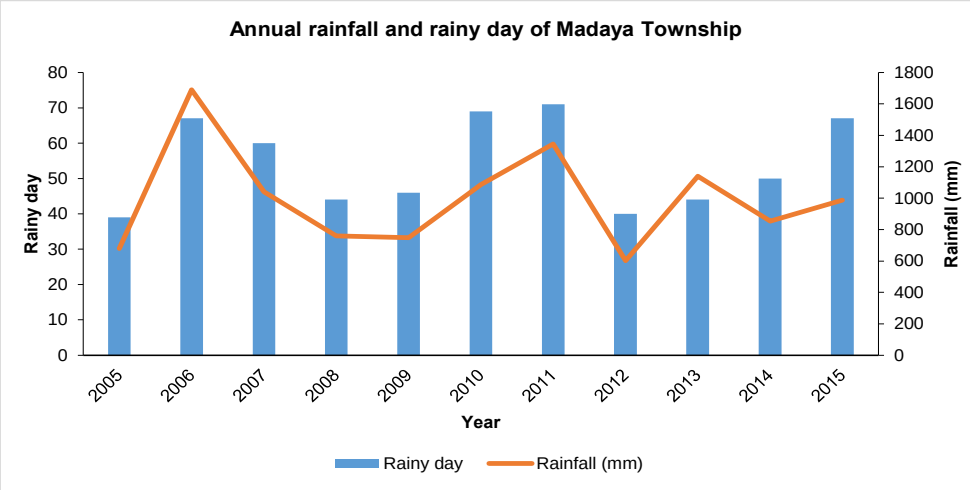
Source: Department of Agriculture, Madaya Township, 2016

As is shown in Fig. 4.4 and Fig. 4.5, the highest annual rainfall of 1,690 mm was observed in 2006 while the lowest 602 mm of rain in 2012 was recorded. Concerning with rainy days, the lowest of 39 days and the highest value of 71 days were recorded in 2005 and 2011 respectively.



Source: Department of Agriculture, Madaya Township

Fig. 4.4 Average Monthly Rainfall of Madaya Township



Source: Department of Agriculture, Madaya Township

Fig. 4.5 Annual Rainfall and the No. of Rainy Days of Madaya Township

4.2.4 Hydrology

The Sedawgyi Dam is located at the Chaungmagyi River in Madaya Township and it stands as the main supply for the irrigation network in the Sedawgyi Region. Its main objective is to supply enough water to boost the agricultural production. The secondary benefits are for the hydropower generation at the dam site and for the increase of water supply to Mandalay. The water resource consists of Sedawgyi Lake and local annual rains. Reservoir of Sedawgyi Dam is used for irrigation and household use by the people in Sedawgyi Area. The primary irrigation canals are diversion canals taking water from the Chaungmagyi River at the Sedaw weir. Fig. 4.6 shows general hydrology including irrigation area of Madaya Township.

Secondary canals are the distribution canals connecting irrigation areas to Mandalay Main Canal (MCC), which is formed in the north by the Sedaw weir where the Chaungmagyi River is separated into three sections of Chaungmagyi River, Yenatha Canal and MCC. Finally, the Chaungmagyi River flows further west into the Ayeyarwaddy River.

Yenatha Canal, a man-made canal, flows into the northern irrigation network distributaries, ranging from distributaries 1 to distributaries 9. The third is the MCC, which flows southward to Mandalay. MMC is also a man-made canal with a constant cross-section over the whole length. Along the MMC there are many distributaries or secondary canals.

Most of the water supply in Mandalay Region is controlled by the Sedawgyi Dam, which regulates discharge of water from the Chaungmagyi River as required. Depending on the requirement for irrigation, the amount of water flow for irrigation can be controlled.

During the summer time, water needs to accumulate in the dam for hydropower generation, resulting in less water for irrigation. On the other hand, during the rainy season the water level is too high in the reservoir area i.e. over-flow gate to spillway are opened to release water. This leads to a large flow into the irrigation canals.

The annual and daily water balance is regulated by the collaboration of Sedawgi HPP and the Irrigation Department. The inflows of the water balance are: 1) inflow by Chaungmagyi River; and 2) rainfall in the catchment area above the dam site. Regarding the water inflow to Sedawgyi HPP, there has been no excessive rainfall to date has occurred in the catchment area.

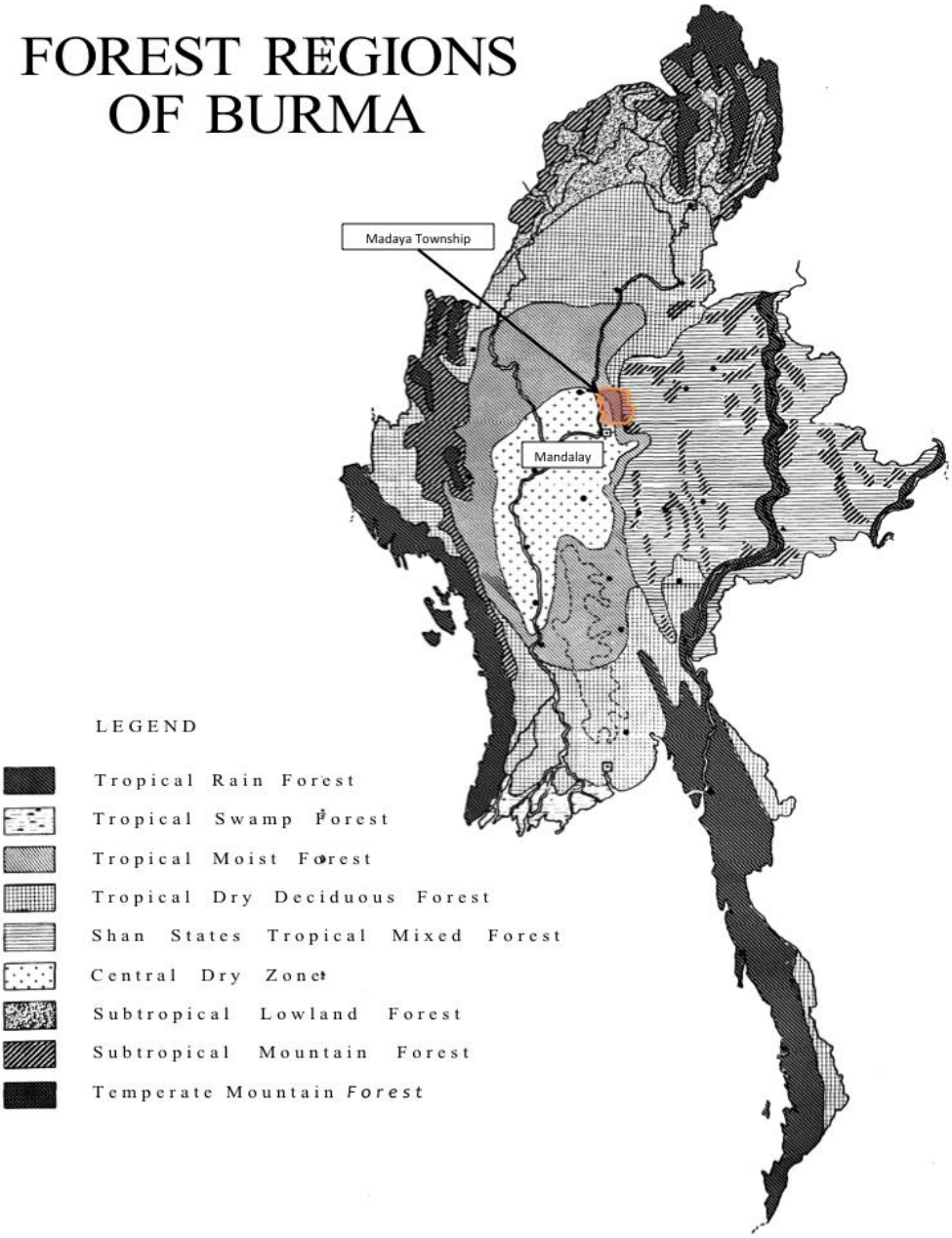
Source: Department of Agriculture, Madaya Township

Fig. 4.6 Irrigation Map of Madaya Township

4.2.5 Forest Area

As per forest areas shown in Fig. 4.8 and Fig. 4.7 where Sedawgyi HPP is located in the northeastern corner of Madaya Township, there is a wide tract of Tropical Mixed Forest of Shan State in the eastern hillside and it gradually changes to Tropical Moist Forest to some extent. Further to west

is the Central Dry Zone where the area is characterized by extensive flat area dominated by agricultural actively.



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

Fig. 4.7 Forest Regions of Madaya Township

As the green shaded area shown in Fig. 4.8 indicates, Tropical Moist Forest on the eastern area of Madaya Township is gradually changed to agricultural area as is shaded in yellow. As has been described before, Teak is traditionally fell down for exporting whereas it is planted for extra cash income of the local community.

In 1999-2000, the percentage of land under forest is recorded as 9.5% in Madaya Township. Although it lies Mainly in the Central Dry Zone and receives low rainfall, there is ample supply of water both from Ayeyarwady River and Chaungmagyi River.

There are three Reserved Forests in Madaya Township. They are: 1) Chaung-tha-baut (7,434 acre); 2) Chaung-tha-baut (extension, 1,801 acre); and 3) Taung-khaung (27,499 acre). Pan–tha- lae and Boe-daw Non-Reserved Forests are designated with 909 acre and 1,063 acre respectively at present.

Source: Myanmar Forest Cover Change 2002-2014, Smisonian and ALARM

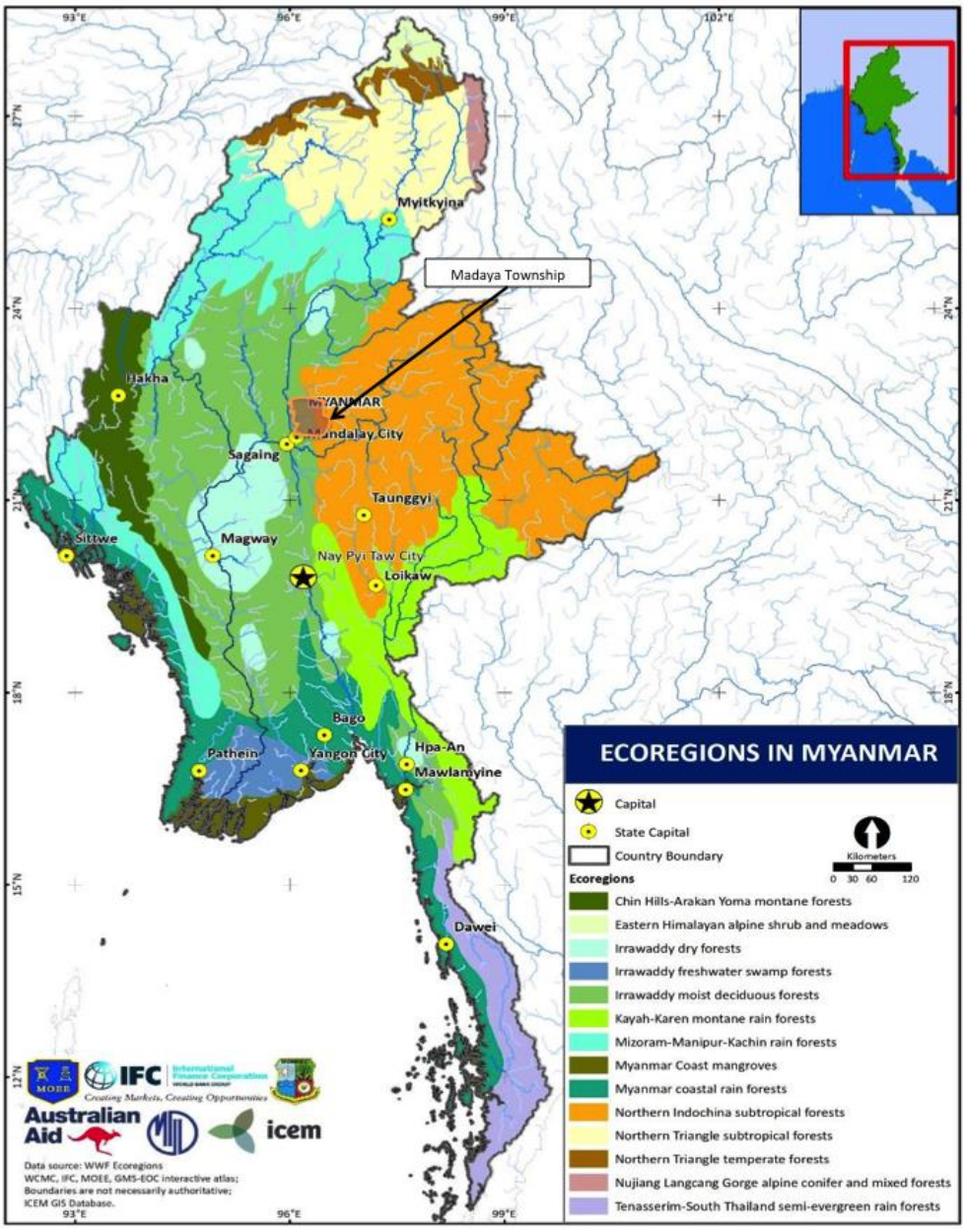
Fig. 4.8 Forest Area of Madaya Township

4.2.6 Eco-system

As has been described in the previous section, distribution of the forest areas in Manadalay Region and eco-system is quite similar. As is shown in Fig. 4.9, Madaya Township is in the "Northern Indochina Subtropical Forest" area on its eastern half and "Irrawaddy (Ayeyarwady) Moist Deciduous Forest" area on its western half.

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.

Both "Northern Indochina Subtropical Forest" and "Irrawaddy (Ayeyarwady) Moist Deciduous Forest" are now considered vulnerable because of the relatively low terrain and easy-access-area for the former and flat alluvial type of land area for the latter are eyed for extensive agricultural development. Sedawgyi HPP is located right on the border between "Northern Indochina Subtropical Forest" and "Irrawaddy (Ayeyarwady) Moist Deciduous Forest".



Source: SEA of the Hydropower Sector in Myanmar, IFC

Fig. 4.9 Eco-Regions of Madaya Township

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

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.

4.2.7 Natural Disasters and Hazards

There are no natural disasters such as landslide, earthquake, etc. recorded near the HPP and in Madaya Township. Floods and inundation sometimes happen in monsoon season, but the impact was not significant. For the rural farming in the Township, because of drought, crops were often damaged. In addition, the incidence of rats and other diseases for legume cultivation occasionally takes place. 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 conditions.

4.2.8 Protected Areas

There is no designated National Parks, Conservation Areas, Important Bird and Biodiversity Areas (IBAs) or habitat of protected species within in the near-by areas of Sedawgyi HPP other than the reserved and non-reserved forests as described in the Section 3.2.5.

4.2.9 Landscape and Aesthetic Value

The landscape in the project area is mainly agriculture fields. Including Sedawgyi HPP site, there is no other significant and aesthetically valuable landscape.

4.3 Environmental Pollution and Control Measures

4.3.1 Air quality

Soot and dust emission from open burning of trees and grass in agricultural field are occasionally seen. Exhaust emission from road traffic vehicles such as trucks and motorbikes are found in some areas that may cause minor air pollution of the project area. Since there is no major air pollution takes place as a result of project implementation, no significant part of Madaya Township is affected by the implementation of the project of hydropower plant The Project.

4.3.2 Water Pollution

The Sedawgyi HPP's The Project are carried out in the area confined in the dam site, which is in possession of EPGE. No part of irrigation system is subject to rehabilitation. A part of The Project is to repair over-flow gate of the spillway i.e. limited amount of water in the reservoir is subject to contamination and discharged water should contaminate river water for which it is limited without any toxic chemicals involved but a limited amount of steel rust and welding debris.

4.3.3 Noise and Vibration

The Sedawgyi HPP's The Project are carried out in the area confined in the dam site, which is in possession of EPGE. There is no significant noise and vibration causes no part of the general public of any concern.

4.3.4 Soil Contamination

There is no data about the analysis of soil contamination. However, because of the replacement of transformers, the following is noted:

a. Replacement of transformers;
b. Removal of transformer's insulating oil;
c. Storage of transformer – outdoor storage area; and
d. Storage of insulating oil, which contains high concentration of PCB – indoor storage area

There is no data on the analysis of soil contamination in respect of the working area for the Project. Thus, contamination of soil including surface and ground water is subject to monitoring.

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

Because of no workforce camp is set up for the Project of Sedawgyi HPP Rehabilitation Works, no solid waste collection is considered necessary. There are limited amount of construction debris generated on site as a result of the Project. Based on the rules and regulation of solid waste management in Myanmar including Factories Act (1951) and Public Health Law (1972), solid waste generated on site should be periodically collected and transported by the contractor of the Project of Sedawgyi HPP Rehabilitation Works.

As described above, insulating oil with high concentration of PCB is generated on site as a result of the Project of Sedawgyi HPP Rehabilitation Works. There are sectorial 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, has not been developed to date.

There is no specific government institution assigned for the task of overall management in terms of toxic chemicals and hazardous wastes management. Thus, until such time as laws and regulations are developed including PCB treatment plant/system is established in Myanmar, insulating oil including transformers are stored on site with which appropriate specification of storage area that do not contaminate soil and water in the near-by area is constructed. For monitoring works, therefore, inspection of storage area, inventory of PCB and any other data appropriate for treatment of PCB maintained on site including soil and water analysis for PCB contents are periodically carried out.

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 Sedawgyi HPP Rehabilitation Works.

4.3.9 Electro-magnetic Interference and Safety for the General Public

There is no electro-magnetic interference and the safety for the general public as a result of the Project of Sedawgyi 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.

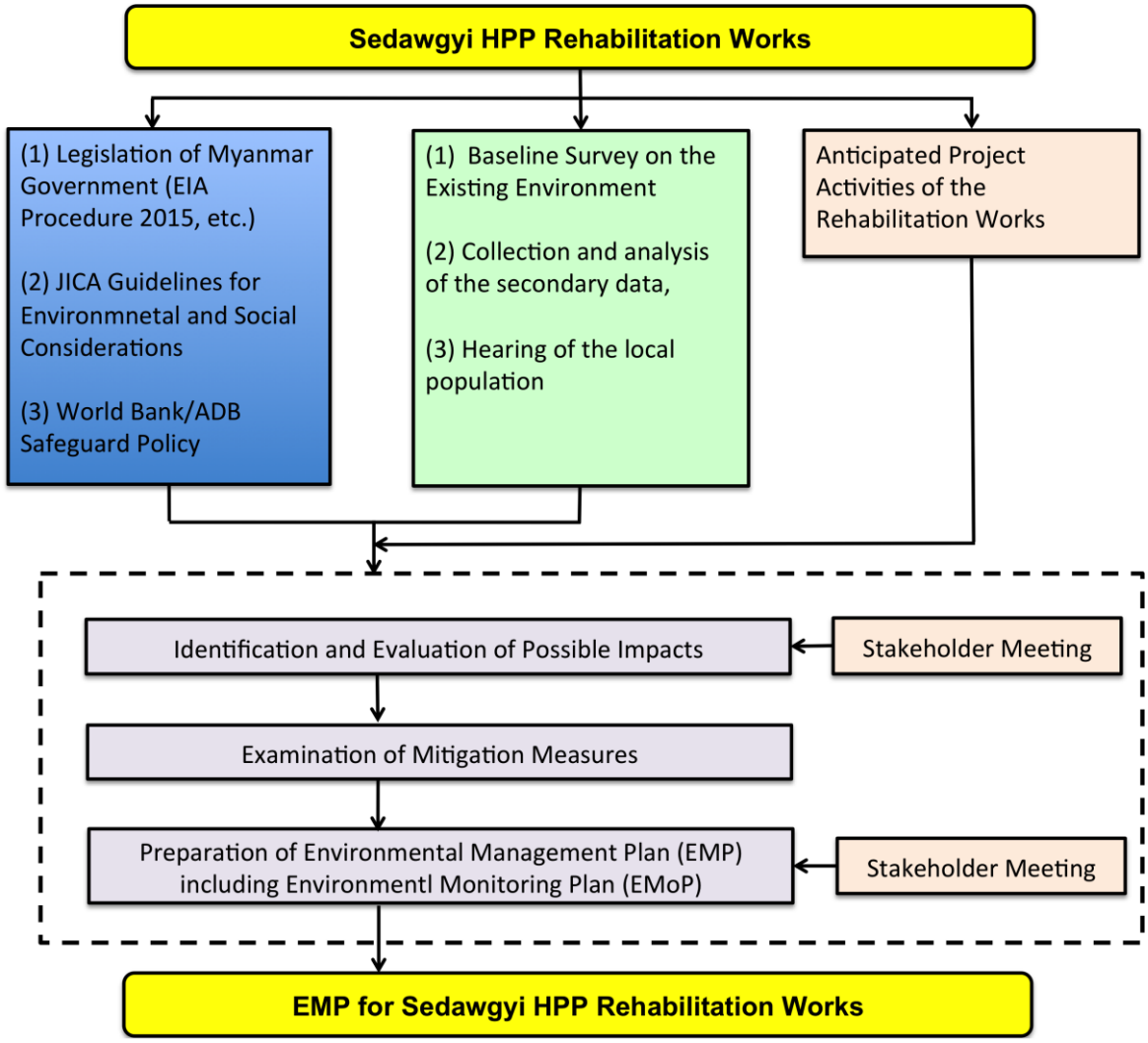
Possible impacts are identified and the extent of the impacts is also evaluated for the planned implementation stage.In order to evaluate the following rating criteria are adopted to examine extent of possible impacts:

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.

5.2 Procedure of Impact Assessment

Procedure of preparation of EMP is shown in Fig. 5.1. Based on the process of Preparation for EMP, including EMoP, the following stages of the Project takes place.



Source: Preparatory Survey on Hydropower Plants Rehabilitation Project, JICA Study Team, Nov. 2016

Fig. 5.1 Schematic Flow of the Preparation of EMP

General procedure is as follows:

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 of the Rehabilitation Works

a. Procurement of the replacing materials/parts for 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/parts and storage of old/replaced electric power generation equipment/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 organized as per Fig. 5.1.

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 Project, 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 Sedawgyi 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 Project for Sedawgyi 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 after the completion of the rehabilitation works".

Table 5.1 Evaluation of Possible Impacts Caused by The Project for Sedawgyi HPP

Environment		Stage			Reasons
		P	I	O	
1. Social Environment					
1	Involuntary Resettlement/Land acquisition/Migration	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.
2	Local economy such as employment and livelihood	D	B+	D	Temporary employment of local people as unskilled labor is anticipated during the Implementation Stage
3	Land use and utilization of local resources	D	D	D	All the activities for The Project will be carried out within existing hydropower plant site. Thus, neither land acquisition nor resettlement is expected to take place.
4	Social institutions/local decision-making mechanisms/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.
7	Gender	D	C	D	No part of the gender differences should be affected by implementation of the Project. Depending on the situation and requirement of the Project, 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 The Project since the works are confined to take place within the EPGE's land area.
9	Misdistribution of benefit and damage	D	C	C	While The Project 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 incresed 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 Project.
12	Fishing Rights, Water Rights and Rights of Commons	D	D	D	The Project 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 Project 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 Project takes place within the EPGE's land area and no workforce put up workforce camp. Thus, there is no infectious disease spread over the project area as a result of the implementation of The Project.
15	Working conditions	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 The Project.
16	Hazard/Public Security	D	D	D	The Project would not trigger or cause disaster and/or jeopardizes public security as a result of the implementation of The Project.
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 The Project.
2. Natural Environment					
1	Topography and Geology	D	D	D	No part of the natural environment of this nature is affected by the implementation of the Project.
2	Soil Erosion/Sand Movement	D	D	D	No part of the natural environment of this nature is affected by the implementation of the Project.
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 Project.
4	Groundwater Conditions	D	D	D	No part of the natural environment of this nature is affected by the implementation of the Project.
5	Environmentally sensitive areas/Protected Areas, IBAs and others	D	D	D	No part of the natural environment of this nature is affected by the implementation of the Project.
6	Terrestrial/Aquatic Flora, Fauna, Ecosystem and Biodiversity	D	D	D	No part of the natural environment of this nature is affected by the implementation of the Project.

7	Landscape and Aesthetic Values	D	D	D	No part of the natural environment of this nature is affected by the implementation of the Project.
8	Micro-climate	D	D	D	No part of the climatic conditions is affected by the implementation of the Project.
9	Global Warming/ Climate Change	D	D	D	No part of the global warming/climate change is affected by the implementation of the Project.
3. Environmental Pollution					
1	Air Pollution	D	D	D	No part of air is affected by the implementation of the Project.
2	Water Pollution	D	D	D	No part of surface water is affected by the implementation of the Project.
3	Soil Contamination	D	D	D	No part of soil condition is affected by the implementation of the Project.
4	Bottom Sedimentation/ Contamination	D	D	D	No part of bottom sediment is affected by the implementation of the Project.
5	Solid Waste	D	B-	C	Transformer's insulating oil, which contains high concentration of PCB has to be removed from the existing transformers at the time of the implementation of the Project and stored in the "leakage-free" warehouse built on site. Figure 2.3, 2.5 and 2.6 shows old (replaced) spare parts storage area and new parts depot area.
6	Noise and Vibration	D	D	D	No part of the general public is exposed to noise and vibrations by the implementation of the Project.
7	Ground Subsidence	D	D	D	No part of the ground for private/public use is affected by the implementation of the Project.
8	offensive Odor	D	D	D	No offensive odor is generated by the implementation of the Project.
9	Disruption of Sunshine Area and Time	D	D	D	No part of the Project 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 Project 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 conditions of the project area.

5.3.2 Assessment of the Environmental Impacts

(1) Natural Environment

As is shown in Table 5.1, 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. Thus, no environmental management plan is elaborated.

(2) Socio-economic Environment

As is shown in Table 5.1, 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.

(3) Environmental Pollution/Industrial Safety

Because of the replacement of transformers containing insulating oil, a large quantity of insulating oil containing PCB is stored on site unless otherwise industrial disposal system if made available within the close proximity of the project area. Handling of PCB itself does not cause direct and significant contamination to soil, ground water and workforce engaging the rehabilitation works. Storage of insulating oil containing PCB has to be dealt with a great care for the workforce in order to prevent them from contaminated PCB.

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. 2.3 tof. They are built on the land in possession of EPGE at present i.e. no land acquisition is involved in the Project.

While storage building is equipped with leakage-proof material and oil trapping bund, periodical inspection checking the leakage of PCB and contaminating is therefore in order to prevent the leakage from leading to significant environmental disaster.

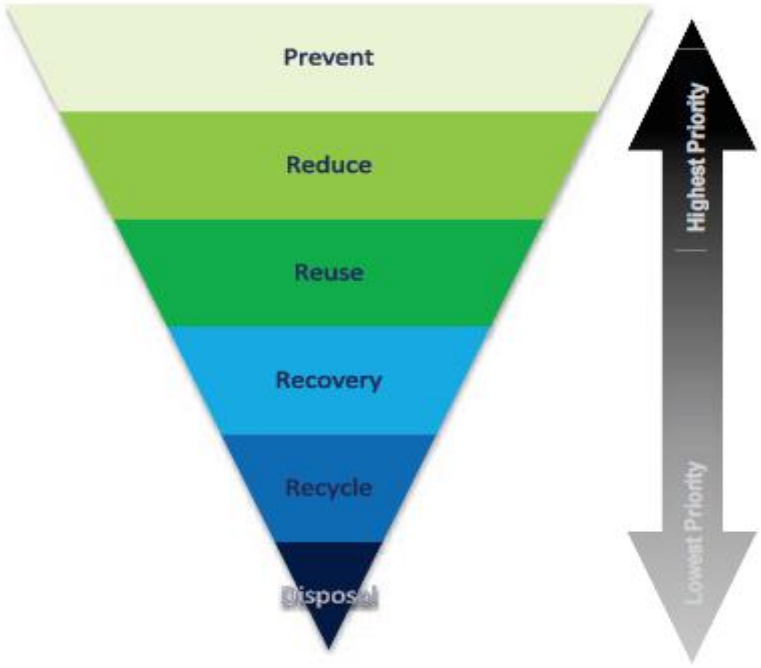
There is no other toxic chemical, explosives or any other substance subject to control and regulation of the Government of Myanmar or international regulations is involved. There is no area of earth moving, cutting and filling, excavation, and concrete placing of any major scale within the framework of the Rehabilitation Works.

Expected number of workers engaged to the Project would be approximately 50 skilled workers that are the employees of EPGE. 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 Sedawgyi 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 steal and aluminum. The concept of waste management plan is shown in schematic figure shown in Fig. 5.2.



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

Fig. 5.2 Concept of Waste Management Hierarchy

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 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. The waste management plan should include steps as follows:

a. Minimize the amount of waste produced;

b. Prepare designated waste storage areas for the wastes, which can not 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 induced by the implementation of the Project of Rehabilitation Works for Sedawgyi HPP in terms of the any part of natural environment during the planning stage. Thus, no mitigation measures or 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 Project to any part of the natural environment during the planning stage. Thus, no mitigation measures or 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 Sedawgyi 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 Sedawgyi 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 toform a team of stakeholder engagement during the period of the rehabilitation works as well as the period of operation and maintenance of Sedawgyi 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 Project to any part of the natural environment during the planning stage. Thus, there are no mitigation measures or environmental management plan is elaborated.

(2) Socio-economic Environment

The following socio-economic environment could be positively affected by the implementation of the Project for Sedawgyi 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 The Project 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 Project.

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 The Project 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 supplier is obliged to supply traffic controller/attendant where heavy equipment transporters are entering into the local area. Where necessary, road signs and barrios 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 Sedawgyi HPP of the replacing transformer and other parts and equipment is via road transportation to Madaya Township. The total distance is approximately 870 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 contactor 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.

Transported parts and equipment for power generation facilities as well as the old and replaced parts and equipment of the Project are stored in the storage area prepared for the Project as is shown previously in Fig. 2.3.

(3) Environmental Pollution/Solid Waste Management

1) Outline of the Management of Solid Waste

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 hymen 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. 2.3 in the Section 2 show storage building constructed on site. Because of insulating oil containing 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 PCB-containing Insulation Oil

A number of units of transformers and their PCB-containing insulating oil that is extracted from each transformer unit subject to storage on site are estimated as follows:

a. Transformer A: 7 Sets Volume of Insulating Oil - 3,150kg/unit

b. Transformer B: 2 Sets Volume of Insulating Oil - 2,750kg/unit

In total, 27,550 kg of insulating oil extracted from transformers and contained into some 150 steel drums for storage of extended period. Transformers after the extraction of insulting oil should also be placed in the warehouse.

In order to prevent insulating oil, which contains PCB, rust of steel materials from contaminating soil and water, and third parties from entering into the warehouse with walls and concrete bund would be constructed for storage purposes.

Insulating oil that contains PCB is stored in “Storage 1” created as a depot for which replaced electro- mechanical parts and equipment of the operation system and other ancillary parts are storage areas as is previously shown in Fig. 2.7.

3) Storage of the Electro-mechanical Parts Containing Chemical Substances

a. Disposal of Electro-mechanical Parts

Electric parts subject to replacement that contain chemical substances toxic to humen health should be stored indoor storage area with concrete floor, whose land ownership is currently in possession EPGE.

Table 5.2 shows electro-mechanical parts of the Sedawgyi HPP subject to replacement. 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.

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.

"Japan's policy on the environmentally sound management of mercury wastes (recommended by the Central Environment Council in February 2015" is generally 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 electro-mechanical part, 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.

All the electro-mechanical parts are stored in the storage area together with the steel drums containing PCB as is shown in Fig. 2.8 to Fig. 2.9.

Table 5.2 Electro-mechanical Parts Containing Chemical Substances

Equipment/Device		Chemicals
Generator	Insulator	Asbestos
	Brake	Asbestos
Measuring Devices	Thermometer	Hg

Electric Components	Soldering portions	Pb

Source: Preparatory Survey on Hydropower Plants Rehabilitation Project, JICA Study Team, Nov. 2016

b. International Safeguard Policies on the Hazardous Materials Management

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;

c. IFC: Environmental Health, Safety (EHS) Guidelines-General EHS Guidelines: Construction and Decommissioning.

International Finance Corporation (IFC), which is one of the organizations related to World Bank, puts out "Environmental, Health, and Safety Guidelines". The guidelines is widely adapted as internationally accepted guidelines for industrial safety for the MDB-funded projects in general and within the safety guidelines, "**1.5 Hazardous Materials Management**" should stringently be applied for the Project for Sedawgyi HPP in particular.

4) 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 Sedawgyi HPP as transformers containing insulating oil, which contains PCB are removed from the site and replaced with new transformers. Insulating oil of old transformers is removed and contained with steel drums, which carry sign for hazardous chemicals as is shown in Fig. 5.3 in English, a Burmese language version of warning sign should also be made and put it up next to the English sign of each drum.

Replaced transformers should be placed in warehouse with concrete floor and bund preventing transformer's residual insulating oil containing PCB from seeping and filtering into soil of the storage area. Roofing is important in order to avoid retarding water in the storage area. Wall could be of steel mesh in order to prevent workforce from entering into the warehouse.

Steel drums containing insulating oil should be stored indoor storage area with concrete floor and bund preventing insulating oil from seeping and filtering into the soil of the storage area, whose land ownership is currently in possession EPGE.

All solid and liquid wastes containing PCB need to be stored with environmentally sound treatment. Such waste may include:

a. Test kits recommended to use by UNEP or chemical industries in general has to be used in order to detect toxic chemical including PCB in the insulating oil of transformers subject to replacement;

b. Test Kits used to detect chlorine content or expired test kits: Transformers are not only potentially contaminated with PCB, but may also contain other toxic chemicals such as mercury. Used and expired test kits should be eliminated using an appropriate treatment methodology;

c. Desiccant (sawdust, fabric etc.), tools, gloves, clothes, rags, etc. must be properly placed in plastic or metal containers, sealed and marked with the appropriate label for waste PCB;

d. Transformers containing or having contained mineral oil with PCB;

e. Parts of equipment containing or having contained PCB;
f. Containers that are no longer usable that used to contained PCB;
g. Washing liquids containing more than 0.5 ug/L of PCB; and
h. Soil and debris.

Fig. 5.3 Signboard for Hazardous Chemicals

5) Industrial Safety and Occupational Health

Contents of Management Plan: Based on the Factory Act (1951) of Myanmar, Confined Space Permit should be obtained for the safety of the workforce to enter any chamber, tank, pit, pipe or any confined space. Safety attendant is provided throughout the period of rehabilitation works taking place in the confined working space. It is the obligation of EPGE to provide personal protective equipment for all workforce engaging the Rehabilitation Works.

International Finance Corporation (IFC), which is one of the organizations related to World Bank, puts out "Environmental, Health, and Safety Guidelines". The guidelines is widely adapted as internationally accepted guidelines for industrial safety for the MDB-funded projects in general and within the safety guidelines, "**1.5 Hazardous Materials Management**" should stringently be applied for the Project for Sedawgyi HPP in particular.

The most important aspect of preventing and minimizing cross-contamination of PCB in equipment, soil, water and air is to ensure the environmentally sound storage of contaminated equipment, whether still in service or out of service. Contaminated equipment and tools used for handling PCB must be isolated and safeguarded but can still be used for future tasks of handling PCB.

6) 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;
b. Relevant domestic and international regulations and guidelines; and
c. Environmentally sound handling and related precautionary and safety measures, including labeling, transport and storage that are expressed in "PCB Transformers and Capacitors - From Management to Reclassification and Disposal, UNEP, 2002" in conjunction with 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 and cumulative 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 operation and maintenance 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 model of EPGE would have to be developed in the light of the energy development scheme of Myanmar. Appendix II shows CSR in relation to the Project

(3) Environmental Pollution

As is previously shown, there is no significant and cumulative environmental pollution of air, water, soil including ground subsidence and microclimate during operation and maintenance stage. However, while no specific environmental management plan is elaborated in respect of the implementation of 5he Project, a number of monitoring works should be carried out as elaborate in the Section 5.5.

(4) Corporate Social Responsibility

As stated before, a team of stakeholder engagement is formed for dissemination of information on the rehabilitation works of Sedawgyi HPP before the Rehabilitation Works take place. Stakeholder engagement is thereafter periodically held, at least twice a year or as deemed necessary carried out.

Grievance redress unit should be established with the organization of EPGE be in operation as soon as the operation and maintenance works begin 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 Sedawgyi 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, operation and maintenance period of the Project for Sedawgyi HPP Rehabilitation Works affects the natural environment and socio-economic environment as well as causing environmental pollution 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 insulating oil that contains PCB as well as replaced 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. 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

Since The Project of Rehabilitation Works for Sedawgyi HPP involves to storing PCB contained insulating oil of transformers, global guidelines[2] for the identification of PCB contained in the insulating oil should be employed. Periodical examination of the storage area for transformer and steel drums including leakage on the floor and bund of 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;

Parameters of monitoring soil contamination are shown in

[2] UNEP (2002). *PCB transformers and capacitors: From management to reclassification and disposal.* Geneva, United Nations Environment

Table 5.4 and water quality are shown in Table 5.3.

Table 5.3 Parameter for Soil Quality Monitoring

Parameter		Analytical Method
1	pH	4AI: pH of 1:5 soil/water suspension at 25°C (Rayment and Higginson 1992) TPS-81 pH-conductivity meter
2	Electrical Conductivity (EC)	3AI: pH of 1:5 soil/water suspension at 25°C (Rayment and Higginson 1992) 2520-conductivity meter
3	Orthophosphate (PO_3)	9G2 Acid extractable phosphase 1:200 soil/0.005M H_2SO_4 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_2O_2 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: Sedawgyi 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 Interna- tional 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 Sedawgyi HPP Rehabilitation Project

2) Monitoring of PCB

Monitoring of PCB stored on site requires delicate management activities as follows:

a. Maintain recording form[3] of PCB analysis as per attached in Annex I;

b. Maintain monitoring form of the storage building examination and report it on the monthly progress report;

c. The soil and ground water analysis should be repeated twice a year for the period of operation and maintenance and record is maintained on site at the supervision of the person in charge of storage. Records should be disclosed at any time when request was made by the general public or government, non-government or international organizations;

d. Storage area of PCB has to be equipped with 1) Name of the person in charge of the storage area, name of the organization responsible for storage including his contact telephone number; and 3) type of toxic materials in storage is clearing written on the signboard; and

e. Warehouse is built as previously shown in Fig. 2.7 to Fig. 2.9 so that it could prevent PCB from entering into soil or surface and ground water and eventually enter into the human and animal food chain as follows:

   - Prevent splashing, leakage, filtration and offensive odor of insulating oil;
   - Prevent wild or domestic animals, rodents, snakes, mosquitoes and insects from entering the warehouse and contaminated by the toxic chemicals that might otherwise become in contact with the general public;

[3] UNEP (2002). *PCB Inventory Form.* http://chm.pops.int/Portals/0/Repository/PCB-general/UNEP-POPS-PCB-FORM-INVENTORY.English.PDF

- Insulating oil of transformer are subject to storage confined in containers of rust-free material and 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.

Table 5.5 shows suggested monitoring form for PCB storage.

Table 5.5 Monitoring Form for PCB Storage

No.	Monitoring Item	Date of Monitoring	Method of Monitoring	Monitoring Result
1	Floor of Storage Building			
2	Bund of Storage Building			
3	Steel Drums Containing Insulation Oil			
4	Result of Soil Analysis			
5	Result of Water Analysis			

Source: EMP Study Team

3) Storage of Replaced Equipment/Parts

Warehouse is built as previously shown in Fig. 2.4 – 2.6 and these equipment/parts are stored in the same storage area as steel drums containing PCB are stored. Thus, stored insulation oils and other chemical substances that otherwise could have touched should be prevented from left on the bare ground so as to avoid toxic chemicals entering into soil and/or ground water and eventually enter into the human and animal food chain. Thus, the following measures are important to implement:

- Prevent wild or domestic animals, rodents, snakes, mosquitoes and insects from entering the warehouse and contaminated by the toxic chemicals that might otherwise become in contact with the general public;
- Insulating oil of transformer are subject to storage confined in containers of rust-free material and 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 implication of the environmental monitoring plan is shown in Table 5.6

Table 5.6 Cost of Monitoring for the Rehabilitation Works of Sedawgyi HPP

Item		Environmental Monitoring Works		Monitoring Cost (US$)	Responsible Organiza-tion	Supervising Organiza-tion
		Implementation Stage	Operation and Maintenance Stage			
1. Social Environment						
1	Local economy such as employment and livelihood	Employment of the local workforce for unskilled labor	-	-	EPGE	Madaya Township
2	Existing Social Infrastructures /Services/Traffic Conditions	Local traffic conditions during the initial period	-	-	EPGE/ Contractor	Madaya Township
3	Distribution of Wealth/ Electricity	-	Increased capacity of electricity should be distributed to local area	-	EPGE	Madaya Township
2. Environmental Pollution						
1	Water Quality Analysis	-	Surface and Ground Water analysis - Twice a year	US$ 3,500/year	EPGE	Madaya Township/ MONREC
2	Soil Contamination Analysis	-	Soil analysis for containing PCB - Twice a year	US$ 3,500/year	EPGE	Madaya Township/ MONREC
3	Solid Waste Storage	Transformer's insulating oil is extracted before it is places 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 contains PCB from seeping/leaking into the soil of storage area.	Monitor periodically (once a year) for the 1) Splashing, leakage, filtration and offensive odor of PCB; 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	1) US$ 35,000 for the first year including construction of 3 buildings of warehouse buildings and improvement of storage area 2) US$ 7,500 per year during and after the 2nd and 3rd year for water and soil analysis twice a year	EPGE	Madaya Township/ MONREC

			resilient from leakages of insulating oil into soil hence no contamination is made to groundwater or surface water of the near-by area.			
4	SCR	Elaborate implementation plan for SCR and disseminate information of the rehabilitation works through stakeholder meetings, web site advertisement and other means of public communications Note: Guidance of SCR is attached in Annex II.	Carry out periodically (twice are year) and maintain any other means of SCR 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 2nd year	EPGE	4

Note: Contractor denotes the manufacturer of all electric equipment and other goods delivering to Sedawgyi HPP site.

6 Results of Stakeholder Meeting

6.1 Methodology and Approach

Stakeholder meeting is held in the near-by villages of Sedawgyi HPP for information dissemination. Direct notification for holding stakeholder meeting was made in-person to the head of township, villages and hamlets concerned with the Project for Sedawgyi HPP.

Upon agreement of the date and venue of the meeting, head of villages and hamlets were informed of the meeting. The general public concerned with the Project for Sedawgyi HPP was invited to the meeting for open discussions.

6.2 Fist Stakeholder Meeting

(1) Meeting Time and Date

First stakeholder meeting was held on 25th June Saturday 2016 in order to disseminate information on the outline of the Project for Sedawgyi HPP. Details of the meeting are as follows:

Date and Time: 25th June, Saturday 2016 (10:00 AM – 12:00 PM)

Venue: Gway Pin village, Madaya Township, Pyin Oo Lwi District, Mandalay Region

Participants: 95 persons (Including village chiefs and elder peoples, key informants, NGOs, Local Government officers from several departments such as Irrigation, Agriculture, Forestry, Fishery, Environmental Conservation, Land Use Departments, and Sedawgyi Hydropower Plant employees).

(2) Presentations of Information on the Rehabilitation Works

a. GAD township officer gave the opening speech about of the project and work for environmental and social considerations including Initial Environmental Examinations (IEE) of the Project for Sedawgyi HPP.

   He emphasized the importance of the participation with peoples of local communities and officers of related departments. He also mentioned that existing multi-purpose Sedawgyi HPP has been contributing to the benefit to living and livelihood activities of communities as it provides sufficient water resources for paddy and farmland for irrigation as well as its electric power supply since 1989. As a result, local economy of Madaya Township in agricultural and other sectors developed significantly.

b. JICA Survey Team briefly explained the purpose and scope of the Project for Sedawgyi HPP as it is a "Preparatory Survey for the Project of Hydropower Plant Rehabilitation".

c. Sedawgyi Hydropower Station Manager of EPGE explained the history of Sedawgyi HPP since 1989 and presented its features. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion of dam site or not to cause any further damages to the natural environment. He also stated that it is necessary to rejuvenate the power generation capacity due to deterioration of the continuous operation for the past 29 years.

d. Local Consultant emphasized that the rehabilitation project is required to comply with both the JICA Guidelines and Myanmar legislations. He explained an IEE level study was required and now the study is in progress according to the JICA Guidelines. At the same time, he also explained that the project is required to obtain prior permission of Environmental Compliance Certificate (ECC) from the Ministry of Natural Resources and Environmental Conservation (MONREC) according to recently enacted Environmental Impact Assessment Procedure 2015 (EIA Procedure) of Myanmar. In addition, he insisted role of community participation and information disclosure of the project by using power point and handouts.

(3) Questions & Answers and Discussions

a. Village leader from the village tract of Sale village, proposed to departments and survey team for the distribution of electric power to rural village near the hydropower station to get more and easily in accordance with the purpose of Myanmar Government vision.

b. Station Manager responded to the question, there are money department of electric under the management of Ministry of Electricity and Energy. He is from the department of electric power production, so he cannot make the decision for distribution of electric power. However, he can understand of community's needs. He suggested that the community should submit to related department for their needs.

c. A businessman from the village of Gway Pin, said the Sedawygi Dam has been contributed the benefit of local community not only in agriculture sector but also in electric power supply. But unfortunately due to construction of the dam some displacement of peoples and houses occurred, and cattle were damaged. Thus, he would like to suggest to the project rehabilitation for hydropower plant for making proper management to avoid displacement and damage to animals and structures as well as to ensure safety.

d. A farmer from the village of Gway Pin, expressed a welcome to the rehabilitation project. At the same time he requested to the Survey Team to inform possible impacts and mitigation measures to local people, because he would like to know the impacts and prepare necessary means in future.

1a) Venue - Primary School of Gwan Pin Village

2) Most of Village Peoples using by Motorbikes

3) Pre-meeting with GAD Officer

4) Presentation by Station Manager

5) Photos of Sedawgyi HPP

6) Presentation by Local Consultant

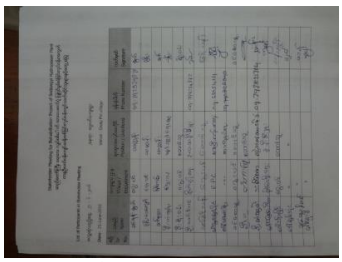
7) Presentation by Village Chief-1

8) Presentation by Village Chief-2

9) Participants - 1

10) Participants - 2

11) Closing remark by GAD Officer



12) Participants List

Source: JICA Survey Team

Fig. 6.1 First Stakeholder Meeting of Madaya Township

6.3 Second Stakeholder Meeting

(1) Meeting Time and Date

Date and Time: 10 September, Saturday2016 (From 9 AM to 11 AM)

Venue: Yay Nan Thar village, Madaya Township, Pyin Oo Lwin District, Mandalay Region

Participants: 195 persons (including village chiefs and elder peoples, key informants, NGOs, Local Government officers from several departments, such as Irrigation, Agriculture, Forestry, Fishery, Environmental Conservation, Land Use Departments, and Sedawgyi Hydropower Plants employees)

(2) Presentations

a. The GAD township officer gave an opening speech about of the project and work for environmental and social considerations including Initial Environmental Examinations (IEE). He emphasized the importance of the participation of local communities and officials of related departments. He also mentioned that existing multi-purpose Sedawgyi Dam have been contributing to the benefit to the living and livelihood activities of communities with providing sufficient water for paddy land and farmland irrigation as well as electric power supply from hydropower generation plant since 1989. As results, local economy of Madaya Township in agricultural and other sectors has been developed significantly.

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. He explained the important needs of rehabilitation work for an hydropower by giving an example of a mobile phone and its battery".

c. Sedawgyi Hydropower Station Manager explained the history of the hydropower since 1989 and mentioned the current features of the Sadawgyi Hydropower Plant. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and no increase of power generation capacity. The rehabilitation work is necessary to perform urgently because of the continuous operation for more than 25 years without performing any such rehabilitation work.

d. Local Consultant emphasized that the rehabilitation project 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. 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 will be no significant negative impact of the rehabilitation project on the environment and the community.

e. Currently, the study is in progress and the report of the study team will be timely completed. The Consultant expected the Environmental Compliance Certificate (ECC) will be approved by the Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation (MONREC). In addition, the Consultant insisted the roles of community participation and information disclosure and thanks all participants for their cooperation for successful completion of the project.

(3) Questions & Answers and Discussions

a. Village leader of Yay Nan Thar village, discussed on the current situation of the dam. The dam is under threat because of the high sedimentation problem caused by the gold mining activities in the upper part of the dam. The timber extraction of the watershed area which become bigger and bigger damaged the dam day by day. It looks like a flat pan since the situation of sedimentation more prominent. It creates paddy fields and settlements of low land area seriously flooded in rainy season. He proposed and requested to the concerned departments and survey team for finding ways and means of the improvement of dam situation in a timely manner. Sedawgyi Dam and its watershed system is very important for all villages to make the sustainable of their livelihood.

b. A villager of Yay Nan Thar village was asked to Irrigation Department. "Is there will sufficient water supply to villages while the project starts?".

c. The question was answered by the township officer of the Department of Irrigation that there will be no concern with the rehabilitation process and irrigation, so that no disturbances on irrigation schedules to the rice fields. He added that from the side of Irrigation Department was ready to distribute for supply water to the villages as before.

d. A farmer from Sa Lay village, asked to the local consultant's presentation. In the presentation was shown for the environmental study results that air pollution is expected no problem for the villagers. But he worries about wastewater and vibration produced by the project operation. He wants to know how to control that problem.

e. The Local Consultant interpreted the question to civil engineer and sub team leader, Mr. Matsunaga and he answered that waste water will not be released to the dam and river. The waste will be kept and stored in steel container before release to environment/surrounding. The vibration may occur in a very small intensity.

f. The Local consultant took the question to civil engineer of JICA survey sub team leader and answer that wastewater will not release to dam and river, every waste will keep and store in steel container for environmental consideration. Other thing of vibration may occur very small, if any.

1) Venue – Community hall, Yay Nan Thar village

2) Registration of participants

3) Opening remarks by Madaya Township GAD Officer

4) Presentation by Station Manager of Sedawgyi HPP

5) Presentation by Local Consultant

6) Presentation by participant -1

7) Presentation by participant -2

8) Partcipants of the Meeting

9) Participants came by motor bikes and cars as well as by walk

Source: JICA Survey Team

Fig. 6.2 Second Statekholder Meeting of Madaya Township

Annex I

PCB Inventory Form

PCB Inventory Form

First issue
August 2002

Inventory of PCB-Containing Equipment

Record number:	
Date:	
Inspector:	

A	Information about the company and the site		
1	Name:		
2	Address:		
3	Address of site: (if different from A2)		
4	Phone:		
	Fax:		
	E-mail:		
5	Name/position of contact:		
6	Type of company / industry type / production at specific site:		
7	Public or private company?		
8	Location:	Industrial zone	
		Other urban area	
		Rural area	
9	Number of staff at visited site:	>50	
		10-50	
		<10	
10	Total number of pieces of equipment at site	Transformers	
		Capacitors	
		Others	
11	Total electricity consumption at site	in 1985	kWh / year
		now	kWh / year
12	PCB elimination action plan in place? - action plan intended but not started? - previous disposal activities? - time frame for program?		*(Use a separate sheet if necessary)*

PCB Inventory Form

First issue
August 2002

B	**Information related to the potentially PCB-containing equipment** *(repeat this section on a separate Section B form for each additional piece of equipment)*		
1	Name of manufacturer and country of origin		
2	Type (transformer, capacitor, *etc.*)		
3	Serial number		
4	Power rating (voltage)		
5	Date of fabrication		
6	Weight:	Equipment (dry weight in kg)	
		Oil / liquid (L or kg)	
		Total weight (kg)	
		Size of equipment (length, width, height in ft or m)	
7	Name of liquid or insulating oil/coolant, *etc.*		
8	PCB content of liquid	> 10 % PCB	
		> 0.05 % PCB or 500 ppm	
		> 0.005 % or 50 ppm	
		< 0.005 % or 50 ppm	
		No PCBs present in liquid (according to plaque)	
		PCB content not known	
		Equipment emptied of liquid	
9	PCB analysis performed? If yes, which method and when?		
10	Source of the above information (*e.g.*, a plaque or name plate on the equipment)		
11	Operational status of equipment	In use: yes / since	
		On stand-by	
		Decommissioned	
12	Condition of equipment	Leaking?	
		Immediate action needed?	
		Storage situation (e.g. open air, locked enclosure *etc.*)	

PCB Inventory Form

First issue
August 2002

13	Maintenance of equipment	Retrofilled?	
		If yes, last retrofill when?	
		By which company ?	
		With which replacement liquid /insulating oil?	
		Name of original liquid / insulating oil, if known	
14	Other observations:		*(Use a separate sheet if necessary)*

C	Information on wastes liable to contain PCB	
1	Nature of the wastes (*e.g.*, transformer oil in drums or reservoirs)	
2	Estimated quantity	
3	Are containers leak-proof?	
4	Is the place of storage clearly marked to show the presence of PCB?	
5	Have soil or buildings been contaminated by leaking PCB? (indicate magnitude of problem if possible, *e.g.* tonnes or cubic metres of contaminated soil)	
6	Brief history of any previous remediation efforts, *e.g.*, removal of PCB-containing equipment and waste PCB for disposal (when, by whom, where to, *etc.*)	
7	Other relevant information (*e.g.*, results of any sampling and analysis already undertaken)	*(Use a separate sheet if necessary)*

PCB Inventory Form

First issue
August 2002

D	Record of site visit	
1	Company official(s) involved Name, position, signature, date	
2	Government inspector(s) Name, position, signature, date	

Explanatory Notes:

The Stockholm Convention on Persistent Organic Pollutants, in its Annex A and Article 6, requires Parties to identify, label and remove from use equipment containing polychlorinated biphenyls (PCBs), and to dispose of the waste PCB-containing materials in an environmentally sound manner.

This inventory form should assist countries in the preparation of their first nation-wide PCB inventory for the following purposes:

1. Identification of owners and locations of potentially PCB-containing equipment and wastes (section A);

2. Identification and quantification of potentially PCB-containing equipment such as transformers, capacitors, vacuum pumps, lamp ballast, and electrical cables (section B); and

3. Identification and quantification of waste PCBs or PCB-contaminated sites (section C).

The aim of this questionnaire is to be simple and resource-efficient but detailed enough to help a country/Party to the Stockholm Convention identify its major PCB sources and establish a priority list for action. Such priority may arise from either high concentrations and large volumes of PCB or immediate risk to the environment due to unsecured use or storage of PCB-containing equipment or wastes.

The questionnaire should be used during a site visit of a government inspector together with one or more staff from the potential PCB owner. Usually one form per site should be filled in, except that in cases where there are multiple pieces of equipment on site, such as transformers, section B should be repeated for each individual piece of equipment (this is not necessary for multiple small items of the same type, e.g. capacitors).

This questionnaire has been issued for the first time in August 2002 on a trial basis. Comments and suggestions for improvements would be welcome.

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Annex II

Corporate Social Responsibility

1 Introduction

Myanmar is an advocate of taking steps to build investor confidence and promote responsible investment. It is also a voice of the general public and civil society as a whole. Concept of CSR and adaptation of it to a part of Environmental Management Plan implemented for infrastructure development project such as the rehabilitation works of Sedawgyi HPP is relatively new.

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 with 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 for their own company benefits. It 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 CSR and that it serves many functions of the companies. In the case of Sedawgyi HPP, DPGE with demonstrable commitments to strong socio-economic and the environmental standards should reduce risks of their legal and operational risks.

Thus, a failure to address emerging standards for environmental management can leave DPGE without capacity to effectively engage stakeholders and pursue business objectives. Thus, willingness to engage stakeholders in transparent dialogues regarding the impacts of corporate operations fosters the environment and socio-economic conditions in which grievances may be amicably resolved before the stakeholders 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 few direct engagements with those in charge of CSR. With rigorous compliance audits, companies may be able to demonstrate their compliance with law, but they may not have the same capacity to demonstrate their efforts tofulfill voluntary commitments. Thus, a failure to demonstrate it is a company fulfilling its commitments to stakeholders can become further costly operation of recovering the damages. There are strong business reasons, therefore, to leverage and integrate CSR into compliance processes.

3 Definition of CSR

There is no single guideline of "CSR". 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, is to respect 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 Developing CSR Strategy

Because of the absence of current guidelines on the environmental and social impact assessment and its associated management plan as well as the country's protection laws and regulations, CSR remain incomplete. 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 adapt measures to maintain EQS of Myanmar.

Based on the Environmental Management and Monitoring Plan, therefore, the following is obliged, by EPGE, to developing CSR for the performance of EPGE:

- **Carry out Local Dialogues:** Plan to engage periodically with the local residents and civil society. It is important to inform the performance of EPGE in terms of the rehabilitation works being carried out on Sedawgyi HPP. 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 Sedawgyi HPP rehabilitation works should be reviewed if the project could meet the real needs of the local people. Creating a program designed tofit 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. 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 Sedawgyi 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 of Sedawgyi HPP rehabilitation works. It will provide necessary information on the impacts induced by the project in relation to local and distant ethnic conflict, human rights, religious diversity, and the role of the government agencies in relation the implementation of the Project. The 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, project implementation organization is requested to prepare "CSR Budget with Staff Dedicated for CSR". Alternatively, outside organization such as NGO experienced with local communication could be employed. A group of three people for a preparation of holding local meeting, creating a set of brochure for circulation as well as to post it on the web site of EPGE and other works related to public awareness could be sufficient to carry out the out line of CSR.

Pursuing a CSR program is therefore viewed as an opportunity to disseminate good practice of the project implementation organization for good reputation. 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 local residents depend. 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 Sedawgyi HPP rehabilitation works. Because a well-designed CSR could bring about the economic benefits of the investment for the Project and that it is felt locally as a goal of the Project.

Annex III

Letter of Commitment

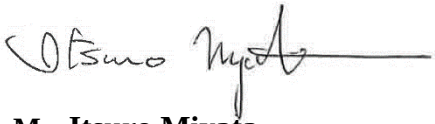
Letter of Commitment
for
The Report of Environmental Management Plan (EMP)
of
the Rehabilitation Project of Sedawgyi Hydropower Plant

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 Sedawgyi 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,



Mr. Itsuro Miyata

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