Initial Environmental Examination

March 2015

MYA: Power Transmission Improvement Project

New 230 kV Transmission Lines between Thida, Thaketa, and Kyaikasan Substations, and New South Okkalapa and West University Substations Yangon, Myanmar

Prepared by the Ministry of Electric Power for the Asian Development Bank

CURRENCY EQUIVALENTS

In this report, "$" refers to United States dollar.

(as of 1 Jan 2015)

Currency Unit	–	Kyat (MMK)
MMK1.00	=	$0.000986
$1.00	=	1013.53

ABBREVIATIONS

ADB:	Asian Development Bank
AH:	Affected Household
BOD:	Biochemical Oxygen Demand
COD:	Chemical Oxygen Demand
EMF:	Electromagnetic Field
EIA:	Environment Impact Assessment
EMP:	Environment Management Plan
EO:	Environmental Officer
EA:	Executing Agency
GRM:	Grievance Redress Mechanism
IA:	Implementing Agency
IEE:	Initial Environmental Examination
MOL:	Ministry of Labour
MOC:	Ministry of Culture
MEPE:	Myanmar Electric Power Enterprise
MOECAF:	Ministry of Environment, Conservation and Forestry
MOEP:	Ministry of Electric Power
MOT:	Ministry of Transport
RP:	Resettlement Plan
PCR:	Physical Cultural Resources
PHA:	Public Health Authority
PPTA:	Project Preparatory Technical Assistance
REA:	Rapid Environment Assessment
ROW:	Right-of-way
PIC:	Project Implementation Consultant
PIU:	Project Implementation Unit
SPS:	ADB Safeguard Policy Statement

TSS:	Total Suspended Solids
YCDC:	Yangon City Development Committee
YESB:	Yangon Electricity Supply Board

WEIGHTS AND MEASURES

^{o}C	–	Celsius
km	–	kilometer
kV	–	kilovolt
kWh	–	kilowatt-hour
LV	–	low voltage
m	–	meter
mm	–	millimeter
mm/kV	–	millimeter per kilovolt

BURMESE VERSION OF THE EXECUTIVE SUMMARY

အစီရင်ခံစာ အကျဉ်းချုပ် (မြန်မာဘာသာဖြင့်)

၁။ အာရှဖွံ့ဖြိုးရေးဘဏ် (ADB) မှ မာတ်အားထုတ်လွှင့်ရေး နှင့် ဖြန့်ဖြူးရေး တိုးမြင့်မှုစီမံကိန်း (PPTA 8342 MYA) အတွက် ကျွမ်းကျင်မှုဆိုင်ရာ အကူအညီပေးရန် မြန်မာနိုင်ငံမှ တောင်းဆိုခဲ့သည်။ ကျွမ်းကျင်မှုဆိုင်ရာ အကူအညီပေးရေးတွင် စီမံကိန်းနှင့်ပတ်သတ်၍ သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ကနဦးလေ့လာမှု၊ စီမံကိန်းရင်းနှီးမြှုပ်နှံမှုအတွက် လိုအပ်သော စာရွက်စာတန်းများ ပြင်ဆင်မှုနှင့် မြန်မာနိုင်ငံအတွင်း လျှပ်စစ်မာတ်အား ဖြန့်ဖြူးမှု ကွန်ယက်တိုးချဲ့ခြင်းနှင့် ပြန်လည်ပြုပြင်ထိန်းသိမ်းခြင်း တို့အတွက်ဖြစ်နိုင်ချေရှိသော လေ့လာမှုများပါဝင်သည်။

၂။ လျှပ်စစ်စွမ်းအား ဝန်ကြီးဌာန (MOEP) သည် ရန်ကုန်မြို့တွင် 230 kV မာတ်အားလိုင်းသစ် နှစ်လိုင်းနှင့် ခွဲရုံသစ်နှစ်ရုံ ဆောက်လုပ်ရန်တင်ပြခဲ့သည်။ မာတ်အားဖြန့်ဖြူးမှု စီမံကိန်းကဲ့သို့ပင် မာတ်အား ထုတ်လွှင့်မှုစီမံကိန်းသည်လည်း အစီရင်ခံစာပါအတိုင်း သဘာဝပတ်ဝန်းကျင် အကျိုးသက်ရောက်မှု လေ့လာခြင်းနှင့် လုံးခြုံစိတ်ချမှု အစီအမံများကို လိုအပ်သည်။

စီမံကိန်းအကြောင်းအရာ

၃။ မာတ်အားထုတ်လွှင့်ခြင်းနှင့် ပတ်သတ်၍ ရန်ကုန်တွင်လက်ရှိ သီတာ၊ သာကေတနှင့် ကျိုက်ကွာဆံ ခွဲရုံတို့နှင့်ချိတ်ဆက်မည့် 230 kV ခံဝန်အားရှိသော မာတ်အားလိုင်းသစ်နှစ်လိုင်းအား ဆောက်လုပ်မည်။ ထို့အပြင် မာတ်အားခွဲရုံသစ် နှစ်ရုံအား ရန်ကုန်မြို့၏ အနောက်မြောက်အရပ်ရှိ အနောက်ပိုင်း တက္ကသိုလ်အနီးနှင့် ရန်ကုန်မြို့၏ မြို့တွင်းမြောက်ပိုင်း တောင်ဥက္ကလာပမြို့နယ် အသီးသီးတို့တွင် ထပ်မံတည်ဆောက်မည်ဖြစ်သည်။

၄။ သီတာခွဲရုံနှင့် သာကေတခွဲရုံ၊ သာကေတခွဲရုံနှင့် ကျိုက္ကဆံခွဲရုံတို့ အကြားဆက်သွယ်မည့် 230 kV ခံဝန်အားရှိ လျှပ်စစ်မာတ်အားလိုင်းတို့အား ဆုံးဖြတ်ရာတွင် အဆင့်နှစ်ဆင့်ပါဝင်သော ထပ်ဆင့်လုပ်ငန်းစဉ်ဖြင့် ဆောင်ရွက်ခဲ့သည်။ MEPE မှ 230 kV မာတ်အားလိုင်းသစ်အတွက် နောက်ဆုံး မာတ်အားလိုင်းလမ်းကြောင်းအသစ်အားထပ်မံ သတ်မှတ်ခဲ့သည်။ ကနဦး သတ်မှတ်ထားသည့် ဓါတ်အားလိုင်းလမ်းကြောင်းအား Fichtner အင်ဂျင်နီယာအဖွဲ့မှ သဘာဝ ပတ်ဝန်းကျင်နှင့် လူမှုရေး အကျိုးသက်ရောက်မှု (မြို့ပြနောက်ယှက်မှု၊ နေရာရွှေ့ပြောင်းခြင်းနှင့် မြေယာပိုင်ဆိုင်မှု) နှင့် ပညာရပ်ဆိုင်ရာ ကုန်ကျမှု စသည်တို့ကို ထည့်သွင်း စဉ်းစား၍ လေ့လာရွေးချယ်ခဲ့ကြသည်။ MEPE သည် နေရာရွှေ့ပြောင်းခြင်း လိုအပ်ချက်နှင့် မြေယာပိုင်ဆိုင်မှု၊ အလျော်ပေးမှုတို့ကို လျော့ချနိုင်ရန်နှင့် ကာကွယ်ရန်အတွက် ကနဦး Fichtner မှ လေ့လာခဲ့သည့် ဓါတ်အားလိုင်းလမ်းကြောင်းကို ညှိနှိုင်းခဲ့သည်။

၅။ တောင်ဥက္ကလာပနှင့် အနောက်ပိုင်းတက္ကသိုလ်ခွဲရုံသစ်များ နေရာချထားမှုအတွက်လည်း သဘာဝပတ်ဝန်းကျင် အကျိုးသက်ရောက်မှု၊ နေရာရွှေ့ပြောင်းမှုနှင့် မြေယာပိုင်ဆိုင်မှုတို့ အပေါ်အနည်းဆုံး (သို့မဟုတ်) လုံးဝထိခိုက်မှုမရှိစေရေးအတွက် အလားတူစံညွှန်းတို့ကို အသုံးပြုခဲ့သည်။ 230 kV မာတ်အားလိုင်းသစ်များအတွက်မူ အစိုးရပိုင်မြေကိုသာ အတတ်နိုင်ဆုံး အသုံးပြုမည်ဖြစ်သည်။ စီမံကိန်းတွင်ပါဝင်သည့် အပိုင်းများမှာ အောက်ပါအတိုင်းဖြစ်သည်။

မာတ်အားလိုင်းသစ်များ

၁။ သီတာခွဲရုံနှင့် သာကေတခွဲရုံတို့အကြား 230 kV နှင့် 66 kV မာတ်အားလိုင်း (Double circuit transmission line 230 kV single + 66 kV single)

၂။ သာကေတခွဲရုံနှင့် ကျိုက္ကဆံခွဲရုံတို့အကြား 230 kV မာတ်အားလိုင်းသစ် (Single circuit transmission line)

ခွဲရုံသစ်များ

၃။ လက်ရှိ 230 kV သာကေတခွဲရုံအတွင်း လိုအပ်သောပစ္စည်းကိရိယာများ တိုးချဲ့တပ်ဆင်ခြင်း

၄။ လက်ရှိ 230/66/။ kV, 2 x 100 mVA ကျိုက္ကဆံခွဲရုံအား ဓရိယာတိုးချဲ့ခြင်းနှင့် ပစ္စည်းကိရိယာအသစ်များ တပ်ဆင်ခြင်း

၅။ တောင်ဥက္ကလာပမြို့နယ်တွင် 230/33/။ kV, 2 x 100 MVA တည်ဆောက်ခြင်း

၆။ အနောက်ပိုင်းတက္ကသိုလ်ခွဲရုံသစ် 230/33/။ kV, 2 x 100 MVA တည်ဆောက်ခြင်း

ဖြစ်နိုင်ခြေရှိသော အကျိုးသက်ရောက်မှုများ

၆။ ကွင်းဆင်းလေ့လာမှုများ သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ အချက်အလက်နှင့် စီမံကိန်းအချက်အလက်များကို အခြေခံ၍ ကနဦး သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ဆန်းစစ်လေ့လာရာတွင် တွေ့ရှိရသည်မှာ MEPE ၏ နောက်ဆုံးအဆိုပြုတင်ပြထားသော 230 kV လျှပ်စစ်မာတ်အားလိုင်း လမ်းကြောင်းများသည် တည်ဆောက်ဆဲကာလနှင့် ဆက်စပ်လျက်ရှိသော ရေတိုအနှောက်အယှက်ဖြစ်မှုများနှင့် ပြန်လည်ကုစား၍ရနိုင်သော အကျိုးသက်ရောက်မှုများကို ဖြစ်ပေါ်နိုင်သည်။ ဆောက်လုပ်ဆဲကာလနှင့် ဆက်စပ်၍ ဖြစ်ပေါ်နိုင်ပြီး စံညွှန်းကုစားမှုနှင့် စီမံခန့်ခွဲမှုများ လိုအပ်သည့် သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ အကျိုးသက်ရောက်မှု ဥပမာတစ်ခုမှာ ခန့်မှန်းခြေ (၁၈-၁၃) ခုခန့်ရှိသော တစ်လုံးတိုင်နှင့် ထောက်တိုင်များကို ပုစွန်တောင်ချောင်း တစ်လျှောက် တည်ဆောက်ရာတွင် တိုင်ရိုက်ခြင်းကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် မြေပြိုတိုက်စားခြင်းနှင့် နန်းမြေပို့ချမှု တို့ပင်ဖြစ်သည်။ တစ်လုံးတိုင်များမှာ သာကေတ-ကျိုက္ကဆံလမ်းကြောင်း၏ အစိတ်အပိုင်းများဖြစ်ပြီး ထောက်တိုင်လေးခုသည် ချောင်း၏တစ်ဘက်တစ်ချက်ဆီရှိ 230 kV လိုင်းအားချိတ်ဆွဲမည်

ဖြစ်သည်။ ထောက်တိုင်နှစ်ခုဆီကို ချောင်း၏နေရာ နှစ်ခုတွင် တွေ့ရမည်ဖြစ်သည်။ အခြားသော ဖြစ်နိုင်ချေရှိသည့် အနောက်အယှက်များနှင့် အကျိုးသက်ရောက်မှုများမှာ သစ်ပင်များ ဖယ်ရှားခုတ်ထွင်ခြင်း၊ ဆူညံသံထွက်ပေါ်ခြင်း၊ ဖုန်မှုန့်များထခြင်း၊ ကားလမ်းများပိတ်ဆို့ခြင်း၊ အလုပ်သမား နှင့်အများပြည်သူတို့၏ ဘေးကင်းလုံခြုံစိတ်ချရမှုနှင့် မြေအချို့အသုံးချမှုများ ဆုံးရှုံးခြင်းတို့ဖြစ်သည်။

၇။ တောင်ဥက္ကလာပ ဓာတ်အားခွဲရုံနှင့် အနောက်ပိုင်းတက္ကသိုလ်ခွဲရုံသစ်တို့ တွင် 230kV in/out double circuit towers ပါဝင်မည်ဖြစ်ပြီး ၄င်းတို့သည် ဓာတ်အားခွဲရုံနှင့် ဆက်စပ်သော အထောက်အကူပြုအစိတ်အပိုင်းများဖြစ်သည်။ ၄င်းတို့ကို MEPE မှ တာဝန်ယူ ထောက်ပံ့မည်ဖြစ်ကာ ADB မှ ငွေကြေးထောက်ပံ့မည့် ဓာတ်အားခွဲရုံများနှင့် လုပ်ငန်းပိုင်းအရ ဆက်နွယ်နေသည်။ အသေးစိတ်ပုံစံများ ရေးဆွဲ၍မပြီးသေးသည့်အလျောက် ၄င်းဆက်စပ်အထောက် အကူပြု အစိတ်အပိုင်းများနှင့် စပ်လျဉ်း၍သီးခြားခန့်မှန်း၍ရသော သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ပြဿနာအကြောင်းအရာများမရှိပေ။ ၄င်းတို့၏ တည်ဆောက်ခြင်းနှင့် လုပ်ငန်းလည်ပတ်ခြင်း တို့သည် ဓာတ်အားခွဲရုံ၏တည်ဆောက်ခြင်းနှင့် လုပ်ငန်းလည်ပတ်ခြင်းတို့နှင့် ပေါင်းစပ်ပါဝင်နေသည်။

၈။ MEPE မှ နောက်ဆုံး ဆုံးဖြတ်ထားသော ဓာတ်အားလိုင်းလမ်းကြောင်းအသစ် နှင့် Fichtner အင်ဂျင်နီယာအဖွဲ့မှ လေ့လာတင်ပြထားသော ဓာတ်အားလိုင်းလမ်းကြောင်းများနှင့် ပတ်သတ်၍ ဖြစ်နိုင်ခြေရှိသည့် သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ အကျိုး သက်ရောက်မှုများအပေါ်တွင် သိသာထင်ရှားသော ခြားနားချက်မရှိပေ။ ၄င်းတို့ နှစ်ခုကြား ကွာခြားမှုရှိသော ဖြစ်နိုင်ချေရှိ အကျိုးသက်ရောက်မှုမှာ ဆောက်လုပ်ဆဲကာလတွင်ဖြစ်ပြီး ၄င်းတို့မှာ Fichtner မှအဆိုပြုသော မြေအောက်ကြိုးအသုံးပြုမည့်အပိုင်း၊ ပုစွန်တောင်ချောင်းကို ဖြတ်၍တည်ဆောက်ထားသော တံတားနှစ်ခု၏ အောက်နံဘေးမှတွဲ၍ ချိတ်ဆက်မည့် cable trays အစား ချောင်း၏ တစ်ဘက်တစ်ချက်စီတွင် ထောက်တိုင်တစ်ခုစီထား၍ ဓာတ်အားလိုင်း ချိတ်ဆက်ခြင်းတို့ ဖြစ်ပြီး ၄င်းတို့ကို တည်ဆောက်ခြင်းကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် အကျိုး သက်ရောက်မှုများနှင့် အနောက်အယှက်များသည် တည်ဆောက်ဆဲကာလအတွက် စံညွှန်းကုစားမှု လုပ်ဆောင်ချက်များဖြင့် လျော့ချကာ ကာကွယ်နိုင်မည်ဖြစ်သည်။

၉။ အနောက်ပိုင်း တက္ကသိုလ်တွင်တည်ဆောက်မည့် ဓာတ်အားခွဲရုံသစ်အတွက် စိုက်ပျိုးမြေအချို့ လိုအပ်မည်ဖြစ်ပြီး တောင်ဥက္ကလာပဓာတ်အားခွဲရုံသည် အစိုးရပိုင်မြေနေရာတွင်သာ တည်ဆောက် မည်ဖြစ်သည်။ 230 kV ဓာတ်အားလိုင်းသစ်ဆွဲခြင်းကြောင့် ခုတ်ရန်လိုအပ်မည့် အပင်များကို အစားထိုးစိုက်ရန်အတွက် MEPE သည် ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ (YCDC) နှင့်ပူးပေါင်းဆောင်ရွက်ရမည်။ ကျိုက္ကဆံခွဲရုံ၌ တိုးချဲ့တည်ဆောက်မည့် 230 kV

ဓာတ်အားလိုင်းအတွက် ထပ်ဖြည့်ရန်လိုအပ်သည့် စက်ပစ္စည်းကိရိယာများကို နေရာချထားရန် အစိုးရပိုင်မြေအနည်းငယ်တွင် တိုးချဲ့ရန်လိုသည်။

၁၀။ အဓိကသက်ဆိုင်သူများနှင့် လူထုတွေ့ဆုံဆွေးနွေးမှုများမှ ရရှိလာသော အဓိက စိုးရိမ်ပူပန်မှုများနှင့် အကြောင်းအရာများကို လေ့လာရာတွင် တည်ဆောက်ဆဲကာလတွင် အများပြည်သူနှင့် လုပ်သားတို့၏ ဘေးကင်းလုံခြုံမှု၊ လျှပ်စစ်ဓာတ်အားအန္တရာယ်ဖြစ်မှု၊ ဓာတ်အားတိုင်နှင့်ကြိုးတို့၏ လုပ်ဆောင်ချက်များယွင်းမှု၊ ပုစွန်တောင်ချောင်းနံဘေးတွင် တည်ဆောက်မည့် တိုင်အောက်ခြေတို့ကြောင့် ဖြစ်ပေါ်လာမည့် နန်းအနည်ပို့ချမှု၊ ဓာတ်အားခွဲရုံနှင့်ဓာတ်အားလိုင်းမှ ထွက်ရှိလာမည့် လျှပ်စစ်သံလိုက်စက်ဝန်း (EMF) ကြောင့်ဖြစ်ပေါ်လာနိုင်မည့် ကျန်းမာရေးထိခိုက်မှုများ၊ ယာဉ်ကြောပိတ်ဆို့မှု ပိုမိုဖြစ်ပွားလာနိုင်မှု၊ ဆောက်လုပ်ရေးလုပ်ငန်းခွင်အန္တီးတွင် ယာဉ်အန္တရာယ်ဖြစ်ပွားနိုင်မှု၊ အလုပ်သမားများနေထိုင်သည့်နေရာတွင် အမှိုက်နှင့် အညစ်အကြေးစီမံခန့်ခွဲမှုနှင့် အလုပ်သမားတို့၏ ကျန်းမာရေး စသည့်အချက်များသည် အဓိကကျကြောင်းတွေ့ရသည်။ အများပြည်သူနှင့် အလုပ်သမားတို့၏ ဘေးကင်းလုံခြုံစိတ်ချရမှုအား ဆောက်လုပ်ဆဲကာလတွင် ပြည့်စုံရှင်းလင်းစွာ ဖော်ပြထားရန်လိုအပ်သည်။

အဓိကသက်ဆိုင်သူများနှင့် တွေ့ဆုံဆွေးနွေးမှုများ ပြုလုပ်ရာတွင် EMF နှင့်ပတ်သတ်သော ကျန်းမာရေးဆိုးကျိုးဖြစ်ပေါ်နိုင်မှုကို အများစုက စိုးရိမ်ပူပန်ကြသည်။ ကမ္ဘာ့ကျန်းမာရေးအဖွဲ့ WHO ၏ နောက်ဆုံးလေ့လာချက်များအရ EMF ထိတွေ့မှုကြောင့် ကျန်းမာရေးဆိုးကျိုးဖြစ်ပေါ်နိုင်မှုမှာ လုံလောက်သော အထောက်အထားမရှိပေ။ WHO ၏တွေ့ရှိမှုအကျဉ်းချုပ်ကို နောက်ဆက်တွဲရည်ညွှန်း (E) တွင်ဖော်ပြထားပါသည်။ သို့သော် စီမံကိန်းပါ ခွဲရုံများနှင့် ဓာတ်အားလိုင်းများ ကင်းလွတ်အကွာအဝေး များကို အများလူထု အန္တရာယ်ကင်းရေးအတွက် နိုင်ငံတကာစံညွှန်း စနစ်များအတိုင်း လိုက်နာမည်ဖြစ်သည်။ ထို့အပြင် စီမံကိန်းတည်ဆောက်ဆဲနှင့် လည်ပတ်ဆဲကာလများတွင် EMF ကိုစောင့်ကြည့်တိုင်းတာရန်အတွက် စီမံကိန်း၏ ပုံစံတွင် ထည့်သွင်းစဉ်းစားထားသည်။

၁၂။ သဘာဝပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် (EMP) ကို 230 kV ဓာတ်အားလိုင်းသစ်နှင့် ဓာတ်အားခွဲရုံသစ်တို့အတွက် သဘာဝပတ်ဝန်းကျင် ကနဦးလေ့လာမှု၏ ရလာဒ်မှ သီးခြားရေးဆွဲထားပြီးဖြစ်သည်။ EMP တွင်ကုစားမှုအစီအစဉ်များ၊ သဘာဝပတ်ဝန်းကျင် စောင့်ကြည့်မှုအစီအစဉ်များ၊ EMP လုပ်ဆောင်ရန်အတွက် ခန့်မှန်းထားသော ကုန်ကျစရိတ်၊ စီမံကိန်းအစိတ်အပိုင်းများအတွက် သဘာဝပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအတွက် သက်ဆိုင်ရာဌာနများ၏ လုပ်ငန်းတာဝန်များနှင့် လိုအပ်သောစွမ်းရည်များပါဝင်သည်။ EMP လုပ်ဆောင်ရန်အတွက် ခန့်မှန်းချေကုန်ကျစရိတ်များမှာ 230 kV ဓာတ်အားလိုင်းများအတွက် အမေရိကန်ဒေါ်လာ 17,000 ဖြစ်ပြီး ဓာတ်အားခွဲရုံသစ်အတွက် အမေရိကန်ဒေါ်လာ 14,500 ဖြစ်သည်။ ၄င်းကုန်ကျစရိတ်များမှာ

အနည်းဆုံးလိုအပ်ချက်ဖြစ်သော ကွင်းဆင်းစစ်ဆေးခြင်းနှင့် မာတ်ခွဲခန်းတိုင်းတာမှုတို့အတွက် ဖြစ်သည်။ EMP အတွက် ကုန်ကျစရိတ်တွင် EMP လုပ်ငန်းဆောင်ရွက်မည့် အဖွဲ့အား သက်တန်းပို့ချမှုအတွက် အမေရိကန်ဒေါ်လာ 5,000 ပါဝင်သည်။

နိဂုံး

၁၃။ ကနဦး သဘာဝပတ်ဝန်းကျင် လေ့လာဆန်းစစ်မှုတွင် စီမံကိန်း၏ feasibility design နှင့် အကျိုးသက်ရောက်မှုခံစားရမည့် သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ရရှိထားသော အချက်အလက်များမှာ စီမံကိန်းကြောင့် ဖြစ်နိုင်ချေရှိသော သဘာဝပတ်ဝန်းကျင် အကျိုးသက်ရောက်မှုများကို လေ့လာဆန်းစစ်ရန်အတွက် လုံလောက်မှုရှိသည်။ တစ်ခုနှင့် အထက် စီမံကိန်းပါဝင်မှု အစိတ်အပိုင်းများ၏ ပုံစံများတွင် သိသာထင်ရှားစွာ ပြောင်းလဲမှုမရှိလျှင် ထိခိုက်မှုလွယ်သော သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုဘဝဆိုင်ရာ အကျိုးသက်ရောက်မှုများတွင် ဆက်လက်၍ သိသာသော ဆိုးကျိုးများဖြစ်မည်မဟုတ်သောကြောင့် ပိုမိုအသေးစိတ်လေ့လာရန်လိုအပ်သည့် သဘာဝပတ်ဝန်းကျင် အကျိုးသက်ရောက်မှုလေ့လာဆန်းစစ်ခြင်း (EIA) ကို ဆက်လက်လုပ်ဆောင်ရန် မလိုပေ။ ကနဦး သဘာဝပတ်ဝန်းကျင် လေ့လာဆန်းစစ်မှုမှ အကြံပေးလိုသည်မှာ စီမံကိန်း၏ အသေးစိတ်ပုံစံများ ရရှိလာသောအခါနောက်ဆုံး စီမံကိန်း၏ ပုံစံနှင့်ကိုက်ညီသော သဘာဝပတ်ဝန်းကျင် စီမံခန့်ခွဲမှုအစီအစဉ် (EMP) ဖြစ်ရန်အတွက် လက်ရှိ EMP ကိုဆက်လက်၍ မြှင့်တင်ပေးရန်လိုအပ်သည်။

I. EXECUTIVE SUMMARY

The Republic of the Union of Myanmar requested project preparatory technical assistance (PPTA) from the Asian Development Bank (ADB) to prepare the Power Transmission and Distribution Improvement Project (PPTA 8342 MYA). The PPTA includes environmental and social due diligence for the project, preparation of the required documents for the project investment, and a feasibility study of the rehabilitation and expansion of transmission and distribution networks in Myanmar.

The Ministry of Electric Power (MOEP) has identified two new 230 kV transmission lines, and two new substations to be constructed in Yangon. Similar to the distribution side of the PPTA, environmental due diligence and safeguards are required for the transmission side of the project which are reported herein.

Project Description

The transmission side of the project consists of two new 230 kV transmission lines to be constructed between the existing substations of Thida, Thaketa, and Kyaikasan in Yangon, and construction of two new substations in the West University area and in South Okkalapa Township in northwestern and north central Yangon, respectively.

A two-step iterative process was undertaken to determine the 230 kV transmission lines between Thida and Thaketa, and between Thaketa and Kyaikasan substations. The Myanmar Electric Power Enterprise (MEPE) determined the final right-of-ways (ROW) for the new 230 kV transmission lines from the ROWs that were initially identified by the Fichtner engineering team which used selection criteria of environmental and social impact (i.e., community safety, urban disturbance, resettlement, and land acquisition), and technical cost. The MEPE adjusted the Fichtner ROWs in order to prevent, or further reduce required resettlement, or land acquisition and compensation.

The same criteria of no, or minimal environmental impact, resettlement, and land acquisition were used to locate the sites for the new South Okkalapa and West University substations. Existing government land will be used as much as possible for the new 230 kV lines. The project components are summarized in box below.

Transmission Lines:

1. New 230 kV & 66 kV TL between Thida and Thaketa substations; double circuit transmission lines (230 kV single + 66 kV single)
2. New 230 kV TL between Thaketa and Kyaikasan substations; single circuit transmission line

Substations:

3. Equipment extension inside existing 230 kV Thaketa substation
4. Area expansion of existing 230/66/11 kV, 2 x 150 MVA Kyaikasan substation for installation of new equipment
5. New 230/66/11 kV, 2 x 150 MVA, South Okkalapa substation
6. New 230/33/11 kV, 2 x 150 MVA, West University substation

Potential Environmental Impacts and Mitigation Measures

Based on site visits, environmental data, and the project description, the initial environmental examination (IEE) of the final MEPE 230 kV transmission lines indicates that the environmental impacts will be restricted to short-term construction-related disturbances and impacts which can be mitigated. An example environmental impact during the construction phase that will need to be managed with standard mitigation measures is soil erosion and sedimentation of Pazundaung creek arising from the installation of the planned piled foundations of the estimated 10 - 13 mono and lattice transmission towers on the banks of the creek. The monopoles will form part of the Thaketa - Kyaikasan corridor while 4 lattice towers will suspend both 230 kV lines across the creek in two locations. Other disturbances and impacts concern tree removal, noise, dust, traffic disruption, public and worker safety, and loss of some land use.

There are 230kV in/out double circuit towers for the new South Okkalapa substation and the new West University substation which will be financed by the MEPE, and will be functionally linked to the ADB-financed substations. While the detailed designs are not complete, there are no anticipated specific environmental issues associated with the tower facilities, and the construction and operation of the tower facilities will be integrated with the construction and operation of the substations.

The final ROWs for the two 230 kV lines determined by MEPE, and the ROWs identified by the Fichtner engineering team do not differ significantly with respect to potential environmental impacts. The potential construction impacts of differences between the MEPE and Fichtner ROWs such as use of short underground sections of cable by Fichtner, and use of cable trays attached to undersides of two bridges to span Pazundaung creek versus use of lattice towers to suspend the cables over the creek can be mitigated with standard construction disturbance mitigation measures.

Some agricultural land will be required for the West University substation site, whereas, the new South Okkalapa substation will be built primarily on government land. The MEPE in collaboration with the Yangon City Development Committee (YCDC) will need to develop a tree planting program to replace the trees that will need to be removed for the new 230 kV transmission lines along major streets in Yangon. Conversely, no tree removal will be required to build the new substations. The small extension to the existing Kyaikasan substation to accommodate new equipment for the new incoming 230 kV transmission line will occur on government land.

The concerns and issues identified during the public and stakeholder consultations focused on public and worker safety during the construction of transmission towers and substations, risk of electrical shock and failure of transmission towers and cables, sedimentation of Pazundaung creek from construction of the tower foundations built on the banks of the creek, the negative health effects of electromagnetic fields (EMF) emanating from transmission lines and substations, increased traffic and risk of traffic accidents near construction sites, and work camp waste management and worker health. Worker and public safety needs to be explicit during the construction phase.

The frequent concern expressed by the public and stakeholders of negative health effects of EMF exposure prompted the IEE to consult the literature to clarify the validity of the issue. The recent extensive review by the World Health Organization of the health effects of EMF exposure indicated that the existing international research literature on health effects of

EMF is inconclusive. The WHO summary of their findings is provided in Appendix E. However, despite the WHO findings the clearances and distances from the new transmission lines and substations from public areas will follow national and international standards and code. Further, monitoring of EMF during the construction and operation of the new transmission lines and substations is included in the design of the project.

An environmental management plan (EMP) has been prepared for the implementation of the 230 kV transmission lines and the two substations to support the results of the IEE. The EMP shall form part of the bid documents and contracts. The EMP provides a separate Impacts Mitigation Plan, and an Environmental Monitoring Plan for the transmission lines and substations, indicative costs for EMP implementation, and specifies the institutional responsibilities and capacity needs for environmental management of the project components. The total estimated cost to implement the EMP is USD $33,940 with $18,220 for the 230 kV lines, and $15,720 for the substations. The cost of the EMP includes an indicative budget of $10,000.00 for training of the implementing agency for implementation of the EMP.

Environmental Due Diligence of Existing Substations

Environmental due diligence of the existing substations of Thida, Thaketa and Kyaikasan was conducted in accordance with the requirements of ADB SPS (2009) to determine existence of any areas which may cause or is causing environmental risks or impacts. Audit findings reveal that the Thida and Kyaikasan substations are owned and operated by the YESB while the Thaketa substation is owned by MOEP.

Areas for improvement in the management of the environment, health and safety were observed and could be considered in the design and operation of the proposed ADB-funded project. Among the major areas for improvement are related to compliance with environmental laws of Myanmar, management of hazardous wastes (used oil and old batteries), preventing oil spills/leaks, fire prevention, ensuring occupational and community health and safety, and monitoring of electromagnetic field (EMF). An institutional plan to strengthen the capacity of MOEP on the aspect of environmental management is recommended. Details of the environmental due diligence is presented in Appendix F.

Conclusions

The IEE indicates that the feasibility design of the project combined with available information on affected environments is sufficient to identify the scope of potential environmental impacts of the project. Providing that significant changes do not occur to the design of one or more of the project components, and that affected sensitive environmental or social receptors are not subsequently discovered, the project retains the Category B status for environment, and further detailed environmental impact assessment (EIA) of the project is not required. The IEE recommends that the EMPs for the project be reviewed and updated at the detailed design phase of the project to ensure that the EMPs meet the final project design.

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II. INTRODUCTION

A. Background to IEE

1. The Government of the Republic of the Union of Myanmar requested project preparatory technical assistance (PPTA) from the Asian Development Bank (ADB) to prepare the Power Transmission and Distribution Improvement Project (PPTA 8342 MYA). This includes performing required due diligence of the project, preparation of the relevant project documents for an investment project, and a feasibility study of the rehabilitation and expansion of transmission and distribution networks in Myanmar.

2. The project will prepare a comprehensive investment plan for the improvement of the power transmission and distribution systems as well as prepare a feasibility study for rehabilitation and expansion of the existing system. The PPTA is assessing: (i) the power demand projections; (ii) the losses including loss reduction program; (iii) capacity and staff skills in the power sector, training needs, and scope for short and long term training plans; and (iv) in identifying imperative rehabilitation and expansion of transmission and distribution projects.

3. The Loan 3084: MYA Power Distribution Improvement Project was approved in December 2013 by the ADB Board. The loan supports the distribution side of the original PPTA. The Initial Environmental Examination (IEE) presented herein addresses the power transmission side of PPTA 8342.

4. Similar to the distribution side of the PPTA, due diligence for the transmission side of the project includes complete social and environmental safeguards requirements. The Myanmar Electric Power Enterprise (MEPE) has confirmed two new 230 kV transmission lines (TL) between the existing Thida, Thaketa, and Kyaikasan substations in Yangon are required. In addition to the two 230 kV TLs, two new substations are required in South Okkalapa Township, and West University area in north central and northwestern Yangon, respectively.

B. Assessment Context

5. The project has been assigned Environmental Category B pursuant to the ADB's Safeguard Policy[1] and recent good practice sourcebook guidance[2]. Appendix A provides the results of the rapid environmental assessment (REA) of the project including climate sensitivity. A category B project will have potential adverse impacts that are less adverse than the impacts of category A project, are site-specific, largely reversible, and can be mitigated with the project environmental management plan (EMP)[3]. The IEE was prepared for the project in the feasibility design stage, using available data and information on sensitive ecological and cultural receptors in the subproject sites that were provided by the Ministry of Environment, Conservation and Forestry (MOECAF), and the Yangon City Development Committee (YCDC).

C. Existing Impact Footprints

6. The two new 230 kV transmission lines will be located in or near the ROWs of existing 66 kV overhead (OHL) transmission lines in urban Yangon. Similarly, the sites of the two

[1] ADB, 2009. Safeguard Policy Statement, ADB Policy Paper.
[2] ADB, 2012, Environmental Safeguards, A Good Practice Sourcebook, Draft.
[3] Footnote 2, pg 19.

substations to be constructed at South Okkalapa Township and West University area are in urban/peri-urban environments. Thus, the potential environmental impacts of the new 230 kV lines, and new substations will be marginal to the existing impact footprints of the existing transmission lines and overall urban impact footprint of the city.

III. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. Myanmar Regulatory Framework for Environmental Assessment

7. Formal directives for conducting environmental impact assessment (EIA) in support of the Environmental Conservation Law (ECL)[4] of Myanmar are evolving. In place to govern EIA are the draft EIA rules[5] or guidelines that the Ministry of Environment, Conservation and Forestry (MOECAF) prepared which support the ECL. Prior to the issuance of the draft EIA rules, the conduct of an EIA was not a requirement for development projects in the country.

8. Notwithstanding the draft status of the EIA rules, the Ministry of Electric Power (MOEP) will be obliged to apply the draft rules in their preparation of the required EIA for the project pursuant to the ECL[6]. The existing draft rules have been developed to meet international standards.

9. Briefly, all projects undertaken by a ministry, government department, organization, corporation, board, development committee, local government or authority, company, cooperative, institution, enterprise, firm, partnership or individual that could cause significant adverse environmental or social impacts are subjected to screening for either and IEE or EIA, and ultimately require an Environmental Compliance Certificate (ECC) from MOECAF before being allowed to proceed. The EIA process involves (i) screening, (ii) scoping for EIA, (iii) EIA/IEE preparation and review, (iv) EIA/IEE approval, and (v) appeal. Before an EIA or IEE is prepared, a project proposal together with the profile of the organization and/or persons to undertake the IEE/EIA investigation and reporting must be submitted to the MOECAF in Naypyitaw. The project proposal is screened by MOECAF using mostly quantitative criteria annexed to the EIA rules to determine whether a project requires an EIA or "lighter assessment" of an IEE. The impact assessment thresholds for new transmission lines and substations from Annex 1 of the draft EIA rules are summarized in Table 1.

Table 1. Assessment thresholds for new transmission lines and substations

Economic Activity	Level of Assessment Required
230 kV Transmission Lines	
< 50 km	IEE
≥ 50 km	EIA
230 kV Substations	
< 10 ha	IEE
≥ 10 ha	EIA

From Annex 1 of Draft EIA Rules (4th edition)

[4] Environmental Conservation Law, the Pyidaungsu Hluttaw Law No. 9 - March 30, 2012

[5] Government of Republic of Union of Myanmar, 2013. MOECAF, Draft Environmental Impact Assessment Procedure, Draft 19, 25 pgs + annexes, May 15, 2013.

[6] Requirement of MOEP to prepare EIA with draft rules confirmed by MOECAF during data collection mission; 29/04/14

10. Table 1 indicates that the proposed 230 kV Thida – Thaketa - Kyaikasan transmission lines will require an IEE given the overall length of each transmission line will not exceed 50 km. South Okkalapa substation with an area of approximately 5.8 ha and the West University substation with an area of 0.8 ha will also require an IEE.

11. Formal public and stakeholder consultation, and disclosure of the project is specified by the draft EIA rules. At least two consultation meetings are held: the first consultation occurs at the beginning of EIA process when the project is introduced and comments are solicited from affected public and stakeholders; and the second consultation occurs after the draft IEE/EIA is completed and when the draft results are presented to the public and stakeholders. A translated summary of the draft EIA/IEE report is distributed during the second consultation. The results of both meetings are addressed in the final IEE/EIA. A copy of the summary of the final EIA/IEE report is provided to General Administrative Offices (GAOs) of affected townships and to MOECAF Yangon in Burmese language.

B. Pertinent Laws, Policy, and Standards for Environmental and Management

12. At the level of the Union [National] the Environmental Conservation Law (2012) provides the basis for the conservation and protection of the natural environment of Myanmar including the marine environment. The ECL provides the common principles of environmental conservation and for other environmental laws and policy. The Environmental Conservation Committee (ECC) within the MOECAF was formed to oversee implementation, enforcement, and further development of the ECL including providing education and assistance to government agencies and proponents with the requirements of the ECL. The ECC also plays a lead role in managing environmental disputes.

13. The recently prepared Yangon Strategic Development Plan[7] provides a comprehensive description of the current legal and regulatory framework for management of the city in addition to planned development visions to 2040. Policy or regulations for environmental management in Yangon are not well developed. The Yangon Development Law (1990) provides the foundation for environmental management through the development responsibilities of the Yangon City Development Committee (YCDC). The YCDC is the executing agency formed to implement the Development Law, and is comprised of approximately 20 departments which oversee all infrastructure development and municipal services in the city. The YCDC is supported by a set of municipal Notifications [bylaws] that govern urban development activity which also prescribe the status quo of environmental management.

14. The environmental laws and policies of Yangon and Myanmar pertinent to the Power Transmission and Distribution Improvement Project (TA 8342 MYA) are listed in Tables 2 and 3. Government directives for land ownership and transfer, compensation, resettlement, or community or public consultation are found in the resettlement Plan (RP) which has been prepared in a separate report.

[7] Nippon Koei, 2013. Strategic Urban Development Plan of Great Yangon, 852 pgs.

Table 2. Environmental protection laws and policies of Yangon

Yangon Municipal

- The City of Yangon Development Law, 1990

- YCDC Notifications [bylaws]:
  1999-
    i. No. 4: Health
    ii. No. 6: Water and Sanitation
    iii. No. 8: Playgrounds Parks, and Gardens
    iv. No. 9: Buildings and Structures
    v. No. 10: Pollution Control and Cleansing
    vi. No. 11: Roads and Bridges
  2001-
    vii. No. 3: City Planning and Land Administration

- YCDC Zonal and Roadside Regulations:
  a. Area for Shwe Dagon Pagoda
  b. Area for Shwe Bone Pwint pagoda
  c. Buildings in Tamwe / Myttar Nyunt Townships
  d. Khint Shwe Wa Road, Kamayut Township
  e. Shin Saw Pu Road, San Chaung Township

- YCDC Yangon City Heritage Building List
  - 189 heritage buildings
  - Yangon Heritage Zone, 94 ha

Table 3. Environmental protection laws and policies of Myanmar

National

- Electricity Law, 1984 – (draft update 2013)
- Environmental Conservation Law, 2012
- Agricultural Land Law, 2012
- Vacant, Fallow, Virgin lands Management Law, 2012
- Conservation of Water Resources and Rivers Law, 2006
- National Forest Action Plan, 2001
- Forest Policy, 1995
- Forest Rules, 1995
- Forest Law, 1992
- Fertilizer Law, 2002
- Protection and Preservation Cultural Heritage Region Laws, 1998
- Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law, 1994
- National Environmental Policy, 1994
- Natural Area Law, 1994
- Freshwater Fisheries Law, 1991
- Pesticide Law, 1990
- Public Health Law, 1972
- Burma Wildlife Protection Act, 1936

Electricity Law of 1984

15. The Myanmar Electricity Law (1984) and the Electricity Rules (1985) were issued for power infrastructure development. The law elaborates the responsibilities of the Inspectorate under the Ministry of Industry for ensuring safety in electricity in generation, transmission and distribution. It includes the testing of all electrical goods produced domestically or imported. If safety is at risk the Inspector has the authority to disconnect supply to any customer. The Inspector also is responsible for determining cause of any injury or death caused by electricity, issuing electrician registration certificates, and establishing standards.[8]

16. Safety clearances prescribed by Clause 76, 77, 80 and 81 of the Electricity Law for 230 kV transmission lines and substations are summarized in Table 4.

Table 4. Safety clearances for 230 kV transmission lines and substations

	Minimum Safety Clearance
Horizontal distance from building	50 ft (15.24 m)
Vertical distance from building	16 ft (4.88 m)
Allowable height of electrical wire for vehicle entry	22 ft (6.70 m)
Min. height if parallel to any road, pavement, street in villages and other narrow lanes	24 ft (7.31 m)
Min. height of electrical wire on any pavement, street in villages, and other narrow lanes	25 ft (7.62 m)
Passing across railway Other requirements: - pass railway at right angle - medium voltage transmission lines must cross horizontal (parallel) and not into the railway area - lightning poles should be 1.5 times its length from the railway	120 ft (36.58 m)
Transmission line vertical distance between each line for 66kV and 230 kV	8 ft (2.44 m)

From Clauses 76, 77, 80, and 81 of Electricity Law

C. Environmental Standards

17. Environmental quality standards are under development by the MOECAF. Currently environmental standards exist for national surface water quality, and wastewater quality for Yangon (Appendix B). The 2012 ECL requires the development of environmental standards for air quality, noise and vibration, wastewater quality, surface water quality, groundwater quality, and drinking water quality. Several ministries have proposed environmental standards for air quality, water quality, and effluents which are still being drafted with estimated promulgation by

[8] Building Institutional Capacity of Ministry of Electric Power. Technical Assistance Consultant's Report Myanmar: Capacity Development and Institutional Report. Anil Terway. Project Number 46254. August 2013.

MOECAF in March 2015. For other environment standards MOECAF defers to the standards of IFC or WHO. Table 5 summarizes draft standards proposed by various ministries.

Table 5. Draft standards proposed by Ministries

Ministry	Environmental Quality Standards
Ministry of Health	Air quality, noise and vibration, drinking water quality
Ministry of Energy	Air pollutants, noise and vibration (from coal power plants), air quality standards, wastewater for general industries
Ministry of Industry	Ambient air quality, wastewater quality
Ministry of Mines	Surface water quality, groundwater quality, air quality, dust, wastewater
Ministry of Labour	Adoption of National Occupational Health and Safety Profile, ASEAN-OSHNET, 2006

D. International Environmental Conventions and Agreements

18. Myanmar is signatory to the following international agreements.

- Convention Concerning the Protection of the World Cultural and Natural Heritage
- Montreal Protocol on Substances that Deplete the Ozone Layer & all amendments
- Stockholm Convention on Persistent Organic Pollutants
- Convention on Biological Diversity
- Cartegena Protocol on Biosafety
- International Tropical Timber Agreement
- Ramsar Convention on Wetlands
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- ASEAN Agreement on the Conservation of Nature and Natural Resources
- United Nations Convention to Combat Desertification
- United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol
- ASEAN Agreement on Transboundary Haze
- Global Tiger Forum, India in August 1994.

E. Overview of Forest Management in Myanmar

19. The National Forest Policy (1995) supports a diversity of eight different forest types ranging from mangrove and dune forests, coniferous & deciduous forests, and Dry Zone forests at mountainous elevations and at sea level which are comprised of a range of different species (see section IV). The primary forest management classifications are: 1) the permanent forest estate (PFE); and non-permanent forest estate (NPFE)[9] as distinguished as follows:

Permanent Forest Estate

- Reserved Forest
    - Protected Area System (parks, reserves, sanctuaries)

[9] Adapted from EFI, 2011. Overview of Forest Law Enforcement, Governance and Trade, Baseline Study 4, Myanmar

    - Plantations (e.g., domestic-commercial, export), watershed maintenance
    - Local community supply/use
    - Closed Forests
- Protected Public Forest
    - Alternate protection of trees and restricted land use in non-reserved lands

Unclassified or Non-permanent Forest Estate

- Open Forests
- Other woodland area

20. There are no permanent estate forests in project area in Yangon. The remaining treed areas near the project areas are classified as unregulated unclassified urban renewal forest areas.

IV. PROJECT DESCRIPTION

21. The scope of the project is summarized by the project components listed in Table 6.

Table 6. Summary of Project Components

Transmission Lines:

1. New 230 kV & 66 kV TL between Thida and Thaketa substations; double circuit transmission lines (230 kV single + 66 kV single); 8.5 km
2. New 230 kV TL between Thaketa and Kyaikasan substations; single circuit transmission line; 8.6 km

Substations:

3. Equipment extension inside existing 230 kV Thaketa substation
4. Area expansion of existing 230/66/11 kV, 2 x 150 MVA Kyaikasan substation for installation of new equipment
5. New 230/66/11 kV, 2 x 150 MVA, South Okkalapa substation; 5.8 ha
6. New 230/33/11 kV, 2 x 150 MVA, West University substation; 0.8 ha

22. The locations of the two new 230 kV transmission lines and two new substations in Yangon are shown in Figure 1. The work on Thaketa substation property consists of installation of new equipment and transformer bays required to receive the new 230kV line from Thida substation.

23. A two-step iterative process was undertaken to determine the final 230 kV transmission lines between Thida and Thaketa, and between Thaketa and Kyaikasan substations. The MEPE determined the final ROWs for the 230 kV transmission lines which used selection criteria of environmental and social impact (i.e., community safety, urban disturbance, resettlement, and land acquisition), and technical cost. The MEPE adjusted the final ROWs in order to prevent, or further reduce required resettlement, or land acquisition and compensation. In addition, the final MEPE 230 kV lines do not include UGC sections. The final ROWs for the 230 kV lines are shown in Figures 2 and 3.

24. The same criteria of no, or minimal environmental impact, resettlement, and land acquisition were used to locate the sites for the new South Okkalapa and West University substations (Table 6). Existing government land will be used as much as possible for the new 230 kV lines and new substations as exemplified by the location of the Kyaikasan substation extension, and locations of West University and South Okkalapa substations (Figures 4 and 5).

A. General Design Criteria of 230 kV transmission lines

25. Design criteria for the two new 230 kV transmission lines to prevent or minimize potential negative environmental and social impacts are summarized in Table 7.

Table 7. General design criteria of 230 kV lines to minimize impacts[10].

* Practice care when traversing or passing close through urban Yangon, in particular avoidance of schools, public buildings, market places, shrines, historical places;
* Use monopole towers of reduced height to minimum environmental impact footprint of lines;
* Keep electrical field, magnetic field, audible noise and TV interference as far as possible below national / international accepted levels (see below);
* Minimize potential impact on urban trees and gardens, and valued cultural property;
* Minimize line access tracks through property;
* Specify stone gabion retaining structures rather than concrete in order to control possible slope stability and erosion; and
* Specify stabilization and recovery of disturbed areas using natural materials (straw mulch, grass, shrubbery).

[10] Adapted from Fichtner Final Report, 10/14.

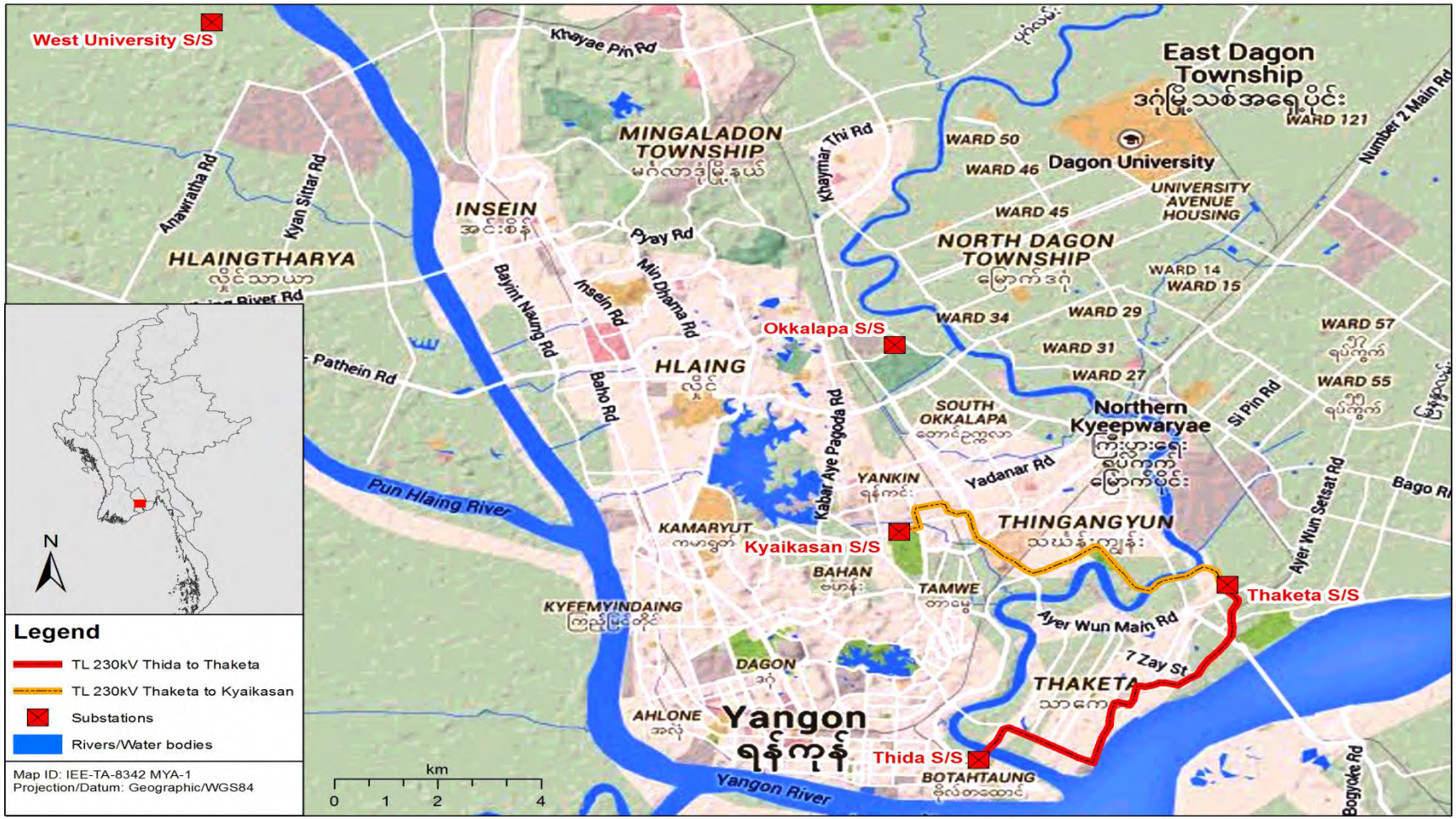


Figure 1. New 230 kV transmission lines, and South Okkalapa and West University S/S

Figure 2. The 230 kV transmission line between Thida and Thaketa substations

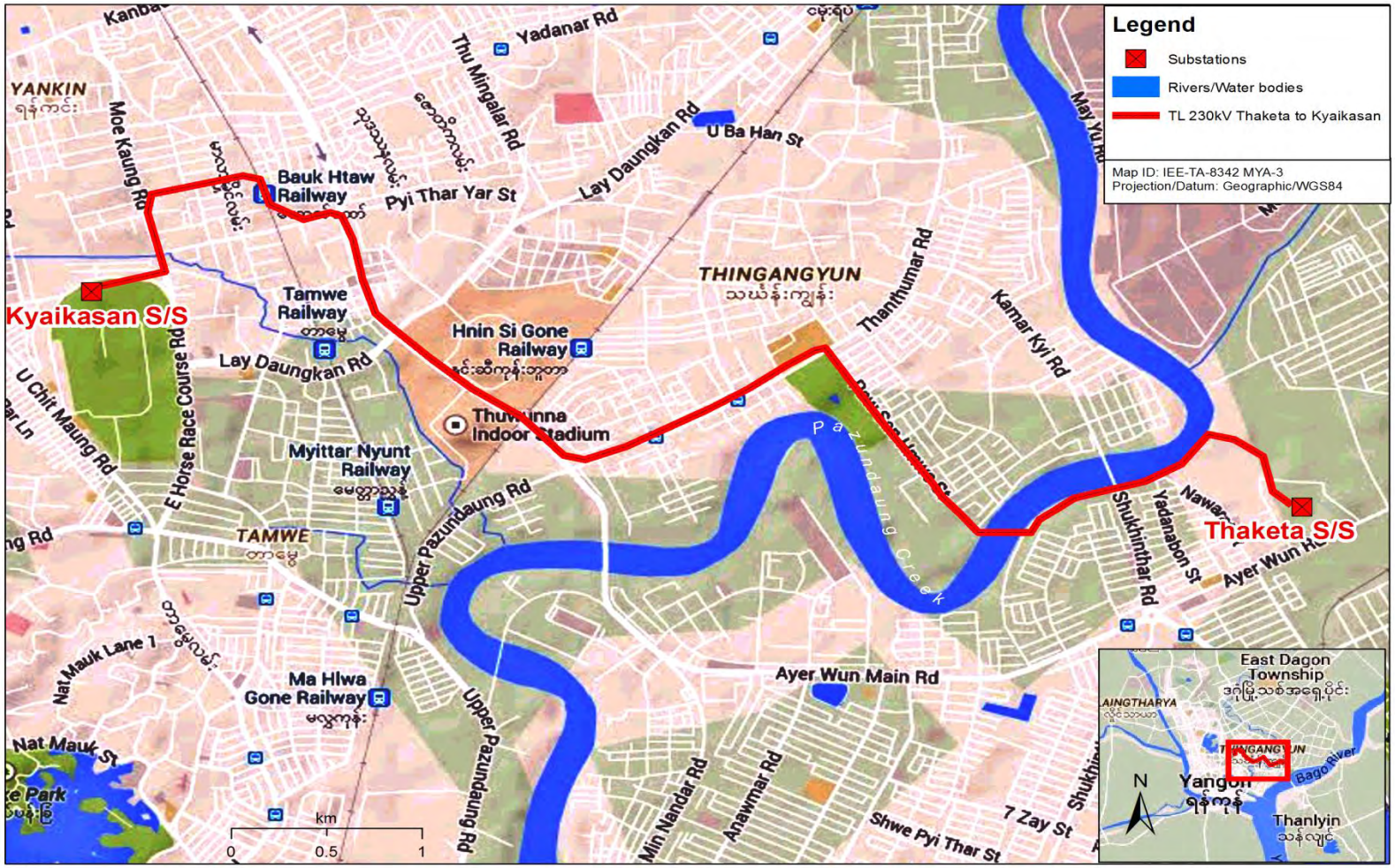


Figure 3. The 230 transmission kV line between Thaketa and Kyaikasan substations

Figure 4. Indicative new equipment expansion area (----) of Kyaikasan substation

Figure 5a. Site of new South Okkalapa substation

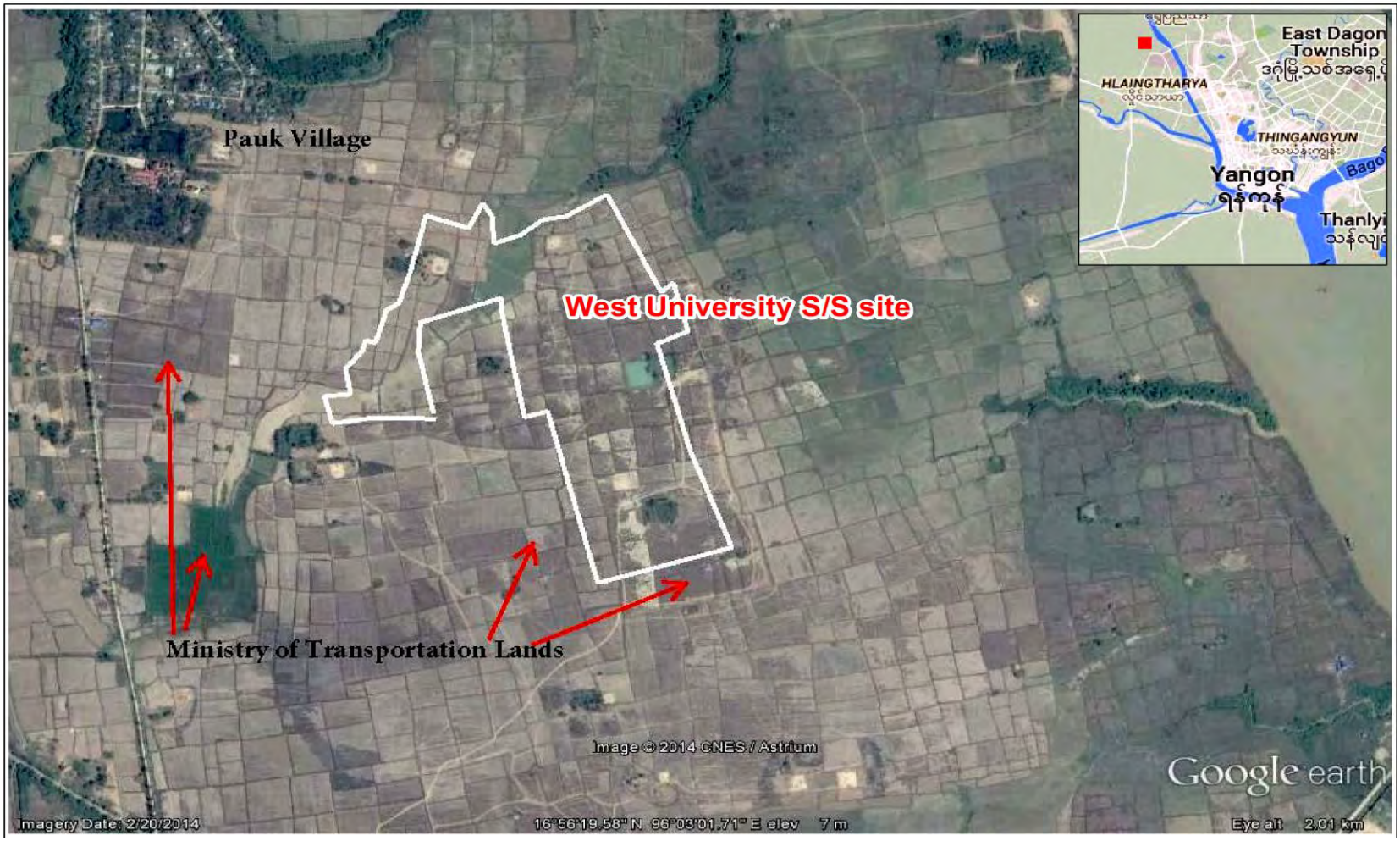


Figure 5b. Site of West University substation

26. The right of way (RoW) of the transmission lines, occasionally called wayleave, is the width of the line corridor required for safe operation. It is defined by the line's environmental impact and by line insulation requirements. At the edge of the RoW corridor, the electric and the magnetic field strength shall not exceed the allowable limits. The electrical clearances to various types of obstacles shall be maintained as required by Myanmar regulations and applicable international norms. The EN 50341-1:12 is proposed as a governing standard, providing an integral approach to the design of overhead lines.

27. The basic design specifications of the overhead transmission line are as follows:

- Conductor 230 kV - 1 - ACCC 463 mm^2, Stockholm;
- Conductor 66 kV - ACCC or existing standard 66kV;
- One OPGW24 similar to GSW 19/2.7 or ACS 70 mm^2;
- Insulators: solid polymer silicone rod (shorter option) or post insulators;
- Supports: steel monopoles, compact design, shorter nominal spans in order to reduce sags and enable monopole design with reduced diameter at bottom (up to 1.4 m),
- Two circuits (230 + 66 kV) on short cross-arms or on post insulators;
- Foundations: concrete, cast in-situ, drilled pylon foundation or driven piles with the cap slab;
- Right of way ca 20 m;
- Added physical impact protection at the base of monopoles (due to traffic);
- Soil types: deleterious, dusty, sandy silts and tills; high water table, possible foundation problems, geotechnical report and piles testing will be required.

B. Specific Design Considerations for the 230 kV transmission lines

1. 230 kV line between Thida and Thaketa substations

28. The new 230 kV line between Thida and Thaketa substations will follow the existing 66 kV route. It is anticipated that the 66 kV line will be decommissioned after the new 230 kV line is installed. Options of different ways to manage the 66 kV line during construction of the 230 kV line in order to prevent power disruption in the area have been identified and need to be finalized. After leaving Thida substation the 230 kV line will cross the Pazundaung creek suspended from large lattice towers parallel to the existing suspended 66 kV line just north of the Maha Bandoola bridge (Figure 2 and 22). From the bridge the 230 kV line follows the existing 66 kV line along the Yamo Nnar and Shukhinthar roads with some divergence across green space to eventually enter Thaketa substation. The alignment stays close to roadways thereby minimizing resettlement and land acquisition, and does not include underground (UGC) sections of cable.

29. The monopoles along Thida – Thaketa line will have the following spatial characteristics:[11]

- Estimated pole height 22.50 m
- Estimated diameter at ground 1.40 m
- Standard distance bottom conductor to ground 9.10 m
- Distance between phases 3.10 m
- Horizontal distance pole to conductor 230 kV 2.40 m

2. 230 kV Line between Thaketa and Kyaikasan substations

30. The installation of a new 230 kV line between Thaketa and Kyaikasan substations shares similar challenges as the line between Thida and Thaketa substations. The existence of the operational 66 kV line will also require consideration of temporary bypasses while the 230 kV is installed in order to prevent local power outages. The existing 66 kV line will be decommissioned after the new 230 kV line is activated.

31. Figure 3 shows the alignment of the 230 kV line between Thaketa and Kyaikasan S/S. From Thaketa substation the line travels north through a short green space before following the south shore of Pazundaung creek before being suspended across the creek to Paw San Hmay Road on heavy lattice towers. From Paw Hmay Road the line turns along Thuwunna Street and then along Waizayandar Road where center median towers are proposed. The alignment traverses minor roads, crosses the railway, and enters the Kyaikasan substation along Moe Kaung Road and North Horse Race Course Road. The line does not include UGC sections. Similar to the Thida – Thaketa line the alignment between Thaketa and Kyaikasan was located to prevent, or minimize resettlement and land acquisition.

32. The monopoles along Thaketa – Kyaikasan line will have the following spatial characteristics:

- Estimated pole height 19.75 m
- Estimated diameter at ground 1.40 m
- Standard distance bottom conductor to ground 9.10 m
- Distance between phases 3.10 m
- Horizontal distance pole to conductor 2.40 m

C. South Okkalapa Substation

33. The South Okkalapa site is bounded by the Ministry of Information lands to the west, Okkala Golf Course to the south, and a road and residential area to the east and northeast (Figure 5). The new substation will be looped into the 230 kV line Thaketa S/S - Hlawga S/S. The substation will occupy an area of approximately 6.3 ha and consist of the following components[12]:

- two (2) 230 kV line feeder bays (fully equipped)
- two (2) 230 kV metering bays (fully equipped)
- two (2) 230/66 kV transformer feeder bays (fully equipped)

[11] From Fichtner final report 11/14
[12] Footnote 12

- two (2) 230/66/11 kV, 150 MVA transformers
- six (6) 66 kV overhead line feeder bay
- one (1) 66 kV bus coupler (fully equipped)
- two (2) 66 kV metering bays (fully equipped)
- substation power supply (MV and LV AC/DC distributions, battery systems etc.)
- control & protection, SCADA, fiber optic telecommunication
- cabling
- grounding
- substation control building (incl. auxiliary systems)
- civil works (foundations etc.).

D. West University Substation

34. The 230/66/11 kV West University Substation will be an extension of the planned 500/230 kV Hlangtharyar / Shwelinpan S/S. The adjacent land is owned by Ministry of Transport (MOT). Pauk village is located northwest of the site with Kone village located just west of the MOT lands (Figure 5). The substation will occupy a total footprint of approximately 34 ha which will consist of the following components[13]:

- access road 445 m X 15 m to site
- two (2) 230 kV line feeder bays (fully equipped)
- two (2) 230 kV metering bays (fully equipped)
- two (2) 230/66 kV transformer feeder bays (fully equipped)
- two (2) 230/66/11 kV, 150 MVA transformers
- six (6) 66 kV overhead line feeder bays
- one (1) 66 kV bus coupler (fully equipped)
- two (2) 66 kV metering bays (fully equipped)
- substation power supply (MV and LV AC/DC distributions, battery systems etc.)
- control & protection, SCADA, fiber optic telecommunication
- cabling
- grounding
- substation control building (incl. auxiliary systems)
- civil works (foundations etc.).

V. DESCRIPTION OF AFFECTED ENVIRONMENTS

35. All the components of the proposed project will be implemented within the jurisdiction of Yangon Region. This chapter describes the existing environmental conditions at the project sites and surrounding areas where the proposed substations and transmission lines will be located.

[13] Footnote 12

A. Physical Resources

36. The Union of Myanmar is a republic in Southeast Asia that is bounded on the north by the Tibet Autonomous Region of China; on the east by China, Laos, and Thailand; on the south by the Andaman Sea and the Bay of Bengal; and on the west by the Bay of Bengal, Bangladesh, and India. Myanmar is located between 09°32'N and 28°31'N latitudes and 92°10'E and 101°11'E longitudes[14].

37. The country covers a total land area of 676,552 km^2 [15]. The country is administratively divided into 7 states, 7 regions, 1 union territory, 5 self-administered zones, and 1 self-administered division. It consists of 70 districts, 330 townships, 84 sub-townships, 398 towns, 3,063 wards, 13,618 village tracts, and 64,134 villages.[16]

38. Yangon is one of the regions of Myanmar. It is composed of Yangon City and periphery areas, divided into four districts and 33 townships. The Northern District is composed of the townships of Mingaladon, Shwepyitha, Hlaintahaya, Insein, Mayangon, Hlaing, and Kamayut. The Eastern District comprises of the townships of North Okkalapa, East Dagon, North Dagon, South Okkalapa, South Dagon, Dagon Seikkan, Thingangyun, Pazundaung, and Botataung. The Western District is composed of Bahan, Kyimyindanig, Sanchaung, Dagon, Ahlone, Lanmadaw, Latha, Pabedan, Kyaukdata, and Seikkan while the Southern District is composed of Seikkyi Kanaungto, Dala, Yankin, Tamwe, Mingala Taungnyunt, Thaketa, and Dawbon.

1. Geography

230 kV Thida – Thaketa - Kyaikasan Transmission Line

39. The proposed 230 kV Thida-Thaketa-Kyaikasan Transmission Line will traverse the townships of Dawbon, Tamwe, Thaketa and Yankin in the Southern District and the townships of Botahtaung, Pazundaung, and Thningangyun in the Eastern District.

40. The corridor of the Thida-Thaketa segment of the transmission line will traverse the southeastern section of Yangon (Figure 2). From Thida substation in Botahtaung township, the transmission line will cross the Pazundaung creek and will run parallel to the existing 66kV transmission line. The alignment will traverse the Yamo Nnar Road and the Shukhinthar Myo Pat Road before it connects to the Thaketa substation.

41. The preliminary design of the alignment of the 230kV Thida-Thaketa transmission line will traverse 13 wards and 4 townships, as outlined in Table 8 and presented in Figure 6.

Table 8. Wards and Townships along 230 kV Thaketa-Thida line

Towers and Substations	Ward	Township
Thida Substation	No. 3	Botahtaung
T-1	No. 4	Pazundaung
T-2, T-3, T-4, T-5, T-6, T-7, T-8, T-9, T-10, T-11, T-12	La Mu Tan	Dawbon

[14] Country Profile, Health in Myanmar, 2013
[15] http://www.myanmartourism.org/FactsaboutMyanmar/index.htm
[16] Country Profile, Health in Myanmar, 2013

Towers and Substations	Ward	Township
T-13, T-14, T-15, T-16, T-17, T-18, T-19, T-20, T-21, T-22, T-23, T-24, T-25, T-26	Myo Thin	Dawbon
T-27, T-28, T-29, T-30, T-31, T-32, T-33, T-34, T-35, T-36, T-37, T-38	Yamonena (2)	Dawbon
T-39, T-40, T-41	No. 3 (Yanpyae)	Dawbon
T-42, T-43, T-44, T-45, T-46, T-47, T-48, T-49, T-50	No. 3 (Manpyae)	Dawbon
T-51, T-52	No. 4 (South)	Thaketa
T-53, T-54, T-55, T-56, T-57	No. 4 (North)	Thaketa
T-58	No. 5	Thaketa
T-59, T-60, T-61	No. 6 (East)	Thaketa
T-62, T-63, T-64, T-65, T-66	No. 10 (South)	Thaketa
T-67, T-68, T-69	No. 10 (North)	Thaketa
Thaketa Substation	No. 9	Thaketa

42. Based on the preliminary design of the alignment, the segment from Thaketa substation to Kyaikasan substation will traverse 12 wards and 4 townships. Table 9 presents the wards and townships along the Thaketa-Kyaikasan transmission line while Figure 7 presents the alignment from Thaketa substation to Kyaikasan substation.

Table 9. Wards and Townships along the 230 kV Thaketa-Kyaikasan line

Substations and Towers	Ward	Township
Thaketa Substation	No. 9	Thaketa
T-1, T-2, T-3, T-4, T-5, T-6, T-7, T-8, T-9	No. 9	Thaketa
T-10, T-11, T-12, T-13, T-14	No. 8	Thaketa
T-15, T-16, T-17, T-18, T-19, T-20, T-21, T-22, T-23, T-24	Thwana (29)	Thingangyun
T-27, T-28, T-29, T-30, T-31, T-32, T-33, T-34, T-35, T-36, T-37, T-38, T-39	Supaung	Thingangyun
T-25, T-26	Thwana (25)	Thingangyun
T-40, T-41, T-42, T-43, T-44, T-45	Sa/Thu Mingalar	Thingangyun
T-46, T-47, T-48, T-49, T-50, T-51	Mi Gyaung Kan (1)	Thingangyun
T-52, T-53, T-54, T-55	Mi Gyaung Kan (2)	Thingangyun
T-56, T-57, T-58	No. 16	Yankin
T-59, T-60, T-61, T-62, T-63	No. 13	Yankin
T-64, T-65, T-66, T-67	No. 15	Yankin
T-68, T-69, T-70	Tamwe Gyi Kha	Tamwe
Kyaikasan SS	Tamwe Gyi Kha	Tamwe

Figure 6. Alignment of proposed 230 kV overhead TL from Thida S/S to Thaketa S/S

Figure 7. Alignment of proposed 230 kV overhead TL Thaketa S/S to Kyaikasan S/S

43. The 230 kV Kyaikasan substation will be located adjacent to the existing 66 kV Kyaikasan substation located at Tamwe Ghi Kha Ward in Tamwe Township. The substation is adjacent to the property of the Ministry of Sports.

44. The site of the proposed 230 kV Thaketa substation will be located within the remaining open area of the property of MOEP that is adjacent to the existing 66kV substation located at No. 9 Ward, Thaketa Township. The site is adjacent to a gas power plant and a 30MV diesel engine power plant.

South Okkalapa Substation

45. The South Okkalapa substation will be located at No. 8 Ward at South Okkalapa Township in Yangon Eastern District. The property is owned by the Ministry of Defense but the exact area for the proposed South Okkalapa substation has not been demarcated yet. Adjacent to the proposed substation site are the fenced property of the Ministry of Defense on the east and a property of the Yaykuu radio transmission area of the Ministry of Information on the west.

West University Substation

46. The West University Substation will be located in a 22.7 ha property near Pauk Village in Hltantabin Township in Yangon Northern District. An additional 0.68 ha of paddy land will be acquired for the access road to the substation site from the existing village road. The proposed substation site is about 2 km away from the Hlaing Thar Yar Special Economic Zone.

2. Topography and Soils

47. The topography in Myanmar is divided into five physiographic regions: (1) northern mountains, (2) western ranges, (3) eastern plateau, (4) central basin and lowlands, and (5) coastal plains. The valley of Ayeyarwady River system and the horseshoe-shaped mountain complex are the dominant topographical features of Myanmar. The central lowlands are generally narrow and elongated in the interior with a width of about 320km across the Ayeyarwady-Sittaung delta. The delta plains are extremely fertile and economically important sections of the country, covering an area of about 46,620 sq km.[17]

48. Yangon is situated in the southern extremity of a long narrow spur of the Bago Yoma. The topography is characterized by the central ridge known as the Shwedagon-Mingaladon anticlinal ridge.[18]

49. The soil in Yangon area consists of fluvial flood plain. The area lies in the delta of the Ayeyawaddy River and along Yangon, Hlaing, and Bago rivers and Nga Moeyeik creek, also called the Pazundaung creek[19]. These water bodies play a major role in the deposition of sediments and soil characterization in Yangon area.

[17] http://www.myanmartourism.org/FactsaboutMyanmar/index.htm
[18] Strategic Urban Development Plan of Greater Yangon, Final Report. April 2013
[19] Footnote 17

50. Based on the published soil map of Yangon, the proposed 230kV Thida-Thaketa-Kyaikasan transmission line corridor, South Okkalapa substation and the West University substation are located in areas where meadow soils and meadow alluvial soils are present. These types of soils occur near the river plains with occasional tidal floods. The soils contain large amount of salts. The meadow soils are composed of silty clay loam. Figure 8 presents the soil types of Yangon.

3. Geology

51. Myanmar slopes downward in elevation from the north to the south. The country is naturally divided into the "Upper Myanmar" and the "Lower Myanmar". The terrain is made up of central lowlands ringed by steep, rugged highlands. The highest point in Myanmar is located in the Hengduan Shan mountains in the north which form the border with China. In addition, the mountain ranges of Rakhine Yoma, the Bago Yoma, and the Shan Plateau run from north to south from the Himalayas. The mountain chains also divide the country's three main river systems, namely, Ayeyarwaddy, Thanlwin, and the Sittang rivers.[20]

52. The geological formation in the Yangon area consists of the Andaman Trench in Bengal Bay located west of Myanmar. The Indian Plate moves northward and subducts underneath the Burma Plate from west to east. Another geological formation is the Sagaing Fault which is located between the Burma Plate and the Sunda Plate in the eastern zone of Myanmar. The Sagaing Fault is located about 40 km east of the Shwedagon Pagoda. It is a regional right hand strike-slip fault rending in the north-south direction.[21] The Sagaing Fault has been reported to cause large-scale earthquakes in Greater Yangon (Figure 9).

53. Geological hazards that have been reported in Yangon include landslides characterized by creeps, earthflow and slumps or block slides. Soil creeps happened at Shwe-Taung-Kyar, Botahtaung and Hninsigon Bobwa Yeiktha. Slumps or block slides have been reported at Inya Myaing, University Avenue Road, and Cantonment, west of Yangon Zoological Garden.[22]

[20] The Geology of Burma (Myanmar): An Annotated Bibliography of Burma's Geology, Geography and Earth Science. R. Lee Hadden. Topographic Engineering Center. September 2008.
[21] Seismic Hazard Maps of Yangon and its Surrounding Areas. Yin Myo Min Htwe. Shen Wenbin. Geo-spatial Information Science (13(3):230-234, September 2010.
[22] Strategic Urban Development Plan of Greater Yangon, Final Report. JICA. April 2013

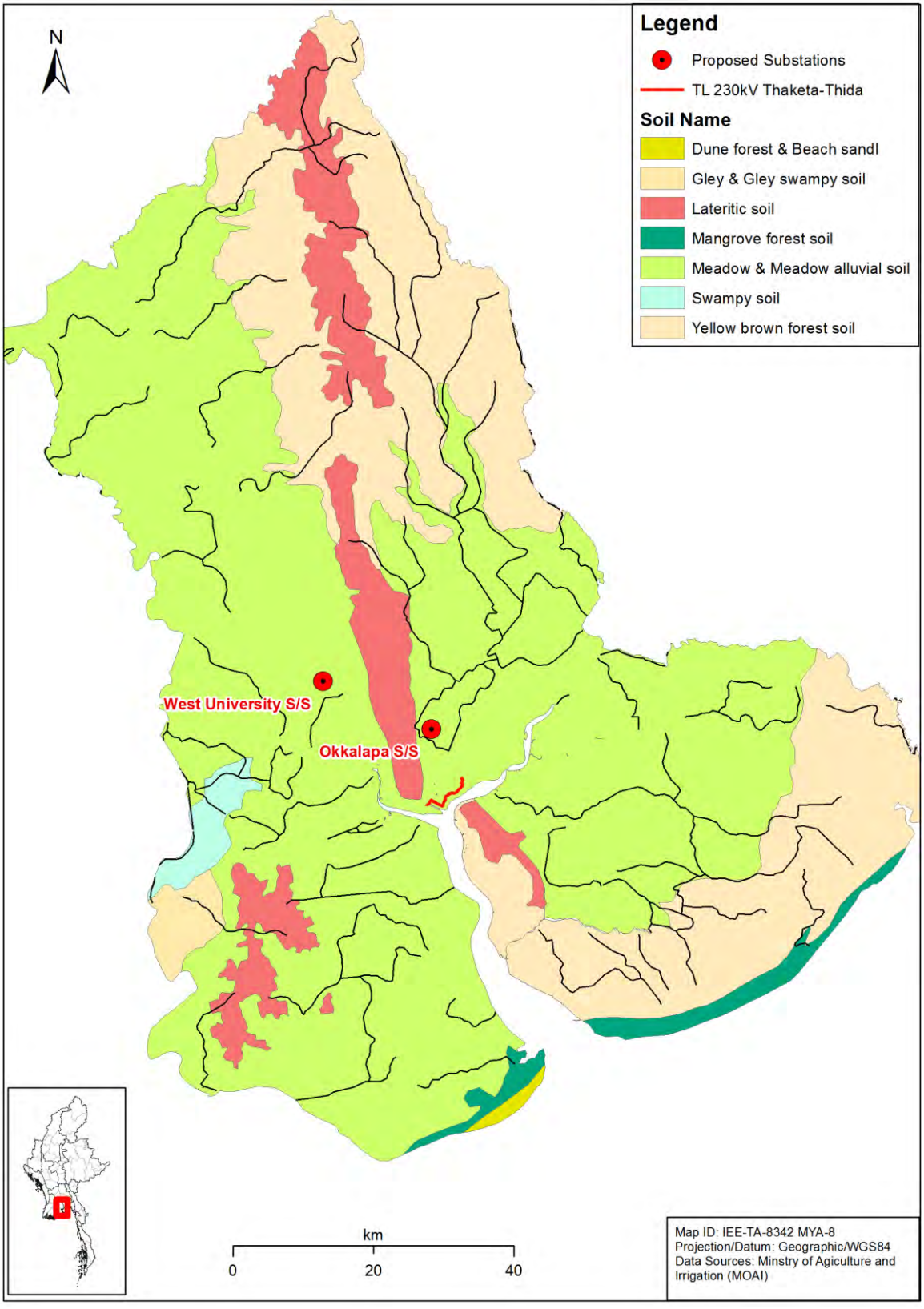


Figure 8. Soils of Yangon

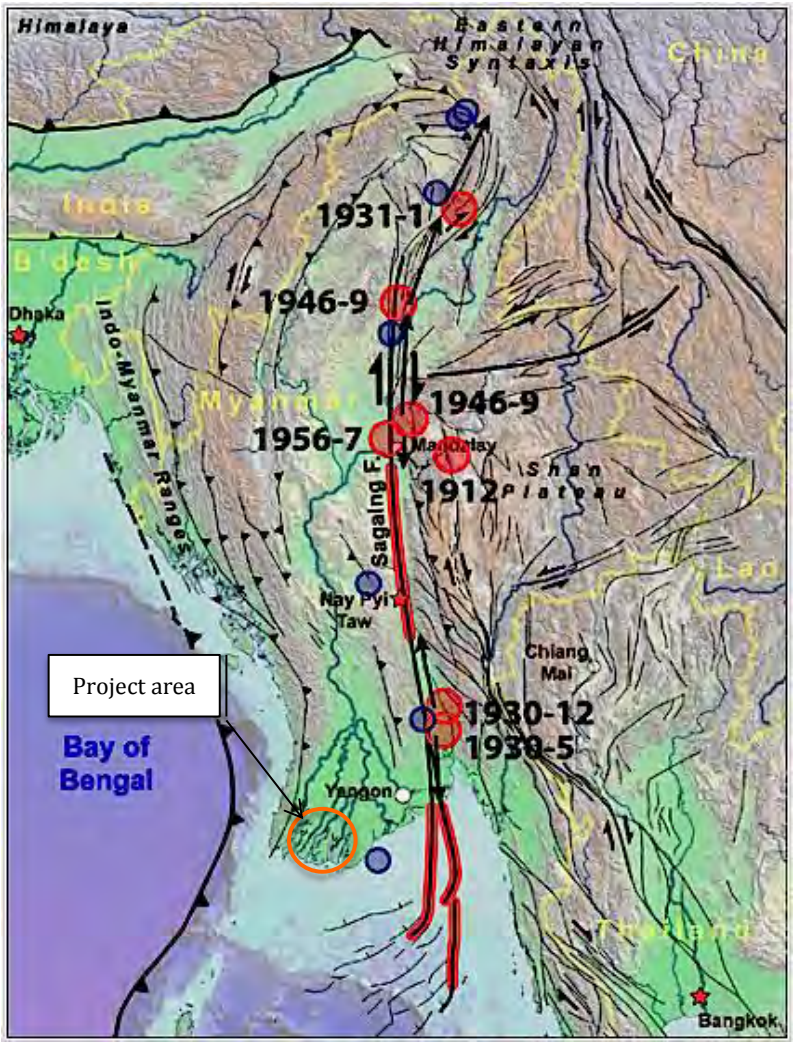


Figure 9. Earthquakes along Sagaing Fault

Source: The Sagaing Fault, Myanmar. www.sagaingfault.info. 27 October 2014.

4. Climate

54. Myanmar's climate is characterized by three distinct seasons, i.e. rainy (mid-May to mid-October), winter (mid-October to mid-February), and the summer (mid-February to mid-May). There is a large variation in the average rainfall in the country because the coastal areas receive an average precipitation in the range of 4,000 to 5,600 mm while the central dry zone receives precipitation in the range of 600 mm to 1,400 mm.[23]

55. The Kaba-aye Meteorological Station in Yangon recorded the maximum monthly temperature in April 2001 at 39.1°C. Minimum monthly temperature was recorded in December 2004 at 13.8°C. In terms of relative humidity, the maximum mean monthly relative humidity is 90.6% in August while the minimum mean monthly relative humidity is 51.4% in February. The mean annual rainfall is 2,749 mm and maximum mean

[23] Hazard Profile of Myanmar. Department of Meteorology and Hydrology. July 2009.

monthly rainfall is 591mm in August. The minimum mean monthly rainfall is 3mm in January and February. Maximum annual rainfall was recorded as 3,592mm in 2007.

56. In terms of wind speed and direction, the annual mean wind speed at the Kaba-aye Station is 1.1 m/s while the maximum wind speed was 42.9 m/s which was recorded in May 2008 at the time of Cyclone Nargis. Wind directions are generally in the SW during summer (March to middle of May) and rainy season (middle of May to middle of October). Wind direction is NE in the cool season from middle of October to February.

57. Wind intensities and direction in Yangon area need to be considered in the design of the high-voltage transmission lines. Historical data reveals that the area may be considered as cyclone risk and storm surge risk. There is 3.2% probability of cyclones occurring in the transmission line areas in Yangon. When accompanied by cyclone, strong winds as high as 120mph, heavy rains of more than 5 inches in 24 hours and storm surges higher than 10 feet occur when there is cyclone formation in Bay of Bengal. For storm surges, 6.70 meter storm surge have been recorded in Kyonkadun which is in the vicinity of the transmission line areas. The maximum observed storm surge height was at Pyinsalu (7m) and at Kyonkadun of Ayeyarwaddy Delta (6.7m) due to cyclone "Nargis".

58. Annually, there are approximately 10 tropical storms in the Bay of Bengal from April to December. Severe cyclones occurred during the pre-monsoon period of April to May and post-monsoon period of October to December. The tropical storms are weak and have a short life span during the monsoon period of June to September.

59. Yangon area is close to the Andaman Sea and is threatened by waves, cyclones and associated weather disturbances. There are areas in Yangon that are often inundated by river floods and the coastal areas are exposed to stormy weather. The bay of Bengal of the North Indian Ocean on the western coast of Myanmar is a typical place for tropical cyclone generation that moves towards the Myanmar coast. The Department of Meteorology and Hydrology reported that the month of May has the highest possible period for cyclones crossing the Myanmar coast. During cyclone "Sittwe" in May 1968, death toll in Myanmar was reported as 1,037. The Ayeyarwaddy Division was also affected by a cyclone in May 1975 that resulted to 304 deaths and the "Mala" cyclone in April 2006 which claimed 37 lives. The most devastating cyclone that hit the Yangon area is cyclone "Nargis" which hit the area from 28 April to 3 May 2008. Cyclone "Nargis" resulted to 138,373 people missing or dead, 3000,000 cattle killed, and over 4,000 houses and schools in more than 6,000 villages destroyed. The damage was estimated at 13 trillion kyat (US$3.25Million).[24]

60. Figure 10 presents the cyclone landfall probability while Figure 11 shows the storm surge observed along the Myanmar Coast (1947 – 2008).

[24] Hazard Profile of Myanmar. Department of Meteorology and Hydrology. July 2009.

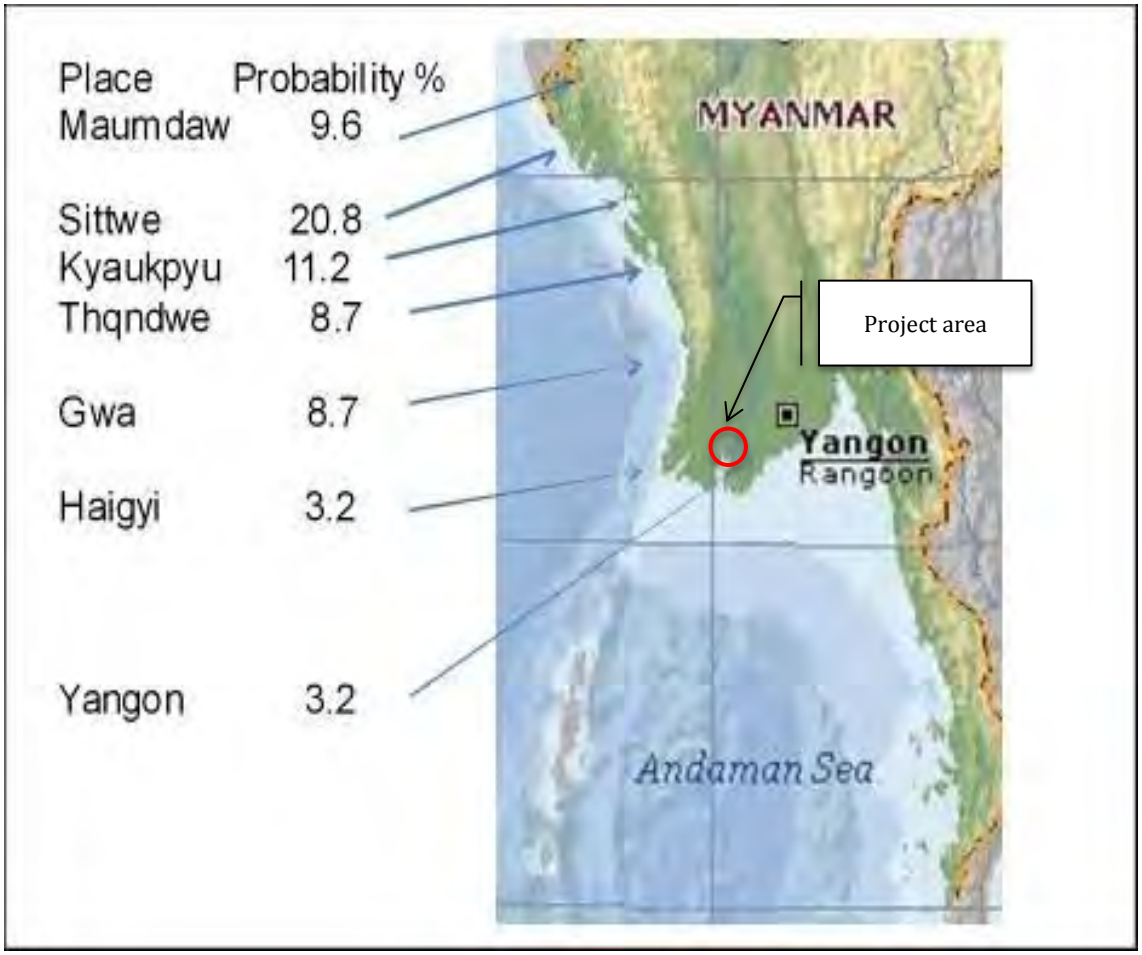


Figure 10. Cyclone landfall probability along Myanmar coast

Source: Hazard Profile of Myanmar, July 2009

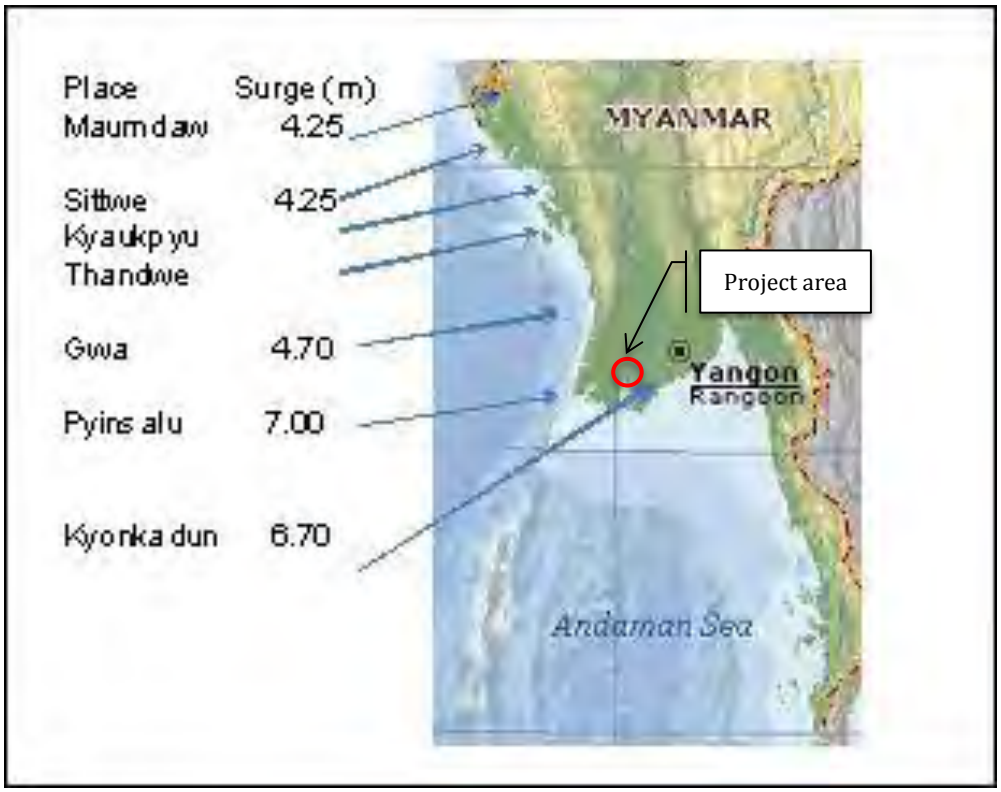


Figure 11. Storm surge observed along Myanmar coast (1947-2008)
Source: Hazard Profile of Myanmar, July 2009

5. Water Resources

61. Yangon is bounded on the south, southeast, and southwest by the Yangon, Hlaing, and Bago rivers. The Nga Moeyeik Creek flows into the center of Yangon City and changes its name to Pazundaung creek before it flows towards the Bago River.

230 kV Thida – Thaketa - Kyaikasan Transmission Lines

62. Pazundaung creek is the nearest body of water to the proposed transmission line corridor. The Pazundaung creek is tidal affected and contains saline water from the Gulf of Mottamma and Andaman Sea (Figure 12). Flow rate of Pazundaung creek was 201 m^3/s in August 2012.[25]

63. About 1.1 km segment of the transmission line from Towers 7 – 14 will be located at the banks of the Pazundaung creek. According to MEPE, the plan is to use bored piles on the tower foundations adjacent to the creek. Although this method will reduce excavation works and potential impacts of soil erosion, appropriate measures need to be instituted to control runoff or sediments and oil-containing wastes into the nearby creek. There are also a few mangroves that are growing along the banks that may be affected by the tower installation.

[25] Strategic Urban Development Plan of Greater Yangon, Final Report. JICA. April 2013

South Okkalapa Substation

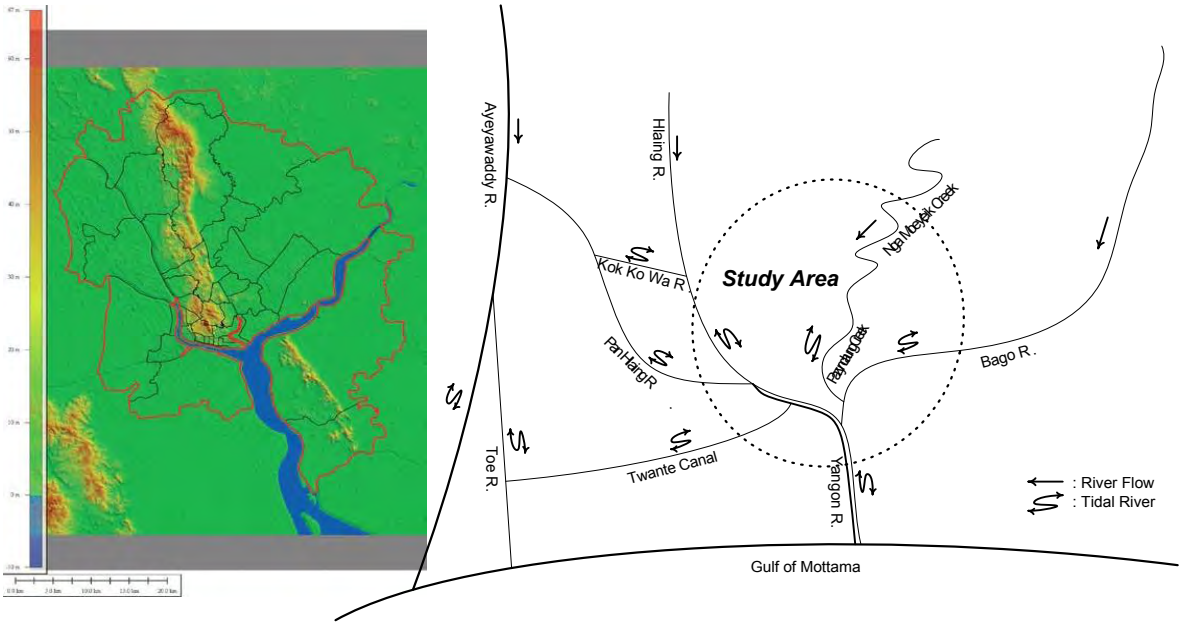
64. The proposed substation is located approximately 570 meters west of the Nga Moeyaik creek, also named as Pazundaung creek at the downstream end when it discharges towards Bago River. There is a drainage canal which runs parallel to road and drains into Pazundaung creek.

West University Substation

65. The proposed West University substation is located about 990 meters east of the Hlaing River. The Hlaing River drains towards the Yangon River and covers a catchment area of 0.52 km^2 in Hlaing township. The Hlaing River discharges about 1851 m^3/s in August 2012 and 17 m^3/s in March 2012 based on information from the Khamonseik Station. Maximum daily flow was recorded as 2752 m^3/s in October in 1997.[26]

Source: m3/s Study Team based on the information of a)http://www.turkey-visit.com and b)Shuttle Radar Topography Mission (SRTM)

Figure 2.1.1: Topographic Map of the Study Area



Source: JICA Study Team based on the information from several maps

Figure 2.1.2: River System In and Around Greater Yangon

Figure 12. River systems in greater Yangon

Source: JICA, YCDC

6. Flooding

230 kV Thida-Thaketa-Kyaikasan Transmission Line

66. Flooding in Yangon is characterized by river floods, localized flood inundation in urban areas due to combination of poor infiltration rate, poor drainage infrastructure, and floods due to cyclone and storm surge. Based on a study conducted by JICA, the area where the proposed transmission lines will be located experiences localized flooding primarily caused by drainage congestion.

[26] Strategic Urban Development Plan of Greater Yangon, Final Report. JICA. April 2013

rmation of a)http://www.turkey-visit.com and b)Shuttle Radar Topography

.1: Topographic Map of the Study Area

the information from several maps

iver System In and Around Greater Yangon

South Okkalapa Substation

67. The site of the proposed South Okkalapa substation is located about 1 meter below the existing road grade level. The area and the surrounding vicinity are vacant and are not reported to be flood-prone areas. However, backfilling works will be undertaken by MEPE at the substation site to raise the grade up to the existing road level, which could have an impact on the existing drainage system and potential flooding in the surrounding areas.

West University Substation

68. At the proposed West University substation, residents in the area have reported flooding up to the existing road level, primarily due to the overflowing of the Hlaing River. Since the substation site is situated about 1 meter below the existing road level, backfilling works may be necessary to secure the proposed substation site against perennial flooding in the area. Elevating the site would potentially aggravate flooding in the surrounding areas during heavy rainfall events. Adequate drainage should be integrated in the site development plan of the project.

7. Air Quality

69. Ambient air quality monitoring data as reported by YCDC were gathered to describe the air quality in Yangon. Ambient air quality measurements were taken in commercial areas, residential areas, and industrial zones in Yangon City from 2007 – 2008 and in sub-urban areas in Dagon Myo Thit – South in 2010 – 2011.

70. Based on these air quality monitoring data, the 24-hour average concentrations of NO_2 and SO_2 at the sites representing the residential, commercial and industrial zones in Yangon are below the WHO Guideline values. However, total suspended particulates (TSP) and particulate matter (PM_{10}) at the three representative sites were higher than the WHO Guideline values. Higher values of TSP and PM_{10} were recorded in the industrial area than in the residential and commercial areas. The main reason for the exceedance with TSP and PM_{10} WHO guidelines was the fugitive dust from community activities such as vehicular movement and construction activities.

B. Biological Resources

71. Myanmar is a country with great variety of habitats and ecosystems supporting a rich biodiversity. About 48% of the mainland is covered by forests according the FAO, 2010. In terms of percentage of land area covered by forest, Myanmar ranks 6 out of 11 among the Southeast Asian countries. The important habitat types represented in Myanmar are forests, wetlands, and the marine habitat. There are eight different forest types, namely, (i) tropical evergreen forest, (ii) mixed deciduous forest, (iii) dry forest, (iv) deciduous dipterocarp forest, (v) hill and temperate evergreen forest, (vi) tidal forest or mangrove forest, (vii) beach and dune forest, and (viii) swamp forest.[27]

72. None of the project components are located in areas classified as ecologically protected areas. The sites of the transmission lines and substations are located in areas where the natural habitat of flora and fauna has been altered due to human interference

[27] Tint, 1995. Cited from Myanmar Protected Areas. Instituto Oikos and BANCA. 2011.

and continuing urbanization and development of these areas. The sites are also not known as paths of migratory birds.

73. The Hlawga Wildlife Park which is situated in Mingaladon Township is the only protected area in Yangon Region. This is a watershed protection forest which was created in 1982 by the Forest Department to provide environmental education facilities, protect the forest and the catchment area of Hlawga Lake. The park conserves three types of habitats, i.e. evergreen forests, mixed deciduous forests and swamp forests. [28]

74. The southern part of the park is the Hlawaga Forest Reserve which is located approximately 11 km north of the Kyaikasan substation. The shortest distance of Hlwaga Park and the West University substation is 7.29 km.

C. Land Use

230kV Thida-Thaketa-Kyaikasan Transmission Line

75. The ROW of the 230 kV Thida-Thaketa-Kyaikasan transmission line will mostly follow existing roads. Table 10 presents the characteristics of the major roads traversed by the transmission line.

Table 10. Roads affected by 230 kV Thida - Thaketa - Kyaikasan transmission lines

Name of Road	No. of lanes	Type of Road	Est. No. of Towers	Est. TL length (km)	Remarks
THIDA SUBSTATION (start of TL)					
Road under Maha Bandoola Bridge	2	Asphalt	5	0.44	
Yamonnar Rd	6	Asphalt	13	1.64	
Shukhinthar Myo Pat Rd	6	Asphalt	13	1.5	Will cross to the northern side towards vacant area to avoid pagoda
Shukhinthar Myo Pat Rd	6	Asphalt	7	0.52	Wide easement; land adjacent to road with some shops
Shukhinthar Myo Pat Rd	6	Asphalt	3	0.27	
Shukhinthar Myo Pat Rd	6	Asphalt	7	0.77	Residential areas close to road
Shukhinthar Myo Pat Rd	6	Asphalt	10	1.22	Diesel and petrol pipeline in southern side will be avoided
Road to Yangon Thanlyin Bridge	4	Asphalt	8	0.47	
THAKETA SUBSTATION					
Riverbank	-	-	14	1.1	Riverbank
River crossing	-	-	2	0.24	River crossing
Paw San Hmway Rd	4	Concrete	10	1.25	
Thuwunna Rd	4	Asphalt	11		

[28] Myanmar Protected Areas. Instituto Oikos and BANCA. 2011

Name of Road	No. of lanes	Type of Road	Est. No. of Towers	Est. TL length (km)	Remarks
Thanthumar Rd	6	Asphalt	10	1.34	Will affect billboards; wide road with enough easement on both sides.
Waizayandar Rd	6	Concrete	6	1.8	Affect trees and water supply pipeline on center island; needs road restoration works after construction; tall buildings towards junction with Thanthumar Rd.
Pyitharyar Rd	2	Asphalt	3	0.17	Road with damaged portions; may worsen traffic during construction
-	-	-	3	0.2	Land bounded by property of home for the aged.
Railway	Railway	Railway	3	0.16	Alongside of railway; needs MOT approval.
Baukhtaw Station St.	2	Asphalt	5	0.52	Wide easement with trees which could be trimmed during operation to maintain safety clearance.
Moe Kaung Rd	4	Asphalt	4	0.43	Wide easement; water supply, drainage lines can be avoided during tower placement; tall billboard at corner with North Horse Race Course Rd. will be affected
North Horse Race Course Rd	6	Asphalt	3	0.24	Poles will be inside the property line
KYAIKASAN SUBSTATION (end of TL)					

76. From the existing Thida substation, the corridor will use special overhead river crossing towers on both sides of Pazundaung Creek. It will then follow the general alignment of the existing 66kV line along Yamo Nnar Road, a 6-lane asphalt-paved road where some small shops may be affected by the project.

77. The transmission line corridor then turns towards the Shukhinthar Myo Pat Road, a 6-lane asphalt-paved road that is characterized by a mixture of residential, commercial establishments, offices, and warehouse buildings. The alignment then turns towards the east within an open area and former cemetery at No. 10 (North) Ward in Thaketa Township in its approach to Thaketa substation.

78. From Thaketa substation, the transmission line will follow a northwesterly route to connect to Kyaikasan substation. The corridor will as much as possible avoid major roads by aligning in part along the bank of Pazundaung creek using transmission towers founded on piles. Special river crossing towers will be provided when the alignment

crosses the creek in a northwesterly direction. On the opposite side of the creek is a lumberyard property where a special river crossing tower will be built.

79. Upon crossing the creek, the line corridor will follow the direction of Paw San Hmay Road where there is ongoing construction of drainage culverts and a residential housing project. The alignment then turns westward to Thuwunna Road, adjacent to a YCDC property, some commercial establishments and a monastery.

80. The transmission line corridor will then traverse the Thanthummar Road, a 6-lane asphalt-paved road and cross the railway bridge adjacent to the Thuwuna Football Stadium. There are mixed residential and commercial establishments along the Thanthumar Road. In addition, there are also advertisement billboards and signage which are owned and managed by YCDC that may be affected by the proposed project to meet the safety clearance requirements. Coordination with YCDC needs to be implemented during finalization of the tower location to discuss the removal of affected billboards along the transmission line corridor.

81. The alignment then turns towards the Waizayandar Road where center island towers are proposed. There are tall commercial buildings near the intersection of the Waizayandar Road and Thanthummar Road. The Waizayandar Road is a newly rehabilitated 6-lane concrete road (3 lanes on both sides). The center island has a width of about 1.5 meters and is characterized with rows of ornamental trees (Figure 13). Underneath the center island, at about 3 ft below the ground level, is a newly installed 36” water supply pipeline which could be affected when towers are constructed at the center island.

Figure 13. Trees along the median of Waizayandar road

82. From Waizayandar Road, the alignment will turn northwards to Pyitharyar Road, a narrow 2-lane asphalt-paved road which connects the Moe Kaung Road and Waizayandar Road. Towards the railway line, the alignment will turn northeast to a vacant property, behind the property of a home for the elderly. The transmission line then crosses the property of the old railway station which is owned by the Ministry of

Transportation towards the Bauk Htaw Station Street. There are residential apartments, houses, and a military property along this street.

83. Traffic congestion can be observed along Pyitharyar Road because of damaged sections of the road causing vehicles to slow down. Pyitharyar Road is a busy road primarily because of its interconnection with these two major roads in Yangon. There are tall buildings at the end of the Pyitharyar Road junction with Moe Kaung Road which could compromise safety clearance since there is not enough easement on this side of the road (Figure 14). Traffic congestion at the junction can also be observed because of sidestreet parking on this narrow thoroughfare.

84. From Bauk Htaw Station Street, the alignment will turn towards the west to Moe Kaung Road before it turns towards the North Horse Race Course Road. The Moe Kaung Road is a 4-lane concrete road with 2-3 meter easement on both sides. The easements are planted with trees which could be avoided during final design of the tower location or which could be trimmed as part of the line maintenance. Two large ornamental palm trees approximately 18" in diameter and 10 – 14 meters high each may need to be cut along this side of the alignment. A school, army compound, residential housing and some commercial establishments can be found along the side of the Moe Kaung Road.

Figure 14. Buildings at the corner of Pyitharyar road and Moe Kaung road

South Okkalapa Substation

85. The South Okkalapa substation will be located at No. 8 Ward at South Okkalapa Township in Yangon West District. The site is owned by the Ministry of Defense. Adjacent to the proposed substation site is a fenced property of the Ministry of Defense on the east and a property of the Yaykuu radio transmission area of the Ministry of Information. From across the project site and Gan Damar Road is the Okkala Golf Course on the east. The general vicinity of the proposed substation site is characterized as open, vacant land.

Figure 15. Site of proposed South Okkalapa substation

Figure 16. South Okkalapa S/S near Yaykuu transmission towers and Gan Damar road

West University Substation

86. The West University Substation will be located at Pauk Village in Hltantabin Township in Yangon North District. The site and immediate vicinity is currently characterized as agricultural land where patches of rain-fed rice land can be found (Figure 17 and 18). Approximately 2 km away from the site is the Hlaing Thar Yar Special Economic Zone. The substation site is about 445 meters away from the village road (Figure 18). Paddy land will be acquired by MEPE for the access road to the substation site from the village road.

Figure 17. Site of West University Substation

Figure 18. Village access road to West University Substation site (on right)

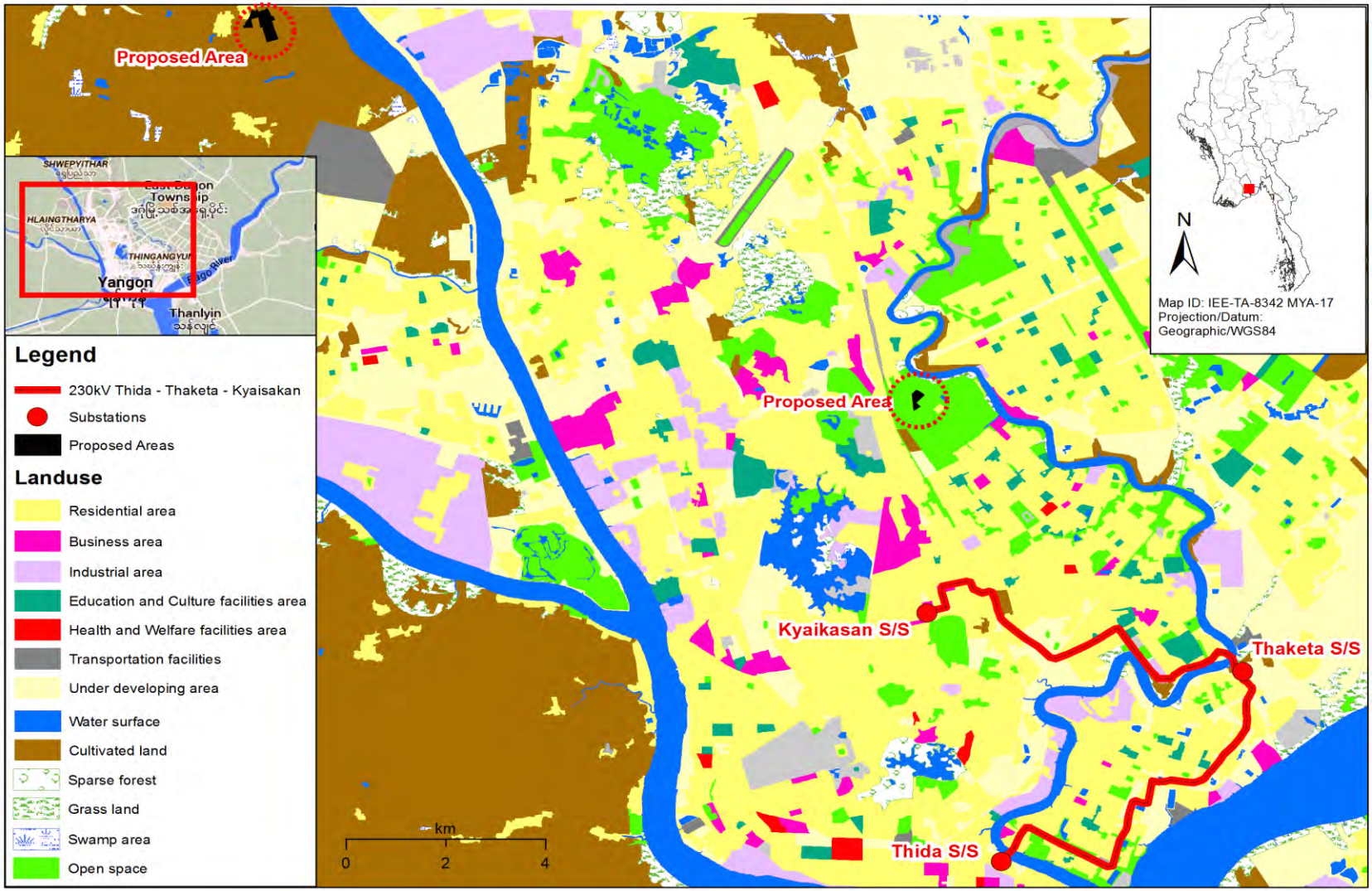


Figure 19. Land use at project sites

D. Social and Cultural Resources

87. The Republic Union of Myanmar has a population of over 60 million. The major racial groups are Bamar, Kachin, Kayah, Kayin, Chin, Mon, Rakhine, and Shan.[29] Over 80 percent of Myanmar practice Theravada Buddhism. Other religions include Christianity, Muslim, Hinduism, and some are animists.

Population

88. Yangon Region has a recorded population of 6,944,000 people as of 2011, representing approximately 12% of the national population. Yangon City experienced rapid population growth with average growth rate of 2.58% annually between 1998 and 2011. Population density is 40.5 persons/ha.

Economy

89. The net production value of Yangon Region is MMK 8,818,345 million as of 2011, accounting for about 22% of the country's gross domestic product (GDP) and making Yangon the "Economic Center of Myanmar". The industrial structure in Myanmar is composed of agriculture, livestock, fishery, and forestry (36%); trade sector (20%); manufacturing sector (20%); services sector (18%); construction (5%); and energy and mining (1%).

90. Yangon Region relies heavily on manufacturing industries which is quite different from Myanmar's industrial structure that is concentrated on agriculture, livestock, fishery and forestry. Yangon Region's industrial structure is composed of the processing and manufacturing sector (37%); trade sector (25%); services sector (24%); construction (5%); and electric power (1%). The agriculture, livestock, fishery, and forestry sector only account to 8% of the total production value.

91. According to data from the Ministry of National Planning and Economic Development (MNPED), there are a total of 15,089 factories in Yangon Region in 2010-2011.[30] The YCDC expects the development of more manufacturing establishments in industrial zones in Yangon (Figure 20).

Power Supply

92. Power supply in Yangon is served by the Yangon Electricity Supply Board (YESB). There 66 kV, 33 kV, 11 kV and 6.6 kV distribution lines around Yangon. Hydropower stations produce 72% of the total power in Myanmar. However, power supply is affected in the dry season due to shortage of water in dams. There are also gas turbines, steam turbines with combined cycle system and steam turbine coal power plants. Four combined cycle gas turbine power stations are operating in Yangon that meets 31% of the total power demand in Yangon Region.

[29] http://www.myanmartourism.org/FactsaboutMyanmar/index.htm
[30] Strategic Urban Development Plan of Greater Yangon, Final Report. JICA. April 2013

Water Supply

93. Yangon is served by the YCDC water supply system which include four reservoirs. YCDC obtains water from the Nga Moeyeik reservoir which is treated in existing water treatment plants. Service coverage of the YCDC water supply system is 42% as of 2010. The remaining 58% of the population obtain water from private wells and other water sources like ponds and rainwater collection system.

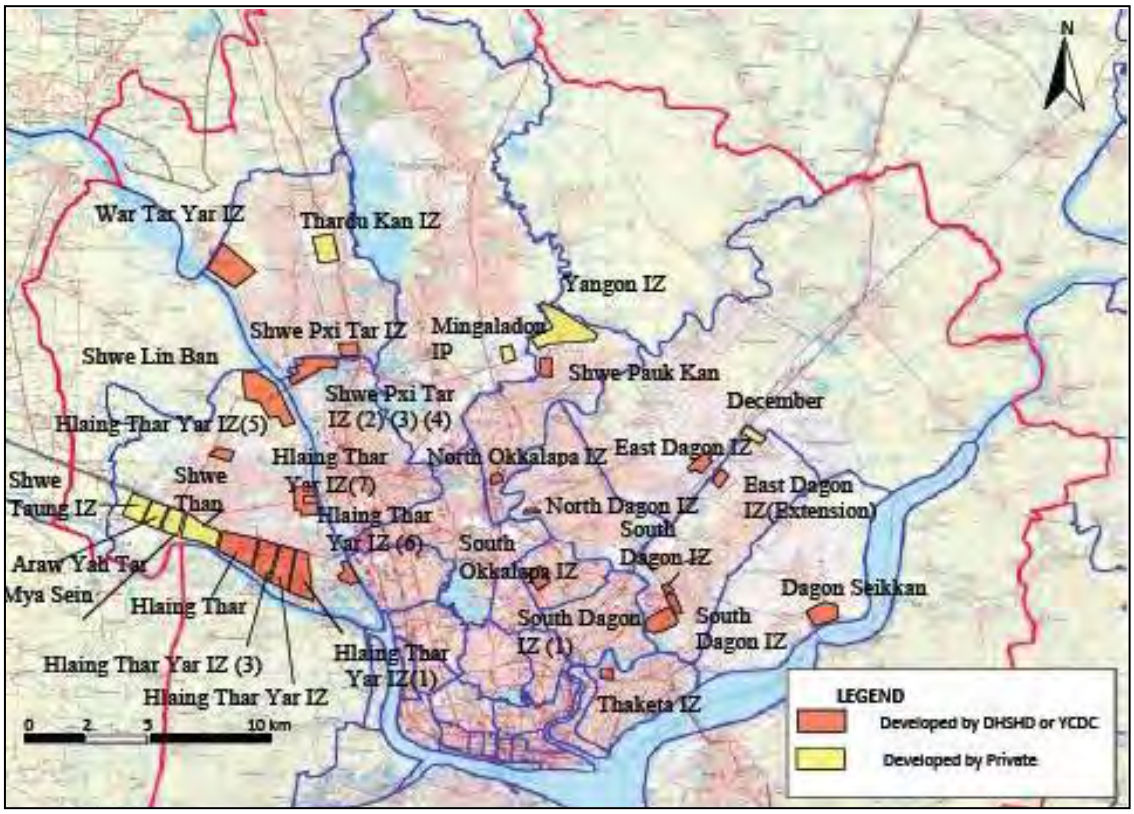


Figure 20. Location of industrial zones in Yangon region

Sewerage and Sanitation

94. The present disposal system in Yangon includes septic tank system (common and individual), pour flush system, fly proof (chute type), unsanitary latrine, and no latrine. Those using septic tank account to 40% of the household population. YCDC requires the installation of septic tanks when constructing buildings. There is also vacuum car service for de-sludging septic tanks. These vacuum cars are owned by the Department of Motor Transport and Workshop of YCDC which carry the sludge to a wastewater treatment plant. Sewer lines in Yangon are limited to the old suburban areas in Ahlone.

Health

95. Health services in Yangon are provided by both public and private health hospitals and clinics. Urban areas like Yangon have specialty hospitals, general hospitals, teaching hospitals, state/regional hospital, district hospitals, and township

hospitals. At the townships, there are curative and preventive health services provided by township health departments aside from township hospitals that provide laboratory, dental, and some major surgical procedures. There are also rural health centers (RHC) that provide health services at the village level. The RHCs are staffed by a health assistant, public health supervisor, lady health visitor, and a midwife who are trained in primary health care and public health.

Physical and Cultural Heritage Site

96. The Shwe Dagon Pagoda is the important cultural and heritage site in Yangon. YCDC enforces zonal regulations in areas around Shwe Dagon Pagoda wherein buildings with more than six stories are prohibited. None of the project sites are located within the restricted zones of the Shwe Dagon Pagoda.

VI. INFORMATION DISCLOSURE AND PUBLIC CONSULTATION

97. Information disclosure and stakeholder consultations were conducted as part of the environmental assessment process. The consultations involved in-depth key informant interviews with township offices, relevant Government offices and formal stakeholder and civil society consultation meetings in Yangon.

98. Because the project is in feasibility study and design phase the consultations aimed at providing an early link between the MOEP/MEPE, YCDC, local township offices, stakeholders, civil society and other government agencies to ensure that environmental issues of the proposed project are identified at the earliest stage of project planning. The consultations also allowed the safeguards team to learn about environmental requirements and issues affecting the community. Specifically, the objectives of the consultation meetings are the following:

- To present the proposed power transmission line and substation project of MOEP/MEPE to stakeholders.
- To solicit views of the stakeholders relative to the proposed project.
- To identify possible environmental issues inherent at the project sites and
- To identify mitigation measures to address these environmental issues in the project design.

99. The following documents the information disclosure process and results of the consultation meetings. Follow-up consultation activities are also outlined to inform the stakeholders of updated information on the detailed design and operational progress of the project.

A. Information Disclosure Process

1. Methodology and Identification of Stakeholders

100. The safeguards team met with the MOEP and MEPE to discuss and design the consultation process following ADB's Safeguards Policy Statement (2009) and the requirements of MOECAF. The agenda, list of agencies to be invited and draft letters of invitations for township offices, wards, and other relevant agencies were developed. The first public consultation meeting on environmental issues was held last 30 May 2014.

The invited stakeholders included the YESB, MOECAF, YCDC, and General Administrative Officers (GAOs) at affected townships.

101. Due to changes in the transmission line corridor another stakeholder consultation was held on 2 October 2014 to present the new proposed transmission line alignment of MEPE and to gather comments and suggestions from the township GAOs and ward authorities. Valuable comments from the townships GAOs allowed MEPE to further refine the alignment.

102. Aside from formal public consultation meetings, focused group surveys and interviews at project-affected sites of the new substations and along the new transmission line corridor were conducted with ward authorities, MOECAF Yangon, and YCDC township offices of South Okkalapa, Tamwe, Thaketa, Botahtaung, Thingungyun, Yankin, and Miyangon. The stakeholder surveys and interviews were held on 26 – 28 July 2014 for ward authorities and affected people near the substations sites. The in-depth interviews with the YCDC townships were held on 27 – 31 October 2014.

103. Civil society groups were also consulted regarding the proposed project. A meeting with the civil society represented by the Environmental and Economic Research Institute (EERI), Gold Myanmar, Myanmar Youth Entrepreneur Association, Myanmar Engineering Society, and Yangon Technology University was held on 07 November 2014.

104. The principles of information dissemination, solicitation, integration, coordination, and engagement into dialogue were incorporated during the consultations. The key informants who were interviewed were selected based on the sector most likely to be affected by the project and from whom information on site facts and prevailing conditions were collected. The opinions of all those consulted helped in the planning and design of the transmission line corridor and substations.

2. Schedule of Public Consultation Activities

105. Table 11 summarizes public consultation and information disclosure activities that were conducted for the project.

Table 11. Schedule of public consultation activities

Date	Activity	Location	Purpose
29 April – 09 May 2014	In-depth key informant interviews	Various offices	To present the project concept design and obtain information and views on environmental, land use and cultural issues at project sites.
30 May 2014	Public consultation	YESB Conference Room, Yangon City	Presentation of the project to township offices of Thaketa, Ahlone, Botahtaung, and Tamwe, YCDC, MOECAF, and YESB
26 – 28 July 2014	Stakeholder survey and interviews	Substation sites (West University and South Okkalapa)	To gather views on environmental issues of ward authorities and communities living near the proposed substation sites.
02 October 2014	Public consultation	MEPE Office, Yangon City	Presentation of the revised transmission line alignment to General Administrative Offices of affected townships

Date	Activity	Location	Purpose
27 – 31 October 2014	Key informant interviews	Various Government offices	Presentation of revised transmission line alignment to YCDC township offices, MOECAF Yangon, and Directorate of Water Resources Improvement of River Systems (DWIR)
07 November 2014	Public consultation	Conference Room, Myanmar Engineering Society, Yangon City	Presentation of the project to civil society groups

B. Results of Public Consultations

106. The detailed results of the public consultations are found in Appendix C. The first public consultation of the proposed project was held at the YESB Conference Room in Yangon City on May 30, 2014. The public consultation consisted of the following component procedures:

i. Presentation of the proposed project, benefits/disadvantages and mitigation measures to address any environmental impacts by the MEPE;

ii. Presentation of the objectives of the public consultation and the EIA study and the overview of the proposed transmission line alignments by the environmental consultant; and

iii. Open discussion on comments of stakeholders about the project and environmental issues that should be considered in the project design.

107. Representatives from the townships of Thaketa, Ahlone, Botahtaung, and Tamwe, various departments of the Yangon City Development Committee (YCDC), MOECAF and Yangon Electricity Supply Board (YESB) attended the meeting. The proposed project was presented by U Thet Paing Myo, Project Manager, Power Transmission Project Department, MEPE. After which, the purpose of the public consultation and the environment safeguards and the initial alignment of the transmission line were presented by the ADB environment consultant. The major comments and issues identified during the meeting are summarized in Table 12 along with the response of the project:

Table 12. Major comments and issues identified by institutional stakeholders

a) Towers should be kept as high as possible to meet safety clearance from existing structures.

Project response:
Tower height will be determined by different factors including safety clearances from existing structures.

b) Close coordination among local townships, YCDC, YESB, MEPE and the design team is necessary. Township offices should be informed about the safety clearances and health and safety concerns to prevent people from building structures near the transmission lines.

***Project response**:*
The successful design and implementation of the new 230 kV transmission line and substations will be closely coordinated with the MEPE, YESB, and YCDC.

c) Design of the project should consider wind load analysis.

***Project response*:**
Wind load analysis is explicit in design and location of transmission lines, and also considers climate change.

d) The area near Thida substation is crowded which could compromise public safety.

***Project response**:*
Both 230 kV transmission lines will be installed in dense urban areas. Great effort has been expended to locate the lines in the most optimal locations to address the impacts and constraints of crowded conditions.

e) Along Strand Road, there are underground sewer, drainage and cable systems. These should be considered in the design of the towers.

***Project response**:*
The 230 kV transmission line along Strand road has been deleted from project.

a) The perennial flooding at Ahlone substation area should be considered in the design

***Project response**:*
Ahlone substation is no longer part of project scope.

b) Mitigation measures following ADB and other international guidelines will be designed to address potential of the project to cause EMF and electric shocks

***Project response**:*
The design of project follows international safety requirements to prevent electrical shock Hazard. Exposure to EMF is not a proven health hazard (see WHO literature review in Appendix E)

108. Due to issues with development of transmission lines along city roads, MOEP decided to revise some of the project components as well as adjust the alignments of the transmission lines. The second public consultation on the project was held on 02 October 2014 at the office of the Myanmar Electric Power Enterprise (MEPE) in Yangon. A total of 40 participants from townships of project-affected sites attended the meeting. MEPE officials explained the changes in the transmission line alignment particularly at the first section starting from Thida substation that avoid passing underneath the Maha Bandoola Bridge and also the changes in front of Dawbon market and Dawbon township YCDC office. The comments and issues identified during the second public consultation were addressed by MEPE at the meeting as summarized in Table 13.

Table 13. Issues addressed by MEPE at public consultation meeting 2/10/14

a) The transmission towers at Towers 9 – 11 will not be a problem since the land is owned by YCDC Park and Playground Department.

b) The MEPE will negotiate Towers 26 and 27 with the Railway Department.

c) The informal settlers at the entrance to the Thaketa substation will be managed by MEPE with coordination with YCDC.

d) The junction of Thuwunna and Pyitharyar Road near Orange supermarket is congested and is characterized with tall buildings. MEPE will survey the area to ensure design of 230 kV line accommodates the congestion and obstacles optimally with minimal disturbance.

109. The summary of comments from the stakeholders identified during the public consultations and the responses of MEPE and project are summarized in Tables 14 and 15. The engineering design-related comments and issues identified by national and municipal electric power transmission and distribution agencies, and government administration offices in Table 12 will be incorporated into the final designs of the project.

Table 14. Summary of issues identified during public consultations

Stakeholder	Comment	Response of MEPE and project
Public Consultation held on 30 May 2014		
U Saw Win Maung, YESB	The existing lines in Yangon are already overloaded. The decision of MEPE to extend the Thida substation is principally to supply power for Yangon downtown area. Although MEPE is the project implementing agency, the beneficiary of the project is the Yangon area, therefore, YESB also needs to be involved.	MEPE will consider the suggestions.
	There are areas where safety clearance is not being met because of existing houses and other structures. With this, the towers should be kept as high as possible. The townships should be informed first about the importance of the safety clearance.	MEPE will continue to coordinate with YESB and inform affected townships about the project and the safety clearance requirements.
U Toe Aung, YESB	One of the technical solutions is to use the existing route for the new 230kV transmission line. The design of the project should consider the wind load since this will be higher than the existing lines.	The technical proposal is still on going. There will be no change in line route as 230 kV line is going to follow the 66 kV existing towers.
	It is difficult to reuse the existing towers, therefore, new poles or towers will be necessary. As the new transmission line is above the ground, there will be construction issues on the street and land acquisition.	MEPE will continue to coordinate with YESB.

Stakeholder	Comment	Response of MEPE and project
	YESB requests MEPE to coordinate with them in all steps of the project.	
U Yan Aung Lin, YESB	There are health and safety concerns if the 230kV line will be installed along the existing 66kV alignment because of presence of houses. Some houses will have to be removed and there might be complaints from affected households. MEPE should work together with different departments and ministries.	MEPE will coordinate with the various departments and offices responsible for housing and utilities, including local offices of Ministry of Labour.
U Aung Lwin Myo, YCDC	Along Strand Road, there is an underground sewerage and drainage system. There will be no problem if the pile driving is 5 ft below. It is necessary for MEPE to conduct the detail survey in each township because some houses might be affected.	MEPE will obtain and consult all maps of city utilities from YCDC. (However, the TL segment from Ahlone to Thida substations has been removed from the project.)
General Administrative Department, Ahlone Township	At the center island of Ahlone between two existing roads are drainage lines and many cables. The area of Ahlone substation also experiences flooded. When YCDC conducts declogging of drainage lines, they are faced with danger because of the presence of cables and clogged canals.	Ahlone substation and 230 kV line excluded from project scope
U Soe Min Aung, General Administrative Department, Botahtaung Township	All engineers and survey groups need to survey the alignment together with YCDC Land Use and Housing Department. If faced with difficulties on resettlement of structures, the MEPE and the YCDC should coordinate and work out feasible solutions.	MEPE will study every pole position and discuss this with the affected communities.
U Yan Lin Aung, YESB	The Project Implementation Consultant (PIC) during implementation should be utilized extensively by the project because MEPE and YESB have limited experience with 230 kV underground lines.	By design there will be a close relationship between PIC, YESB, YCDC, and the local townships during detailed design phase and later during implementation of the 230 kV transmission line.
U Khin Maung Kyi, MOECAF Yangon	According to the EIA law, transmission line over 100 kV needs to undertake an EIA. There are no major environmental impacts of the project except for potential electromagnetic field (EMF) and electric shocks. The project needs to refer to applicable international guidelines to address these impacts.	MEPE will comply with the required laws, e.g., Environmental Conservation Law and Electricity Law, and will coordinate closely with MOECAF, and will be assisted by the PPTA and PIC. Negative health effects of EMF are inconclusive (Appendix E).
Public Consultation held on 02 October 2014		
The GAOs provided comments on the new alignment during the detailed presentation.		
GAOs	Move the transmission line at Towers 15 – 16 a little further to the east because there is a wastewater/drainage outlet to the river.	PIC and MEPE will consider in detailed designs

Stakeholder	Comment	Response of MEPE and project
GAOs	Negotiate with the Ministry of Transport regarding the use of land for Towers 15-16.	MEPE will coordinate with MOT with assistance from PPTA and PIC.
GAOs	At Towers 26 and 27, MEPE needs to coordinate with the Railway Department	MEPE will coordinate with the railway Department with assistance from PPTA and PIC.
GAOs	At the entrance to Thaketa substation, MEPE needs to coordinate with YCDC because of informal settlers.	MEPE will coordinate with the YCDC to manage optimally informal settlers in affected areas.
GAOs	At the junction of Thuwunna Road and Pyitharyar Road is a congested area with tall buildings. The alignment should avoid this congested area.	MEPE will be informed of this issue. MEPE Survey Engineer will check the area to determine optimal solution.

Table 15. Results of public consultation held on 07 November 2014

Ei May Khine, Environmental & Economic Research Institute	There is a lack of awareness of the public on environmental management, thus, programs to increase awareness should be developed.
Project Response:	Awareness of environmental issues and required environmental management of the new 230 kV transmission lines and South Okkalapa and West University substations are addressed initially with the formal public and stakeholder consultations of the project, and then later as part of the capacity development and training of responsible parties for the environmental management of the project.
Phyu Phyu Shein, Myanmar Environment Institute	a) During the construction period, health issues and social conflict resolution should be considered. Proper toilets and regular medical checkup of workers should be provided since workers at temporary construction sites are possible carriers of diseases.
	b) Personal protective equipment including training on its use should be provided to workers.
Project Response	a) The EMPs for the project (chapters X and XI) prescribe specific mitigation measures for the management of the health of worker force and waste management in worker camps. b) The EMP specifies required training and protective equipment for workers as part of the occupational worker safety for the project. c) The feasibility study of the project includes assessment of the suitability of all selected lands for substation and transmission line development.
Phyu Thant, Myanmar Youth Entrepreneur Association	a) Negative impacts of electromagnetic field should be considered because the proposed lines are close to residential areas.
	b) Prepare a traffic management plan to consider high traffic volumes at certain days.
	c) Select areas with enough space for the construction materials to avoid traffic.
Project Response:	a) Health effects of EMF have not been proven by international medical community (Appendix E).

	b) The EMPs for the project (chapter X and XI) prescribe traffic management during the construction and operation of the new 230 kV transmission lines, and substations. c) As part of b)
Dr. Kyaw Swar Tint, Yangon Technology University	a) Public consultations and information disclosure should continue.
	b) There is high risk of riverbank erosion when constructing towers near the river. Emergency response plan should also be implemented to avoid riverbank erosion and potential damage of poles/towers and the transmission line.
	c) Alignment should select the least impact route.
	d) Future city development issues should be considered when selecting the best route.
	e) The project should follow MOECAF's procedures and other relevant policies aside from the ADB guidelines.
Project Response:	a) The public consultation and disclosure process by design will continue to end of project implementation. b) Prevention of erosion and sedimentation of Pazundaung creek from installation of tower foundations is explicit in the EMPs of project (chapter X and XI). Protection of tower foundations from erosion is built into the design of the towers installations. c) The primary criterion of the transmission alignments is minimal social and environmental impact. d) The Yangon Development Master Plan was part of the rationale and design of the transmission lines. e) The project will and must follow MOECAF regulations and guidelines.
Si Thu Aung, Myanmar Engineering Society	a) Provide safety barriers, signs and fences during construction to avoid accidents.
	b) Assign safety officers at the construction sites.
Project Response	a) Construction site worker and public safety measures are explicit in the EMP for the project (chapter X). b) Assignment of a safety officer for all construction sites will be a requirement of selected contractors for the project.

C. Results of Focused Consultations with Key Informants

110. Interviews with representatives of relevant Government agencies such as MOECAF and various YCDC departments such as the Department of Engineering, City Planning and Land Administration Department, and the Water and Sanitation Department were conducted as part of the due diligence of the proposed project from the period 29 April – 09 May 2014. The in-depth interviews primarily focused on presenting the project concept design, obtain baseline environmental, land use and cultural information for the project sites as well as Government clearance requirements. The opinions of the agency representatives on the perceived environmental impacts of the project and their suggestions to properly implement the project were also discussed.

111. Following the changes in the project components and alignment of the transmission line in Yangon, additional consultation meetings were conducted at the MOECAF Yangon and at YCDC local township offices which has jurisdiction over the project affected areas from the period 27 – 31 October 2014. These one-on-one meetings with YCDC Executive Officers and staff were held to inform them of the

proposed changes in the transmission line alignment and solicit their comments particularly on environmental issues within their areas of jurisdiction. Table 16 summarizes the issues raised during the in-depth key informant interviews.

Table 16. Summary of issues identified during key informant interviews

Agency/ Office	Date of Meeting	Persons Consulted	Issues Raised	Response of Project
Ministry of Environmental Conservation and Forestry (MOECAF)				
MOECAF, Naypyitaw	April 30, 2014	U Hla Maung Thein – Deputy Director General U San Oo – Director, Policy Department U Than Aye – Director, Policy Department Daw Ni Ni Aung – Director, Pollution Control Department	• EIA procedures are still in the draft stage but the EIA process is already being implemented based on the Environment Conservation Law and the Investment Law. The 230 kV transmission lines require an IEE based on current version of the draft EIA Procedures. • Community consultations need to be conducted particularly for the proposed project in Yangon to make the people aware of the project. .	IEE/EMP have been prepared in view of current EIA procedures and rules Community consultations on the project components were conducted, and documented herein
MOECAF, Yangon	October 28, 2014	U Myo Lwin – Director, Environmental Conservation Department U Khin Maung Te – Assistant Director	• The 6th edition of the draft EIA Procedures and 4th edition of the scoping requirements are now being followed by MOECAF in determining the EIA requirements for projects. At the moment, only some minor revisions on the chapter on fines and penalties are being deliberated on the draft procedures. • Based on the Checklist of Requirements of the draft EIA Procedures (6th edition), the following are the requirements: ○ 230 kV transmission lines < 50km need an IEE while those ≥ 50km need an EIA. ○ 230 kV substations requiring an area <10 ha need an IEE while those ≥ 10 ha need an EIA. • The Thida-Thaketa-Kyaikasan TL can be combined as an IEE while the South Okkalapa Substation will be a separate IEE. The West University Substation which covers an area more than 10ha will need an EIA. These requirements will be further defined when MOEP submits a proposal with the profile of the 3rd party EIA preparer to	As above MOECAF IEE/EIA screening criteria reported in IEE ADB screening identifies requirement for an IEE for all project components. A single IEE will be prepared for the 230 kV transmission lines and two substations in order to consolidate the project components in IEE, and to prevent information

Agency/ Office	Date of Meeting	Persons Consulted	Issues Raised	Response of Project
			MOECAF in Naypyitaw. The proposal will be evaluated by the Environmental Conservation Department in Naypyitaw to determine the requirements. MOEP will then submit the EIA/IEE for review. The Screening Committee can ask for amendments or additional information on the report. • On public consultation, at least 2 meetings should be held. The 1st meeting will be during the initial stage to disseminate the project to stakeholders while the 2nd meeting will be after the preparation of the EIA/IEE whereby the potential impacts and proposed mitigation measures will be presented. A summary EIA in Burmese language is provided during the 2nd public consultation and also provided to township GAOs and MOECAF Yangon. • A Grievance Redress Mechanism (GRM) is not formally outlined in the draft EIA Procedures but should be integrated into the EMP. • Once an ECC has been issued to the project, MOECAF Yangon will monitor the project implementation.	redundancy. However, separate EMPs will be prepared for: 1) the 230 kV lines; and 2) for the two substations to assist anticipated contractor work packages including preparation of the contractor environmental management plans (CEMP) from the EMPs. The ADB national consultant in consultation with the international consultant will provide advice to MOEP/MEPE as needed with their responsibilities with the EIA procedures of Myanmar including: i. their submissions of MOEP/MEPE to MOECAF ii. additional public consultation iii. translation of technical terminology iv. advice on Grievance Redress Mechanism requirements
Yangon City Development Committee (YCDC)				
Dept of Engineering	May 9, 2014		• The existing underground transmission line cable and other underground utilities are along Strand Road[31].	Project component excluded. See footnote 30.

[31] The former alignment which includes proposed underground cables along Strand Road were discussed during the meeting. This section of the transmission line has been removed by MOEP from the project.

Agency/ Office	Date of Meeting	Persons Consulted	Issues Raised	Response of Project
(Roads and Bridges)		U Tin Maung Kyi – Head	• Installation of underground cable may be risky. • The YCDC-Department of Engineering Roads and Bridges needs to be informed of the exact location of towers of the 230kV transmission line.	Underground cable will not be used. The EMP for 230 kV lines specifies need for close coordination between MEPE and YESB and YCDC.
City Planning and Land Administration Department	May 9, 2014	Dr. Tow Aung – Deputy Head	• The master plan of Yangon City was provided which contains information about the environmental conditions, sewer/drainage, water supply, among other in Yangon City.	Yangon Master Plan was used extensively in the project design and for IEE.
Water and Sanitation Dept	May 9, 2014	U Myo Thein – Assistant Chief Engineer	• Water supply pipelines may be affected if built along major roads. • Water supply in Yangon may be affected because power interruption may happen during construction. This concern should be considered in the project design.	The location of all below and above ground utility conduits is explicit in the project design, and is further identified as a potential impact area of project in IEE.
Local YCDC Offices				
YCDC Thingungyun Township	Oct. 27, 2014	U Yi Htun – Executive Officer U Zaw Min Htuu – Assistant Executive Officer	• There are poles that are located close to the road. There is not enough clearance between poles and buildings particularly at T-25 to T-35. • Future plans of property owners to construct buildings more than 2-storeys high along the road will be restricted. • It is better, safer and less costly if the lines traverse open space or playground areas. • At the center island of Waizayandar Road is a recently installed 36" water supply pipeline which is about 3 – 4 ft below ground level. The road is also newly rehabilitated. The alignment can be placed on the right side of the road. • The trees at the center island of Waizayandar Road are regularly trimmed and maintained by YCDC township offices. If there are	These issues, and potential impacts are carried forward and addressed in the IEE, and in the EMPs for the new 230 kV lines, and new substations.

Agency/ Office	Date of Meeting	Persons Consulted	Issues Raised	Response of Project
			trees that will be affected, MEPE needs to inform YCDC.	
YCDC Tamwe Township	October 27, 2014	U Than Oo – Executive Officer Daw Thandar Aung – Assistant Executive Officer, Water Department	• There is no problem if the proposed 230kV Kyaikasan-Thaketa TL will follow the existing 66kV line because there is no need to look for new area. • If the line will pass through East Horse Race Course Road and Lay Daung Kan St., there is possibility of causing traffic congestion during construction since this is a heavy traffic area. Many road accidents have also occurred along Lay Daung Kan St. involving poles at the center island. • There is also an international school in the area where children would cross the street and expose them to hazards of electrocution. MEPE needs to ensure the safety of the line. • On the expansion of the Kyaikasan substation, there is no concern since this is within the compound of the substation. • It is suggested that MEPE should use good quality poles because existing poles already have cracks. • There are water supply lines along Moe Kaung Road which should be avoided during construction. • There is a billboard at the corner of East Horse Race Course Road and Moe Kaung Road measuring 15 ft x 45 ft. YCDC income from the billboard advertisement will be affected. It costs 20,000 kyats per sq.ft. for 1 year.	The rationale for following the 66 kV ROW where possible has always been to benefit from existing cleared ROW. Public and worker safety issues, are carried forward and addressed in the IEE, and in the EMPs for the new 230 kV lines, and new substations. The loss of all forms of livelihood revenue is addressed alongside compensation for land lass in separate Compensation/ resettlement Plan
YCDC South Okkalapa Township	October 28, 2014	U Myint Swe Oo – Executive Officer	• Waizayandar Road is a newly rehabilitated road which was only completed about 8 months ago along with the installation of the water pipeline at the center island. On both sides of the road are open concrete drainage culverts (with some covered portions). • During the proposal stage, MEPE should work with the Road and Bridge Department, Water Supply and Sanitation Department of YCDC.	Utility damage issues are carried forward and addressed in the IEE, and in the EMPs for the new 230 kV lines, and new substations. Required agency relationships indicated above.

Agency/ Office	Date of Meeting	Persons Consulted	Issues Raised	Response of Project
		U Aye Kaw – Assistant Executive Officer	• MEPE should also consider the plans of owners who are planning to extend existing one-storey buildings along the road.	Protection of interests of affected landowners and responsibilities of MEPE are addressed Compensation/ resettlement Plan
YCDC Thaketa Township	October 28, 2014	U Thein Kywel Htay – Assistant Executive Officer	• The project should ensure safety of people. Safety clearance of the existing 66kV line is not being met and there have been reported accidents like electrocution resulting to death. Last year a victim died while climbing a tree that is already touching the 66kV line. Safety clearance should be ensured for the 230kV line. • The project should avoid plants that have been planted by the Garden Department of YCDC. • All roads traversed by the alignment within Thaketa township are already widened but in other areas future plans for road widening should be considered by MEPE. • There are drainage outlets to the river which should be avoided. The MEPE should coordinate with the River Training Department of the Ministry of Transport. • There is a fuel line along Shukinthar Myo Pat Road from Thaketa to Thida SS, which is managed by the Ministry of Gas and Energy that should be avoided, by the transmission line.	Public and worker safety issues, are carried forward and addressed in the IEE, and in the EMPs for the new 230 kV lines, and new substations. A tree and vegetation restoration plan is included in EMPs Potential damage to wastewater and stormwater drains, and receiving creeks are addressed by IEE and EMPs Fuel line protection along Shukinthar Myo Pat Road, and other project areas is included with urban utility conduit protection measures in IEE and EMPs.
YCDC Yankin Township	October 29, 2014	U Myat Kyaw – Executive Officer	• MEPE needs to work closely with the water, road and bridge and sanitation departments of YCDC. As much as possible, the project should not cause impact on existing drainage, water supply and roads. • There is a 6” water pipeline on the other side of Moe Kaung Road	These potential issues and impacts were identified by other agencies, and are addressed as indicated above.

Agency/ Office	Date of Meeting	Persons Consulted	Issues Raised	Response of Project
			and near the railway station that will be avoided by the alignment. • For trees that will be cut, MEPE needs to coordinate with the YCDC Garden and Playground Department. • In general, the proposed project is good but it should minimize its impact to the community and existing structures. The new MEPE route is much better because it selected areas with wider space than the former alignment along the existing 66kV line.	
YCDC Miyangon Township	October 31, 2014	U Aye Thaung – Executive Officer	• MEPE needs to work closely with other ministries and departments particularly the Ministry of Information because of the presence of the radio transmission tower near the site of the proposed South Okkalapa substation. • In the area near South Okkalapa substation, there are no houses that could be affected. There are also no water supply network or drainage lines on the side of the proposed project area. • If soil will be backfilled at the substation site, MEPE has to observe the following procedures: o MEPE has to submit the proposal to the Department of Road and Bridge of YCDC in order to get permission for construction vehicles and delivery trucks to access the roads. The letter should also include the routes to be traversed by the trucks. o YCDC should not allow spilling of soil on the existing roads and causing dirt on roads. Should this occur, the MEPE or the contractor will be charged.	The Ministry of information will be closely consulted throughout the implementation f he project. Required permits from YCDC and other urban management agencies will be obtained. The EMPs for the project components have mitigation sub-plans for managing excavation, works, transportation, and soil management according to MEPE requirements.
Ministry of Transport				
Directorate of Water	October 29, 2014	U Sein Tun - Director	• The DWIR implements channel improvement of waterways by virtue of the Conservation of Water Resources and Rivers Law. The	

Agency/ Office	Date of Meeting	Persons Consulted	Issues Raised	Response of Project
Resources Improvement of River Systems (DWIR)			procedures have been issued on 22 January 2013. Under the law, any agency or organization are required to get clearance from the Ministry of Transportation for a project affecting water resources. • The proposed installation of TL poles along riverbanks should ensure that it will not destroy navigation channel and that it will not destroy any river channel improvements like revetments and dikes without prior approval of the Ministry through the DWIR.	This directive of the DWIR applies directly to the crossings of the 230 kV lines Pazundaung creek, and the noted potential impacts of the 230 kV lines which are also presented in IEE.

D. Results of stakeholder surveys and interviews

112. Stakeholders within the community where the proposed substations will be located were surveyed. A set of questions was developed to guide the discussion during the survey. After a brief introduction of the project, project objectives and location, the following questions were asked of the respondents:

1. What do you think are the positive impacts of the project?
2. What do you think are the negative impacts of the project?
3. Do you have any suggestions on how to address these concerns about the project?
4. Do you have any suggestions on how to ensure disclosure of updated information about the project?
5. What do you think are the perceived benefits that can be derived by affected persons from the project?
6. Do you have suggestions on how to handle complaints related to the project?

113. The respondents were able to freely express their concerns of the proposed project in their neighborhood. The major concerns identified by the stakeholders are re-stated below along with the response of the project.

1) The design and implementation of the project should ensure safety and prevent explosions and electric shocks. There have been past experiences on explosions and sparks from substations and transmission lines. There is perceived greater danger with the proposed project because of higher voltage of the substation and transmission lines.

***Response of project**:*
Integrated into the engineering designs of the new transmission lines and substations are internationally recognized safety measures to prevent electrical, hazards, shocks or explosions.

2) The strength of the cables and poles should be ensured to prevent accidents.

***Response of project**:*
The size and guage of poles, transmission cable, and mounting hardware will include a wide margin of operational safety to prevent breakage during the highest wind storm events.

3) Trimming of trees should be done regularly because of experiences on electric sparks from existing lines which are touching trees.

***Response of project**:*
Regular trimming of trees along transmission lines is essential for sustainable power management aa well as safety.

4) The access roads to Thida substation and the street at the back of the substation are too narrow for fire engines to access the site and for cars to escape in case of fire and explosion.

***Response of project**:*
Access and the width of roads to Thida substation will be modified as needed to

provide safe operation and maintenance of the new 230 kV transmission line.

5) The locals should be informed about the developments of the project.

***Response of project**:*
The public and stakeholder consultation and information disclosure process of the project will continue to the end of project implementation (see below). Further, the EMP (chapter 10) of IEE prescribes the continuation of the process at the beginning of the pre-construction phase of the project.

a) There are affected persons because of land acquisition at the proposed West University substation.

***Response of project**:*
A key criterion for the selection of the West University substation and the South Okkalapa substation was to minimize land acquisition. The extent of acquisition is reported separately in the RP for the project.

114. When asked about the perceived benefits of the project, the respondents disclosed that there would be reduced electricity cost, less blackouts, more convenience, and employment opportunities during the construction and implementation of the project.

E. Future Public Participation and Information Disclosure

115. Based on the preliminary interviews and public consultations there is a need to provide additional information on the exact locations of transmission line towers when the detailed designs of the transmission line alignments have been finalized. Follow-up consultations with the same stakeholders should be organized and be implemented by MEPE with assistance from YESB during the detailed design phase of the project. The Project Implementation Consultant can assist with these consultations.

1. Disclosure of IEE

116. The executive summary of the IEE will be provided in Burmese language and disseminated during the 2nd public consultation of the project in compliance with the requirements of MOECAF. The IEE report will also be disclosed at the ADB website (www.adb.org) and at the MOEP website (www.moep.gov.mm) together with the translated IEE executive summary in Burmese language. The hard copies of these reports will also be made available at the MEPE substations and township offices.

2. Consultation and Outreach

117. The MEPE will carry out additional consultations with the affected stakeholders when the final project alignment and tower locations have been finalized. In addition, the MOECAF requires the presentation of the project to stakeholders in compliance with the Environmental Conservation Law prior to the submission of an EIA report to MOECAF. Likewise, another public consultation meeting needs to be done to present the results of the EIA as well as the proposed EMP to address adverse impacts of the project. These additional consultation and disclosure activities during detail design and prior to construction will be conducted by the MEPE to finalize the location of the towers and to

follow-up the results of the consultation and information disclosure activities that have been conducted for the proposed project.

118. During this consultation process, the IEE, EMP, and grievance redress procedure will be presented to gather comments and concerns from affected stakeholders. The consultation meetings with affected stakeholders will be conducted in coordination with the Township offices and wards.

119. During project construction, the MEPE will provide information about the project through project messages and signs at township offices and along transmission line alignments to provide brief information about the project and the contact persons in case complaints are raised against construction activities.

120. During the operational phase of the project, the MOEP through the transmission line maintenance department will continue to coordinate with the townships and wards to ensure that concerns of stakeholders are readily addressed.

VII. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION

A. Approach to Assessment

121. The IEE of the project was structured by the three development phases of the project components (i.e., *pre-construction*, *construction*, and *post-construction operational* phases of the 230 kV lines and substations) which allowed potential impacts of common project component activities to be addressed together thereby minimizing redundancy in the assessment. However, potential impacts specific to a project component are addressed separately as required. This structure is carried forward and used to structure the EMP prepared for the project (section X).

B. Pre-construction Phase

122. The negative impacts associated with the pre-construction phase of the project concern land acquisition and compensation, and possible resettlement. Some temporary and permanent land loss requiring compensation will occur due to line tower construction, while required resettlement is expected to be nil or minimal. The permanent loss of land will occur for the tower foundations and RoW requirements while additional land will be temporarily required for construction activities and vehicle movement. The details of the land losses and compensation of the final 230 kV transmission lines and the new substations are found in the Resettlement Plan (RP) which has been prepared separately.

Updating Environmental Management Plan

123. The EMP prepared for the 230 kV transmission lines, and the substations will need to be updated during the pre-construction phase to ensure that the EMP fully addresses the potential impacts of the final detailed designs of the 230 kV lines and substations. Finalization of the EMP will include updating the mitigation and monitoring plans that will manage and measure potential impact areas the 230 kV lines and substations introduced below. The updated EMP will be used by the contractors to

prepare their contractor environmental management plans (CEMP) for the 230 kV lines and substations.

C. Construction Phase

124. Potential environmental impacts of the project are associated primarily with the construction phase of the two 230 kV lines and two new substations. The substations sites in north central and northwest Yangon, and both transmission lines in southeastern Yangon are not located in ecological protected areas. The ROWs for the new 230 kV lines and substation sites do not support critical wildlife habitat or rare or endangered species. The 230 kV lines are not located near any of the 188 buildings and structures that form the Yangon City Heritage List. The Shwe Dagon pagoda which is the most famous and highly valued ancient monument and protected zone of Yangon is not near the construction areas.

1. Potential impacts of transmission lines and substation construction

125. Short-term construction-related impacts that will be common the two 230 kV transmission lines and new South Okkalapa and West University substations are reduced and/or blocked public access, disrupted agriculture, noise, dust and air pollution from NOx, SOx, and CO caused by construction truck traffic and heavy equipment use, soil and garden/paddy pollution caused by equipment operation and maintenance, potential public and worker accidents e.g., exposure to cable and equipment on ground, increased traffic and risk of accidents, erosion and potential surface water sedimentation, drainage and flooding problems, solid waste and domestic pollution from worker camps, damage to existing roads used by construction vehicles, and social and community problems caused by migrant workers.

126. Common construction management measures to mitigate potential impacts caused by the construction of the two 230 kV transmission lines and substations are exemplified in Table 17. The mitigation measures for the construction impacts and disturbances are detailed in the project EMPs.

Table 17. Construction impact mitigations of transmission lines and substations

1) Open excavations should be fenced, and trenches covered where public walkways or vehicles must cross.
2) A cultural chance find management sub-plan for all construction areas must be in place in the EMPs for cultural artifacts and property.
3) Regular use of wetting agents should be employed at construction sites and along construction roads to minimize dust.
4) All construction vehicles and gas powered equipment should be maintained in proper working order to minimize emissions, and should not be operated at night if possible to minimize noise nuisance.
5) Speed limits should be posted and adhered to by construction vehicles on all existing and temporary construction roads.
6) Where possible construction vehicles should use different roads or dedicated

lanes of roads shared by the public.

7) Trees and other vegetation at all construction sites and along road corridors should be protected with minimal removal (see below).

8) Present and past land use should be reviewed to assess whether excavated soils are contaminated spoil. Contaminated spoil should be disposed at a landfill or a location approved by MOECAF or YCDC.

9) Berms and/or silt curtains should be constructed around all excavation/trench sites and along all rice paddy and surface waters to prevent soil erosion and sedimentation.

10) Local workers should be used as much as possible to prevent or minimize influx of migrant workers, and incidence of social disease and community unrest.

11) Worker camps must have adequate domestic waste collection facilities and sufficient pit latrines that are located away from public areas and surface waters.

12) Dedicated fuel storage areas must be established away from public areas and marked clearly.

13) To minimize the risk of public and worker injury, appropriate Ministry of Labour ASEAN-OSHNET guidelines for Occupational, Safety, and Community Health must be applied or the IFC/World Bank Environment, Health, and Safety Guidelines (2007) that govern the safe and orderly operation of civil works should be followed.

14) Aggregates (e.g., sand, gravel, rock) that are transported by truck should be covered.

15) Prolonged use of temporary storage piles of fill should be avoided, covered, or wetted regularly to prevent dust and erosion.

16) Sand extraction from any rivers for construction fill should be done at licensed areas only.

17) Storage of bulk fuel should be on covered concrete pads, away from the public and worker camp. Fuel storage areas and tanks must be clearly marked, protected and lighted. Contractors should be required to have an emergency plan to handle fuel and oil spillage.

2. Environmental Issues of 230 kV transmission lines

127. The 230 kV transmission lines will not cause significant impacts to the environment. Both line alignments are located in an urban environment and will not traverse any ecologically sensitive nor culturally/historically protected areas. Environmental issues that may occur as a result of the alignments are construction-related and can be addressed with appropriate mitigation measures. Environmental issues that need to be considered for both alignments are summarized below:

a. Impact on community health and safety

128. The alignments could pose danger to community from electrocution when the new 230 kV lines are being installed particularly if the prescribed safety measures and clearances from the lines are compromised during the construction period. Because sections of both alignments are located in highly dense areas in Yangon, safety clearance from the alignment should be investigated in the selection of the final tower location to avoid accidents. There may also be difficulty in constructing in congested areas.

b. Impact on traffic

129. Both lines of transmission towers are located along thoroughfares in Yangon. Traffic congestion will occur during the foundation works and pole installations, thus, requiring proper coordination with YCDC for traffic management.

c. Impact on noise and air quality

130. Short-term impacts of noise and dust caused from civil earthworks during construction of both alignments will occur from both brought about by the excavation of tower foundation, installation of towers, and movement of construction trucks and heavy equipment.

d. Erosion and soil runoff

131. Most of the new tower foundations will require excavation for the footings which will generate loose soil leading to potential erosion of adjacent areas including drainages or Pazundaung creek.

e. Existing roads, billboards, drainage and water supply lines

132. The roads alignments of transmission lines are surfaced with concrete or asphalt. The installation of tower foundations on these roads will damage the roads, thus, requiring complete road restoration after tower installation.

133. Drainage culverts and water supply lines are located along the sides of the roads. Coordination with YCDC is needed to ensure that these road structures and utility services are not damaged by the construction of tower foundations. The design of the lines must be aligned with the existing and future urban plans of YCDC for the area.

134. In addition, along these roads are billboards and signage which are being managed by the YCDC. Most of the affected billboards measure 15 ft x 45 ft. [32] To maintain conductor clearance of the transmission line the billboards located near the proposed 230 kV line corridors will need to be removed. Coordination with YCDC is needed when the tower foundation locations are finalized to clarify the extent of the impact and required relocation or restoration of affected billboards and signs.

[32] Based on information gathered from YCDC township interviews, YCDC annual income from a commercial billboard is 20,000 kyats per sq.ft.

f. Impact on land use

135. The proposed 230 kV alignments while close to existing 66 kV lines, will affect land use in areas adjacent to the new towers. Construction of buildings more than 2-storeys will be restricted in areas along roadsides where vertical and horizontal safety clearance needs to be maintained. While shoulder area of these roads are generally for commercial use, future plans of some property owners to expand and build higher structures may become restricted because of the presence of the transmission line.

g. Impact on trees

136. There are trees along the 230 kV line ROWs which will need to be cut or trimmed for the new lines, and to allow for future line maintenance. The proposed alignment on Waizayandar road runs along the approximately 1.5 m median of ornamental trees (Figure 13). The selection of tower locations must avoid the trees along the median. Coordination with YCDC is essential for tree removal and subsequent mitigation by tree replacement at site or elsewhere in Yangon.

h. Impacts on water supply

137. The alignment along median of Waizayandar road needs to consider carefully the new 36" water supply line that was installed about 1 meter below the surface of the median. The MEPE must consider an appropriate design and construction methods to avoid the water pipeline during tower foundation construction. In addition complete restoration of the damaged portion of the road and island must be assured by MEPE.

i. Impacts on Pazundaung creek

138. The MEPE plans to use bored piles for the tower foundations on the bank of the Pazundaung creek (Figure 21). Although this method will reduce excavation works and potential soil erosion, appropriate measures need to be applied to control runoff of sediments and oil-containing wastes into the nearby creek. There are scattered mangroves growing along the banks which may be affected by the tower installation. MEPE must coordinate with the Directorate of Water Resources Improvement of River Systems (DWIR) of the Ministry of Transport and YCDC with the final design and construction works along Pazundaung creek.

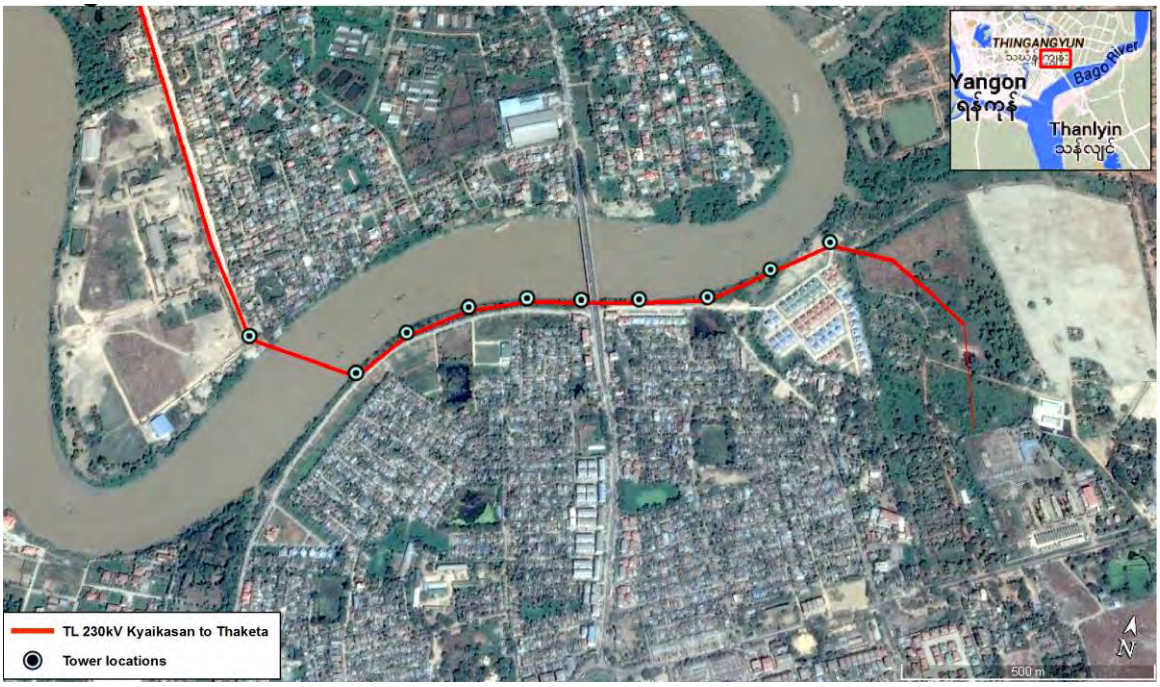


Figure 21. Indicative tower locations of line along Pazundaung creek

3. Summary of impacts of 230 kV transmission line alignments

139. Table 18 summarizes the environmental issues of the alignment corridors between Thida – Thaketa – Kyaikasan S/S. Tables 19 and 20 summarize characteristics of the roads that are affected by the alignment between Thida and Thaketa S/S, and between Thaketa and Kyaikasan S/S.

Table 18. Environmental issues of 230 kV Thida – Thaketa - Kyaikasan lines

Environmental Impacts	MEPE Alignment
Impact on community safety – electrocution	Yes
Traffic congestion during construction	Yes
Traffic accidents during operation because of tower presence on roads	Yes
Impact on noise during construction	Yes
Impact on air quality during construction	Yes
Soil erosion and runoff during foundation works	Yes
Damage to existing roads	Yes

Damage to billboards	Yes
Damage to drainage canals	Yes
Damage to water supply lines	Yes
Limit building height along roads – impact on land use	Yes
Removal of trees	Yes
Impact on existing bridge stability	No
Impact of underground lines	No
Discharge of oily wastes	Yes
Impact on riverbanks and mangroves	Yes

Table 19. Roads affected by 230 kV line between Thaketa – Kyaikasan S/S

Name of Road	No. of lanes	Type of Road	Est. No. of Towers	Est. TL length (km)	Remarks
North Horse Race Course Rd	6	Asphalt	3	0.24	Poles will be inside the property line
Moe Kaung Rd	4	Asphalt	4	0.43	Wide easement; water supply, drainage lines can be avoided during tower placement; tall billboard at corner with North Horse Race Course Rd. will be affected
Baukhtaw Station St.	2	Asphalt	5	0.52	Wide easement with trees which could be trimmed during operation to maintain safety clearance.
Railway	Railway	Railway	3	0.16	Alongside of railway; needs MOT approval.
-	-	-	3	0.2	Land bounded by property of home for the aged.
Pyitharyar Rd	2	Asphalt	3	0.17	Road with damaged portions; may worsen traffic during construction
Waizayandar Rd	6	Concrete	6	1.8	Affect trees and water supply pipeline on center island; needs road restoration works after construction; tall buildings towards junction with Thanthumar Rd.
Thanthumar Rd	6	Asphalt	10	1.34	Will affect billboards; wide road with enough easement on both sides.

Name of Road	No. of lanes	Type of Road	Est. No. of Towers	Est. TL length (km)	Remarks
Thuwunna Rd	4	Asphalt	11		
Paw San Hmway Rd	4	Concrete	10	1.25	
	-	-	2	0.24	River crossing
	-	-	14	1.1	Riverbank

Table 20. Roads affected by 230 kV line between Thaketa-Thida S/S

Name of Road	No. of lanes	Type of Road	No. of Towers	Est. TL length (km)	Remarks
Road to Yangon Thanlyin Bridge	4	Asphalt	8	0.47	
Shukhinthar Myo Pat Rd	6	Asphalt	10	1.22	Diesel and petrol pipeline in southern side will be avoided
Shukhinthar Myo Pat Rd	6	Asphalt	7	0.77	Residential areas close to road
Shukhinthar Myo Pat Rd	6	Asphalt	3	0.27	
Shukhinthar Myo Pat Rd	6	Asphalt	7	0.52	Wide easement; land adjacent to road with some shops
Shukhinthar Myo Pat Rd	6	Asphalt	13	1.5	Will cross to the northern side towards vacant area to avoid pagoda
Yamonnar Rd	6	Asphalt	13	1.64	
Road under Maha Bandoola Bridge	2	Asphalt	5	0.44	

140. The transmission lines will be constructed in densely populated areas of urban Yangon, but will not traverse ecologically sensitive or culturally/historically protected areas. Construction impacts arising from lines are primarily related to losses of trees and garden areas, construction disturbances of noise, dust, traffic disruption, worker and public safety, potential short-term erosion/sedimentation of Pazundaung creek, and the need for safety clearances from existing utility conduits, structures, and buildings.

141. The final tower locations should be selected to avoid tall buildings and densely populated areas as much as possible. The construction-related environmental issues can be avoided and mitigated through the implementation of appropriate mitigation measures and through coordination with the appropriate authorities such as the MOECAF, YCDC and township offices and the Ministry of Transport.

4. New South Okkalapa substation

142. The site for the South Okkalapa substation (Figure 5) was selected by MEPE to minimize resettlement and land acquisition which also acts to reduce environmental/social impacts. The common construction-related impacts summarized in Table 17 need to be managed with consideration of the adjacent Ministry of Information

lands to the west, the Okkala Golf Course to the south, and the roadway and residential settlement which form northeast boundary of the site. Special attention is required to manage construction disturbances to the single dwelling located between the golf course and substation site.

143. Construction traffic along the roadway to the site needs to be managed to minimize congestion the risk of accidents with local and golf club traffic. Heavy excavation works and truck traffic should not occur if prevailing wind is from the north in order to not inundate the single dwelling and the golf course with dust.

5. New West University substation

144. Similar to the South Okkalapa site the site of the West University substation (Figure 5) also minimizes resettlement and land acquisition due to the extensive Ministry of Transport lands to the west and south of the site. The construction-related disturbances (Table 17) such as land erosion and dust, and construction waste on the agricultural lands to the north and east need to be managed. If possible civil works should be scheduled when crop planting is not occurring. Temporary berms between the construction site and the stream that flows to the river northeast of the site are needed to prevent erosion and sedimentation of the watercourses. Pauk and Kone villages to the west and northwest of the site will be affected by the construction traffic that will use the village access road if a temporary construction road is not built to the site. Construction vehicle traffic should be kept separate from village traffic. Effort to hire construction workers from Pauk village and other local villages should occur, and foreign worker camps should be kept away from the villages.

6. Kyaikasan substation extension

145. The potential construction-related impacts of the extension to the Kyaikasan substation (Figure 4) are minor because the extension is on government land. The indicative footprint area of the extension needs to be finalized based on the extent of addition substation equipment is needed to receive the new 230 kV line. However, because the extension is on Military lands social and public impacts will zero to minimal. The trees and shrubbery that will be cleared should be replaced most appropriately with tree planting on the adjacent Ministry of Sport lands.

D. Operation Phase

1. 230 kV lines between Thida – Thaketa – Kyaikasan Substations

146. Potential impacts of the operation and maintenance of new 230 kV transmission lines in urban areas are worker and public injury, and from unauthorized public access to the towers, respectively. Clearly visible signage should be posted at two sides of the base of all transmission towers indicating possible dangers to the public. All employees must be trained adequately to service and maintain the lines.

147. The negative health effects from electromagnetic field (EMF) radiation from the transmission line have not been established conclusively by the international medical research community (Appendix E). In locating the transmission lines, MEPE will ensure that horizontal and vertical safety clearances from structures are complied with. In addition, EMF levels along the line will be monitored.

148. Regular trimming of trees near the 230 kV lines can occur to maintain vertical and lateral safety clearance and access. However, particular care with trimming must be directed to the large ornamental share trees along the island median of Waizayandar road.

2. New South Okkalapa and West University substations

149. Similar to the operation of the transmission lines the public must be kept away from the substations. A high wired fenced perimeter should be installed with danger warning signs posted every 10 m along the fence. The worker force of the substations should be properly trained for substation operation and maintenance, and for emergency situations. Substation vehicle traffic should follow all road regulations shared by local residents.

E. Associated facilities

150. The detailed designs of associated tower facilities of South Okkalapa and West University substations (Table 6) are not complete. However, there are no anticipated specific environmental issues associated with the construction or operation of the tower facilities. Construction and operation of the tower facilities will be integrated with the construction and operation of the substations, thus potential construction or operational impacts of the tower facilities will be managed alongside potential impacts of the substations.

F. Cumulative impacts

151. There are no anticipated cumulative impacts of the project.

G. Climate Change

152. The project components will not influence ongoing global or regional greenhouse induced climate change. Noteworthy is that the primary source of electricity generation in Myanmar is hydropower which compared to thermal generation from coal or other fossil fuels is much more climate friendly.

153. As introduced by the REA for the project (Appendix B) the project could be vulnerable to climate-change induced regional changes in the frequency and intensity of rainfall, flooding, and wind events. The elevations of the foundations of the new South Okkalapa and West University substations must be determined with a wide margin of resilience to increased flooding on the agricultural lands.

154. Similarly, the foundations of all transmission towers with special reference to towers along the banks of the tidal Pazundaung creek are sensitive to sea level rise, and must be located well above high water and flood levels with foundation designs resilient to prolonged flood events and ocean storm surge. The monopole tower and cable materials and design must also be resilient to increased severity of wind events.

VIII. ANALYSIS OF ALTERNATIVES

155. The analysis of project alternatives focused on the Fichtner 230 kV transmission line corridors between Thida, Thaketa, and Kyaikasan substations introduced above. No alternative sites for the West University and South Okkalapa substations were examined.

156. The Fichtner 230 kV transmission line corridors between Thida, Thaketa, and Kyaikasan substations are compared with the final MEPE corridors in Figures 22 and 23. With respect to potential environmental impacts the differences between the Fichtner line alignments and the MEPE line alignments are minor and not significant. Potential issues of the Fichtner 230 kV alignments are summarized below.

The 230 kV cables attached to Maha Bandoola and Thuwunna bridges

157. The Fichtner 230 kV line ROWs between Thida, Thaketa, and Kyaikasan substations include laying the 230 kV cables in cables trays attached to the undersides of the Maha Bandoola and Thuwunna bridges as the means to cross Pazundaung creek (e.g., Figures 22 and 24). The installation of cable trays and cable beneath the bridges could expose Pazundaung creek to pollution from construction waste falling or being discarded from overhead into creek. Also, boat navigation below the bridges could be disrupted from overhead construction activities and falling waste.

158. Attaching the trays and 230 kV cable to the bridges could potentially affect the structural stability of the bridges given the bridges were not designed to carry the additional load. The MEPE would need to secure engineering safety clearance from the Road and Bridge Department of YCDC in order to proceed with the tray and cable installation.

Impact of underground cable (UGC) sections

159. The Fichtner proposal of installing short UGC sections of the 230 kV lines at the approaches to bridges and some substations will avoid congested overhead lines especially near the substations but will also cause increased local construction disturbance associated with required trench excavations. Moreover, close coordination with YCDC would be required to ensure existing underground utility conduits such as water supply and drainage are not affected, or are moved as necessary.

Densely populated areas along Ayeyarwun and Pyitharyar roads

160. The Fichtner Thaketa-Kyaikasan 230 kV alignment follows densely populated sections of Ayeyarwun road which will not meet the horizontal and vertical safety clearance requirements for 230 kV transmission line. Similarly, future plans of owners of land to construct high-rise buildings along this major commercial road will be restricted when a transmission line is built at the easement.

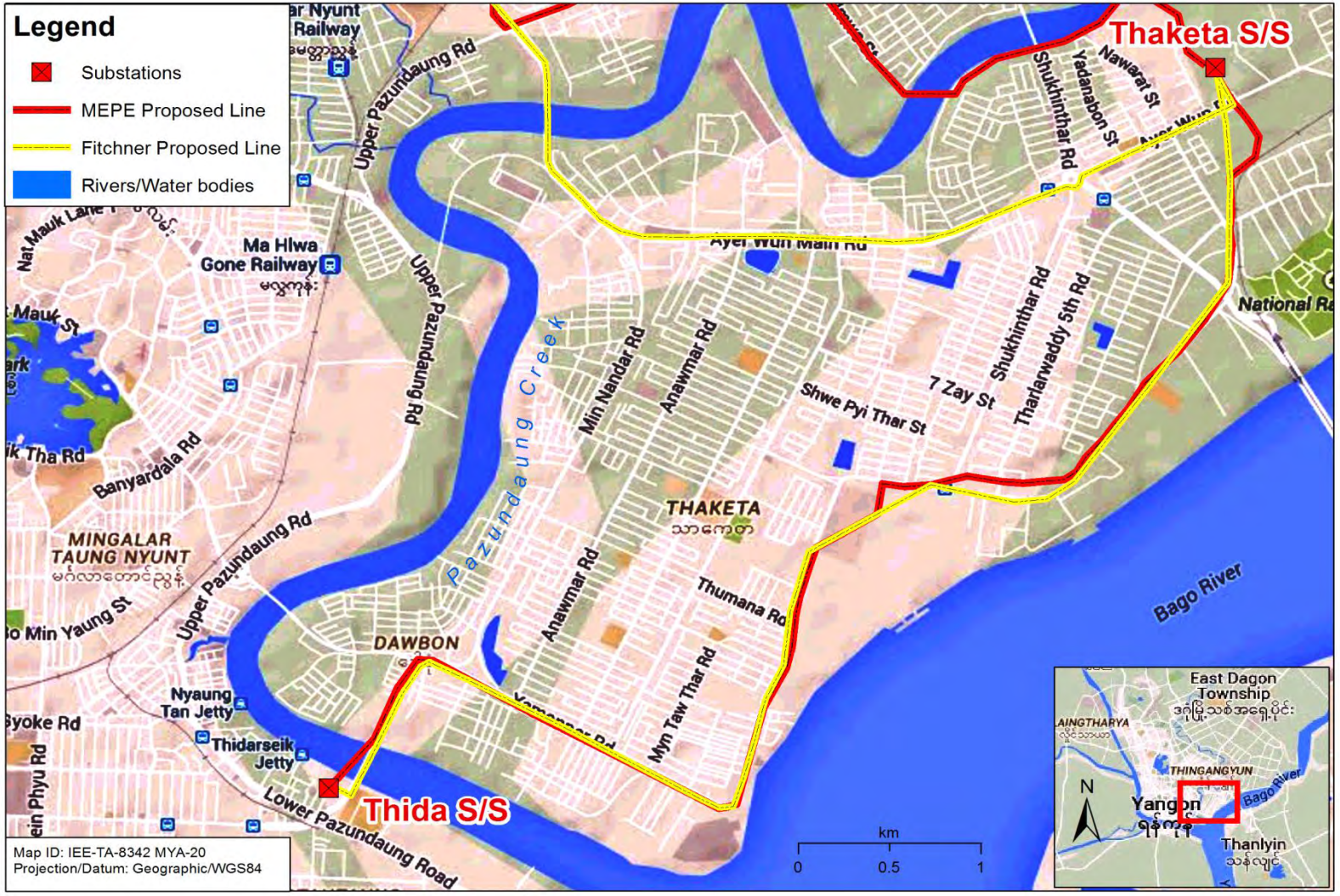


Figure 22. MEPE and Fichtner 230 kV lines between Thida and Thaketa S/S

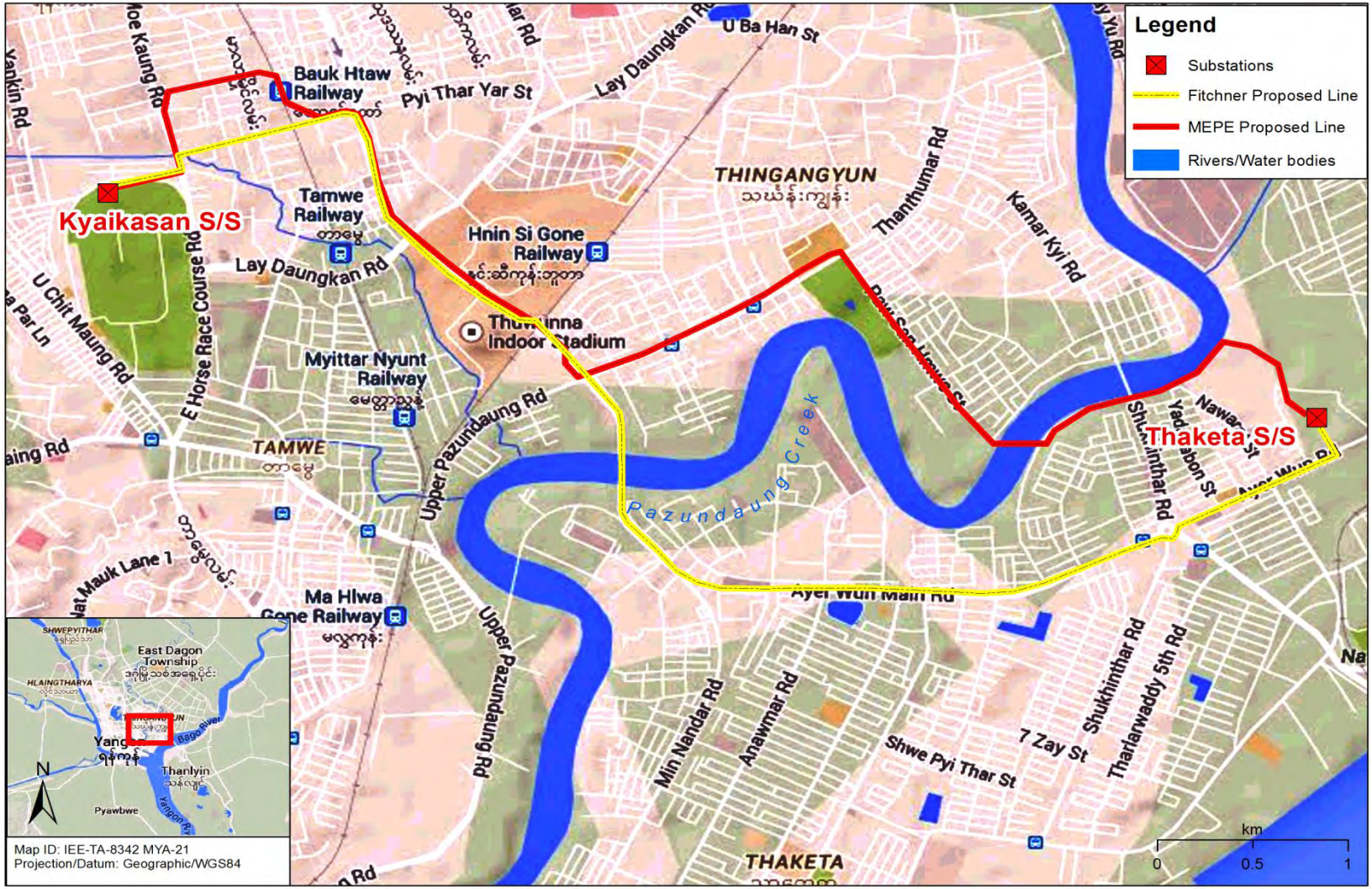


Figure 23. MEPE and Fichtner 230 kV lines between Thaketa and Kyaikasan S/S

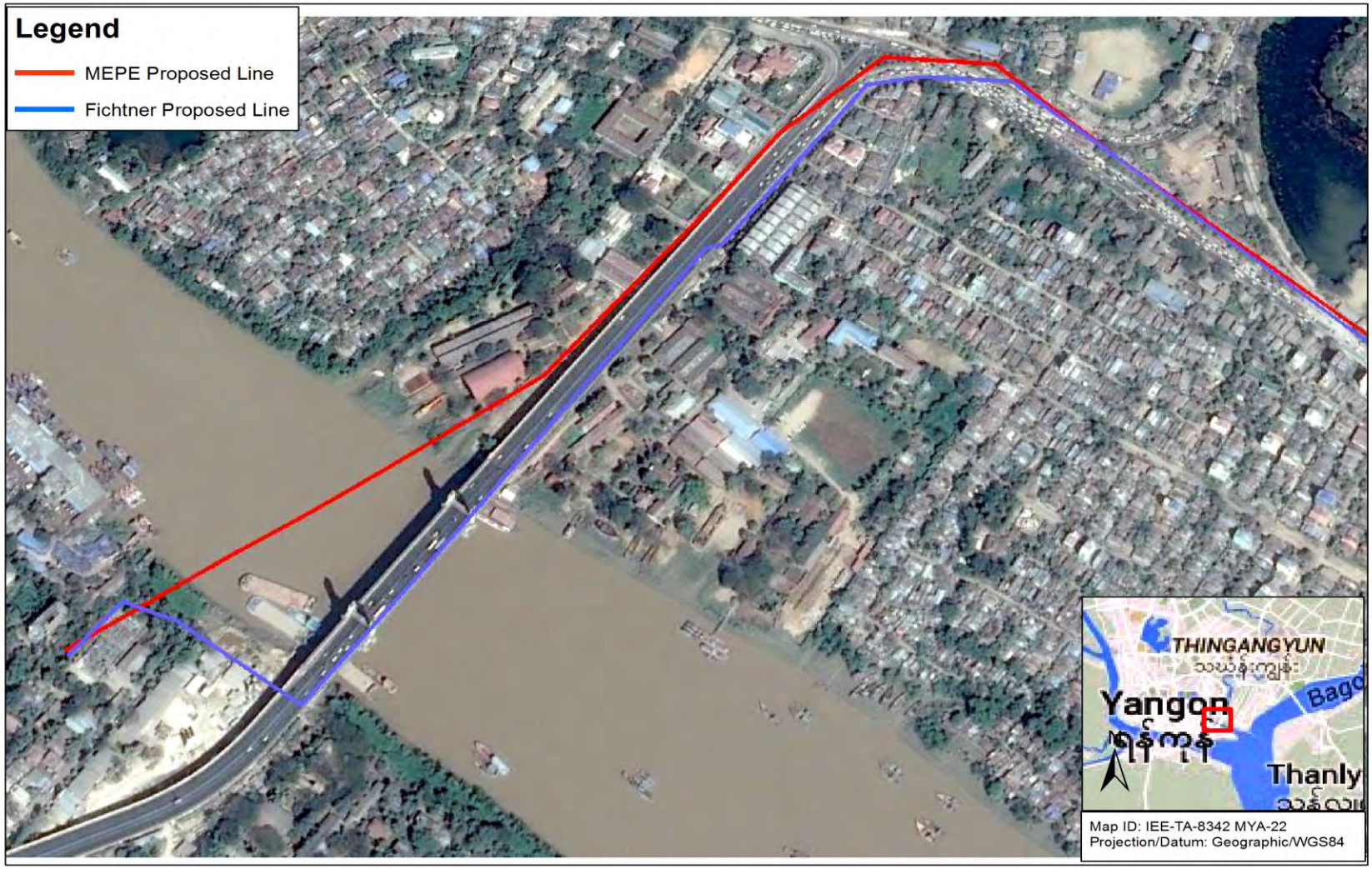


Figure 24. MEPE line and Fichter line corridor at Maha Bandoola bridge

161. Monopoles are proposed along Pyitharyar Road which is a narrow two-lane road that connects the major Moe Kaung and Waizayandar roads which results in Pyitharyar Road being a busy road. Side-street parking exists along the road Pyitharyar Road. The tall buildings along the road at the junction with Moe Kaung Road could compromise safety clearances for the 230 kV line due to insufficient easement on that side of the road. Heightened traffic congestion will occur during the construction and installation of the monopoles poles and lines.

Impacts on new road and drainage lines along Waizayandar Road

162. Safety clearances for the installation of the transmission line along Waizayandar road need to be considered carefully given the tall buildings near the intersection of Waizayandar road with Thanthummar road (Figure 25). Waizayandar Road is a newly rehabilitated concrete six lane road which includes dual lateral drainage culverts. The proposed Fichtner alignment could damage the rehabilitated road and drainage culvert function. Coordination with YCDC is essential to ensure complete road and drainage restoration following construction.

Tall buildings on the side of the road.

Drainage culverts

Figure 25. Affected structures on Waizayandar road

163. Tables 21 – 23 provide a comparison of environmental and social issues between the Fichtner and MEPE line corridors.

Table 21. Summary comparison of MEPE and Fichtner 230 kV lines

Environmental Impacts	Fitchner Alignments	MEPE Alignments
Impact on community safety - electrocution	Yes	Yes
Traffic congestion during construction	Yes	Yes
Traffic accidents during operation because of tower presence on roads	Yes	Yes
Impact on noise during construction	Yes	Yes
Impact on air quality during construction	Yes	Yes
Soil erosion and runoff during foundation works	Yes	Yes
Damage to existing roads	Yes	Yes
Damage to billboards	Yes	Yes
Damage to drainage canals	Yes	Yes

Environmental Impacts	Fitchner Alignments	MEPE Alignments
Damage to water supply lines	Yes	Yes
Limit building height along roads – impact on land use	Yes	Yes
Removal of trees	Yes	Yes
Impact on existing bridge stability	Yes	No
Impact on underground lines to Thaketa SS	Yes	No
Discharge of oily wastes	Yes	Yes
Impact on riverbanks and mangroves	No	Yes

Table 22. Roads affected between Thaketa and Kyaikasan S/S by Fichtner Line

Name of Road	No. of lanes	Type of Road	Est. No. of Towers	Est. TL length (km)	Remarks
Fichtner Line					
North Horse Race Course Rd	2	Asphalt	2	0.18	Poles are inside property
Moe Kaung Rd	4	Asphalt	2	0.1	Wide easement; water supply, drainage lines can be avoided during tower placement; tall billboard at corner with North Horse Race Course Rd. will be affected
Pyitharyar Rd	2	Asphalt	3	0.92	Narrow road, not enough safety clearance on the side; tall bldgs. at junction with Moe Kaung Rd.
Waizayandar Rd	6	Concrete	8	1.52	If tower will be located at road side, may damage new road with concrete culvert; line corridor is close tall buildings at the junction with Thanthumar Rd
Thanthumar Rd	6	Concrete	7	0.85	Will affect billboards; wide road with enough easement on both sides
Thuwunna Bridge	2	Asphalt	3	0.25	
Ayeyarwun Rd	4	Asphalt	17	4	Narrow road; not enough safety clearance; densely populated

Table 23. Roads affected between Thaketa and Thida S/S by Fichtner Line

Name of Road	No. of lanes	Type of Road	No. of Towers	Est. TL length (km)	Remarks
Fitchner Line					
Maha Bandoola Bridge	4	Asphalt	5	0.76	Bridge design may not carry dead load from TL cable
Shukhinthar Myo Pat Rd	6	Asphalt	8	2.05	
Shukhinthar Myo Pat Rd	6	Asphalt	2	0.8	Residential
Shukhinthar Myo Pat Rd	6	Asphalt	5	1.37	Diesel and petrol pipeline in southern side will be avoided
Shukhinthar Myo Pat Rd	6	Asphalt	2	0.11	Residential
Yamonnar Rd	6	Asphalt	3	1.74	
Rd approaching Maha Bandoola Bridge (Yamonnar Rd)	2	Asphalt	4	0.84	

164. The MEPE and Fichtner transmission line options will be constructed in densely populated areas of urban Yangon, and will not traverse any ecologically sensitive nor culturally/historically protected areas. Construction issues arising from both line alternatives are primarily related to local losses of trees and garden areas, construction disturbances of noise, dust, traffic disruption, worker and public safety, short-term erosion/sedimentation of Pazundaung creek, and the provision of safety clearances from existing utility conduits, structures, and buildings. There is no significant difference between the construction-related environmental impacts of the final MEPE and initial Fichtner lines.

165. For both alignment alternatives the final tower locations should be selected to avoid tall buildings and densely populated areas as much as possible. The construction-related environmental issues can be avoided and mitigated through the implementation of appropriate mitigation measures and through coordination with the appropriate authorities such as the MOECAF, YCDC and township offices and the Ministry of Transport.

166. The trees and shrubbery on the land for the extension will need to be cleared. Replacement trees should and would most appropriately be planted on the Ministry of Sport lands to the south of the Kyaikasan substation.

IX. GRIEVANCE REDRESS MECHANISM

167. A Grievance Redress Mechanism (GRM) is a systematic process for receiving, validating and addressing affected people's project-related complaints. A GRM is developed to address concerns of the community and stakeholders about the project in a transparent and timely manner.

168. In general, MOEP/MEPE will work proactively towards preventing grievances through the implementation of impact mitigation measures and community liaison activities that anticipate and address potential issues before these issues become grievances. Through the GRM, MOEP/MEPE shall promptly address affected people's concerns, complaints, and grievances about the project's environmental performance.

A. Type of Complaints

169. Complaints about the implementation of the project may occur during the different phases of the project, i.e. site preparation, construction and equipment installation and during operation. Any affected person may raise and submit a complaint if the project activity has a detrimental impact on the environment, the community, or the quality of life of the people. Grievances may include the following:

- Negative impacts on a person or a community that includes adverse changes on way of life and livelihood such as loss of trees, land, crops, water supply, power supply, irrigation, and other nuisances;
- Hazards to community health and safety including electrocution, fires, and explosion;
- Construction-related nuisances such as noise and dust generation and improper disposal of wastes;
- Failure to comply with environmental policies, safety clearance requirements and other legal obligations;
- Peace and order problems in the community due to presence of migrant construction workers.

B. Accessibility

170. The proposed project and the GRM should be presented to villages/wards, townships and affected households during follow-up consultation meetings with stakeholders and affected communities.

171. The MEPE through the Power Transmission Project Department (PTPD) as the Project Management Unit (PMU) shall be the focal department of MOEP/MEPE during the construction phase. When the project becomes operational, MEPE's Transmission Line Management Office (TLMO) in Naypyitaw will take over the responsibility of managing the project including any complaint that may be raised against its operation.

172. The MEPE shall set-up a hotline for complaints, including responsible persons under PTPD and TLMO to act on the complaint. The name(s) of the MEPE contact person(s) and the hotline number shall be placed on notice boards at the construction site, project office and at local government offices, e.g. villages, townships and district offices.
Affected people will be free to express their grievances in writing or verbally through the village/ward administrators and these would be referred to the MEPE for appropriate action.

C. Grievance Resolution Process

173. The grievance resolution process shall be deliberated and acted upon by three important entities: (i) Village/Ward Administrator; (ii) Power Transmission Project Department (PTPD) of MEPE during the construction phase; and (iii) MEPE – Transmission Line Management Office in Naypyitaw during the operational phase.

174. The village/ward administrator shall:

- Act as the first line of the branch of government that will receive a complaint;
- Register the complaint from an affected member of the community;
- Documents the resolution of the complaint; and
- Refer the complaint to higher level of executive branch is the complaint is not resolved by MEPE.

175. The Power Transmission Project Department and the Transmission Line Management Office of MEPE shall:

- Validate community complaints;
- Coordinate with the contractor or appropriate MEPE unit/department regarding actions towards the resolution of complaints;
- Communicate actions undertaken by the contractor and/or appropriate MEPE unit/department to the village/ward; and
- Monitor project performance to avoid recurrence of the problem.

176. Normally, complaints related to environmental issues are resolved at the level of the village/ward. To ensure that there is a system to receive, record, and respond to such complaints from the community, the GRM shall be established by MEPE in consultation with the village/ward administrators prior to the start of site works. Figure 26 presents the Grievance Redress Mechanism.

177. Upon receipt and registration of the grievance by the village/ward administrator, the matter should be immediately referred to the PTPD-MEPE during construction or to TLMO-MEPE during operation of the project. The PTPD/TLMO should immediately carry out a review and assessment of the validity of the complaint and seek measures to resolve valid complaints. If it is determined that the complaint is not connected to a project activity or that the project is being carried out in full compliance with applicable national and international standards, the PTPD /TLMO should explain the circumstances to the affected person and the village/ward administrator.

178. The PTPD/TLMO will be given 15 days to resolve the complaint and provide feedback to the affected person and the village/ward administrator on the results of the investigation and the proposed course of action. If the complainant considers the issue to be satisfactorily resolved, the village/ward administrator documents the resolution of the complaint. PTPD/TLMO will continue monitoring the implementation of remedial measures undertaken by the contractor and/or concerned MEPE unit/department.

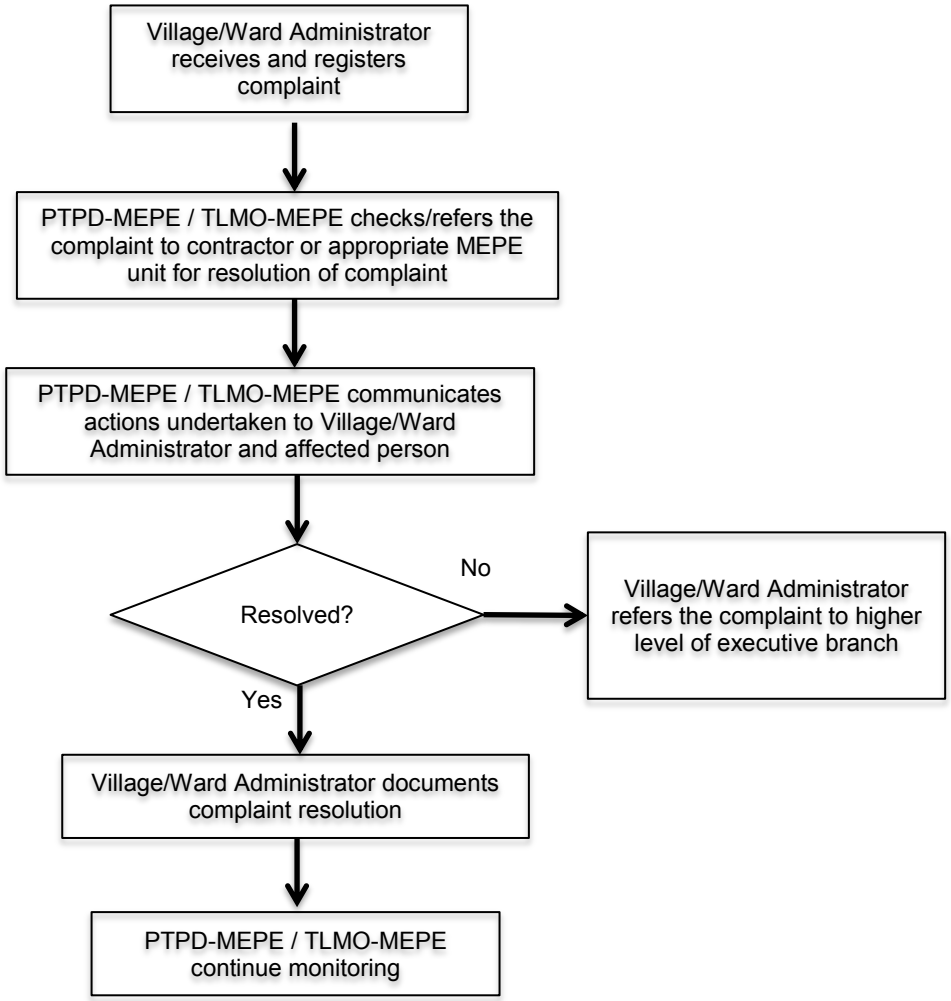


Figure 26. Structure and process of the grievance redress mechanism

179. If the affected person is not satisfied with the actions to resolve the complaint, the affected person may raise the complaint before the General Administrative Department (GAD) of the concerned township which is the next higher level of the executive branch of government in Yangon City. The Township GAD will hear the complaint and may call a meeting among the affected person, PTPD/TLMO and the contractor to discuss the resolution of the complaint. A remedial action agreeable to all parties should be developed. The contractor under the supervision of the PTPD/TLMO should undertake the resolution of the complaint within one week.

180. If the affected person is still not satisfied with the actions undertaken to resolve the particular complaint, he/she may file the complaint with the District Office. The District Office will record the complaint, further investigate the complaint, and will also call on the affected person, PTPD/TLMO, and the contractor to discuss the resolution of the complaint. Commitments and schedule of action and resolution of the complaint that is agreeable to all parties should be developed during the meeting with the District Office. If the complainant considers the issue to be satisfactorily resolved, the grievance resolution process will be documented by the District Office.

181. If the complaint remains unresolved, the affected person has the option to elevate the issue to the next higher levels of the Executive Branch of Government which is the State/Regional Office. Figure 27 presents the hierarchy of the grievance resolution process.

182. The last recourse of the affected person on unresolved grievance will be the judicial body through which punitive clauses of the Environment Conservation Law may be used to prosecute offending parties.

D. Grievance Follow-up

183. The MEPE through the Power Transmission Development Project or Transmission Line Management Office may contact the complainant at a later stage to check if activities continue to pose problems to the affected person or community. If there is a remaining problem, the issue will be treated as a new complaint and may re-enter the GRM process.

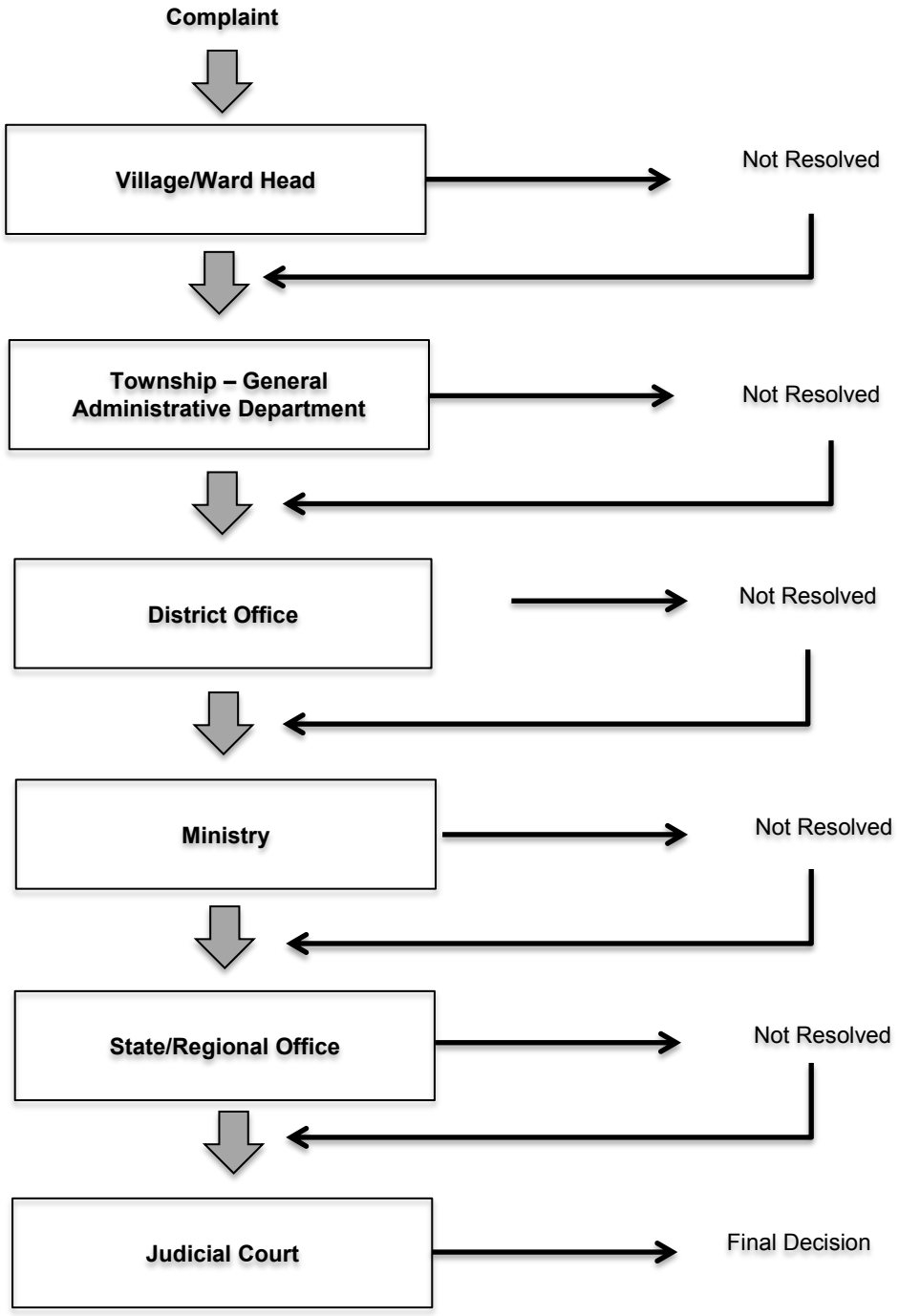


Figure 27. Hierarchy of grievance resolution process

X. ENVIRONMENTAL MANAGEMENT PLAN

A. Introduction

184. An environmental management plan (EMP) has been prepared for the implementation of the two 230 kV transmission lines between Thida – Thaketa – Kyaikasan substations and the implementation of the new South Okkalapa and West University substations in Yangon. The EMP also includes the extension to the Kyaikasan substation to accommodate additional equipment required for the new 230 kV line (figure 4 and Table 4 of IEE). The EMP provides separate Impacts Mitigation Plans and Environmental Monitoring Plans for the 230 kV transmission lines, and for the new substations for ease of implementation by the different construction contracts.

185. The purpose of the EMP is to integrate the results of the IEE into a formal management plan that is implemented in parallel with the 230 kV transmission lines and new substations to prevent or minimize the potential environmental impacts and issues that were identified by the IEE. The EMP addresses the results of the public consultations on the project that were convened as part of the IEE.

186. In addition to the Impacts Mitigation Plans, a Monitoring Plans, the EMP also provides an Emergency Response Plan. The EMP also prescribes the institutional responsibilities for the implementation of the EMP. The EMP is a management tool that provides a set of directives and guidelines that the project owner follows to prevent or minimize unnecessary environmental impacts of the 230 kV transmission lines and the new substations.

B. Institutional Arrangements and Responsibilities

187. At the feasibility stage, the primary management framework[33] responsible for the implementation of the EMPs for the 230 kV transmission lines and the new substations is summarized as follows. The MOEP is the executing agency (EA) while the MEPE is the Implementing Agency (IA). With assistance from an overall Project Implementation Unit (PIU), the IA will implement the transmission lines and substations, and the EMP.

188. The PIU is supported by the Project Implementation Consultant[34] (PIC). The PIC assists with completion of the detailed project designs, assists the PIU in updating the EMP to address the detailed project designs, and assists with the implementation of the EMP. The PIC also delivers required capacity development and training to the PIU. The PIU oversees and monitors the work of the construction contractor(s) who implements the construction EMP (CEMP)[35]. A summary of indicative responsibilities for implementation of the EMP is provided below.

189. **The responsibilities of the EA (MOEP) include**:

a) Overall responsibility for implementation of EMP;

b) Provide coordination and supervision for environmental and social safeguards;

[33] Adapted from Fichtner final report (10/14) and ADB project documents
[34] PIC to be defined
[35] Contractor Environmental Management Plan prepared by contractor as part of bid documents based on EMP

c) Submit semi-annual environmental monitoring reports to ADB;

d) Liaise with ADB on the implementation of the EMP; and

e) Coordinate with PIU on the resolution of issues arising from the implementation of EMP.

190. **The responsibilities of the PIU include**:

1. Assist the PIC in updating the EMP to meet final detailed designs of 230 kV transmission lines and the new substations;
2. Notify MOECAF to confirm approvals of 230 kV lines and new substations are met;
3. Include the CEMP requirements in contractor bid documents including bid evaluations and contracts based on updated EMP;
4. Closely coordinate with YESB and YCDC prior to the implementation of the project to ensure safety clearances are met along the transmission line ROW;
5. Lead follow-up meetings with all affected stakeholders;
6. Undertake day-to-day management of EMP implementation activities;
7. Ensure compliance with loan covenants and assurances in respect of 230 kV lines and new substations, including EMP (as well as IPPs, GAPs, resettlement plans);
8. Prepare and submit semi-annual reports on EMP implementation to IA/EA;
9. Oversee implementation of CEMP and monitoring plan by contractor;
10. Undertake regular construction site inspections to ensure contractor implements CEMP properly; and
11. Ensure contractor submits monthly reports on environmental mitigations and monitoring.

191. **The responsibilities of the PIC are**:

a) Update the EMP to meet final detailed design of 230 kV lines and new substations;

b) Provide technical direction and support to PIU for implementation and monitoring of EMP;

c) Oversee design and delivery of capacity development and training of PIU and contractor(s) on environmental management;

d) Provide advice and support to contractor and PIU with their monitoring activities;

e) Review all reports prepared by contractor and PIU for EA and ADB; and

f) Review location of any possible contaminated sites along 230 kV lines corridors.

192. **The responsibilities of Contractor include:**

a) Implement CEMP for construction phase of 230 kV lines and substations; and
b) Prepare and submit monthly reports on mitigation and monitoring activities of CEMP any environmental issues at construction sites to the PIC and PIU.
c) Implement the environmental sampling required prior to and during construction according to the monitoring plans of the EMP.
d) Perform any required laboratory analyses according to the monitoring programs during the construction phase; and
e) Prepare and submit quarterly reports to PIU on the results of the monitoring activities.

193. The YCDC with support from the MOECAF are the agencies which will regulate environmental management of the 230 kV lines and new substations in Yangon. The MOECAF provides direction and support for environmental protection-related matters including application of the draft EIA Rules in support of the Environmental Conservation Law (2012).

194. The ADB provides guidance to EA/IA with any issues related to EMP, and reviews semi-annual reports on EMP activities compiled and submitted by EA.

C. Summary of Potential Impacts

195. The potential impacts of the project 230 kV lines[36] and the new substations are summarized in Table 24.

Table 24. Summary of potential impacts

Project Phase	230kV Transmission Lines	New Substations[37]
Pre-Construction Phase	• Permanent loss of some residential, commercial, and industrial lands for foundations of new monopole transmission towers, and some loss of government land for Kyaikasan substation extension • Permanent loss of property and income from YCDC billboards and shops.	• Permanent loss of government land, and some agricultural land for the West University substation
Construction Phase	• Temporary losses of residential, urban-agricultural, commercial, and industrial land along RoWs of the new 230 kV transmission lines. Loss of trees along affected Yangon streets including trees for extension to Kyaikasan substation.	• Temporary losses or access to agricultural land adjacent to West University substation, and to government land at both substations • Common construction-related civil works disturbances such as dust,

[36] Includes extension to Kyaikasan substation
[37] New substations refer to the proposed West University and South Okkalapa substations.

Project Phase	230kV Transmission Lines	New Substations[37]
	• Common construction-related civil works disturbances such as dust, noise, reduced and/or blocked public access, disrupted business and recreation, and air pollution from NOx, SOx, and CO caused by increased truck traffic and heavy equipment use, soil and Pazundaung creek pollution caused by equipment operation and maintenance, public and worker accidents, increased and disruption of traffic, traffic accidents, damage to existing roads, land erosion and sedimentation of Pazundaung creek, urban drainage and short-term flooding problems, solid and domestic waste from worker camps, and potential social issues and community problems caused by migrant workers.	noise, reduced and/or blocked public access, disrupted local business and recreation, and air pollution from NOx, SOx, and CO caused by increased truck traffic and heavy equipment use, soil pollution caused by equipment operation and maintenance, public and worker accidents, increased disruption of traffic, and potential traffic accidents, damage to existing roads, land erosion and potential sedimentation of river northeast of West University substation site, drainage and short-term flooding problems, solid and domestic waste from worker camps, and potential social issues and community problems caused by migrant workers.
Operations Phase	• Risk of public safety due to unauthorized access to transmission towers. • Risk of worker injury from insufficient training, and inadequate safety measures applied to operation and maintenance of transmission towers.	• Risk of public safety due to unauthorized or un-prevented access to substations. • Risk of worker injury from insufficient training, and inadequate safety measures during operation and maintenance activities of substations

D. Mitigation Plans

196. The impact mitigation measures are presented in comprehensive individual mitigation plans for the transmission lines and substations (Tables 25 and 26). The mitigation plans are structured by the three development phases defined by the pre-construction, construction, and post construction operation phases. Environmental issues and concerns raised at the stakeholder meetings are addressed in the mitigation plans.

197. The mitigation plans combine construction phase impacts that are common to the new 230 kV transmission lines between Thida, Thaketa, and Kyaikasan substations, and the new West University and South Okkalapa substations for which single mitigation measures are prescribed. Thus, common impact mitigation measures are not stated more than once. However, impacts and required mitigations specific to an individual transmission lines and substations are specified. The mitigation plans identify potential impacts, required mitigations, responsible parties, location, timing, and indicative costs.

198. The mitigation plans are decidedly comprehensive because they will need to be updated to meet the final detailed designs of the 230 kV lines and the new substations.

The plans are organized into a series of mitigation sub-plans that address specific potential impact areas of the 230 kV lines and substations. The sub-plans will assist the contractors with the development of their CEMPs as part of their bid documents, and ultimately will allow the PIU, PIC, and contractors to focus more or less on the different potential impact areas as they arise with the implementation of the final designs of the project. Mitigation sub-plans of the EMP are drafted for example for: a) Construction drainage; b) Erosion; c) Noise and Dust; d) Contaminated Spoil Disposal; e) Solid and Liquid Waste Disposal; f) Construction and Urban Traffic; g) Utility and Power Disruption; h) Worker and Public Safety; i) Tree and Vegetation Removal and Site Restoration; j) Construction Materials Acquisition, Transport, and Storage, and k) Cultural chance finds.

Table 25. Impact mitigation plan for 230 kV Thida-Thaketa-Kyaikasan transmission lines

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Pre-Construction, Detailed Design Phase								
Confirmation of required resettlement, and compensation	No negative environmental impacts	1. Affected persons well informed well ahead of implementation of both 230 kV lines.	All affected persons in project areas	Before project implemented	See resettlement plans	See resettlement plan	EA/IA/PIU	Resettlement committees
Disclosure, and engagement of community	No negative impacts	2. Initiate Information Disclosure and Grievance process of IEE	For all construction sites.	Beginning of project	Quarterly	No marginal cost[39]	IA/PIU	PIU
GOM approvals	No negative impact	3. Notify MOECAF of initiation of 230 kV lines to complete EA requirements, and obtain required project permits and certificates.	Entire TLs	Before construction	As required	No marginal cost	EA/MOECAF	MOECAF

[38] Costs will need to be updated during detailed design phase.
[39] No marginal cost indicates that costs to implement mitigation are to be built into cost estimates of bids of contractors

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Detailed designs of 230 kV lines,	Minimize negative environmental impacts	4. Work with PIC[40] to complete detailed designs of the two 230 kV transmission lines. Ensure the following measures are included: a) identification of spill management prevention plans, and emergency response plans for 230 kV line construction sites; b) no disturbance or damage to culture property and values; c) minimize acquisition of urban agriculture/gardens and treed property e) no or minimal disruption to Yangon city water supplies along access roads, utilities, and electricity with contingency plans for unavoidable disruptions; f) no or minimal disruption to normal pedestrian and vehicle traffic along all affected roads with contingency alternate routes; g) develop specific plan to notify affected residents and of construction activities, and provide construction activities schedule to minimize disruption of normal commercial and residential activities.	Final siting of each TL	Before construction initiated	Once with detailed designs documents	No marginal cost	PIC	EA/IA

[40] Project Implementation Consultant for detailed design phase to be determined

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Update EMP	Positive environmental impacts	5. Identify any new potential environmental or social impacts of detailed designs of 230 kV lines, and include in EMP 6. PIC to update the public and stakeholder input through follow-up consultations. 7. Update mitigation measures and monitoring requirements of EMP where necessary to meet detailed designs of 230 kV lines, and to protect affected environments. 8. Submit updated EMP with any new potential impacts to ADB for review. 9. Complete individual management subplans of CEMP for: a) Construction drainage; b) Erosion; c) Noise and Dust; d) Contaminated Spoil Disposal; e) Solid and Liquid Waste Disposal; f) Construction and Urban Traffic; g) Utility and Power Disruption; h) Worker and Public Safety; i) Tree and Vegetation Removal and Site Restoration; j) Construction Materials Acquisition, Transport, and Storage, and k) Cultural chance finds.	Entire ROWs of TLs	Before construction initiated	Once with detailed designs documents		PIC	IA/PIU
Update EMP	Positive environmental impacts	10. Update where necessary locations of vulnerable shade trees along ROWs of 230 kV transmission lines	All TL sites, and Kyaikasan substation extension	Before construction initiated	Once with updated EMP	See Monitoring Plan below	PIC	IA/PIU
Confirm approved construction waste disposal sites	No negative impact	11. Notify MOECAF or YCDC to confirm locations of disposal areas for construction and hazardous waste for Project, and obtain required permits. 12. Create registry for migrant construction workers.	For both TLs	Before construction	As required	No marginal cost	IA/MOECAF/ YCDC	PIU

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Develop bid documents	No negative environmental impact	13. Ensure updated EMP is included in contractor(s) tender documents, and that tender documents specify requirements of EMP must be budgeted. 14. Specify in bid documents that contractor(s) must have experience with implementing EMPs, or provide staff with training and experience.	For both TL ROWs	Before construction begins	Once for all tenders	No marginal cost	PIC	EA/IA/PIU
Create awareness of physical cultural resources in area	No negative environmental impact	15. EA to review potential locations of affected physical cultural resources, and explain possible PCR to contractor(s) and PIC.	All project areas	Before construction begins	Once	No marginal cost	EA/IA	IA/PIU
Obtain and activate permits and licenses	Prevent or minimize impacts	16. Contractor(s) to comply with all statutory requirements set out by YCDC, MOECAF, and MOT for use of construction equipment, and construction operations such as YCDC approvals for construction vehicle use of city roads, and management of excavation and transport of soil, and from MOT approvals for construction works near Pazundaung creek pursuant to the Conservation Water Resources and Rivers Law	For all construction sites	Beginning of construction	Once	No marginal cost	EA/PIC	PIU and contractors
Capacity development	No negative environmental impact	17. Develop and schedule training plan for IA/PIU to be able to fully implement CEMP, and to manage implementation of mitigation measures by contractor(s). 18. Create awareness and training plan for contractor(s) whom will implement mitigation measures.	All project areas	Before construction begins	Initially, refresher later if needed	No marginal cost	PIC	PIC
Recruitment of workers	Spread of sexually transmitted disease	19. Use local workers as much as possible thereby reducing number of migrant workers	All work forces.	Throughout construction phase	Worker hiring stages	No marginal cost	EA/IA	Contractor's bid documents

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Construction Phase of 230 kV Transmission Lines Between Thida, Thaketa, and Kyaikasan Substations								
Initiate EMP and sub-plans,	Prevent or minimize impacts	20. Initiate updated EMP and CEMP including individual mitigation sub-plans for different potential impact areas that are completed in pre-construction phase (see sub-plan guidance below).	For all construction sites along ROWs of TLs	Beginning of construction	Once	No marginal cost	IA/PIC	PIU and contractors
Construction along ROWs of TLs	Pollution and social problems	21. Ensure waste disposal facilities including portable toilets and garbage cans. 22. A solid waste collection program must be established and implemented that maintains a clean construction site. 23. Locate separate pit latrines for male and female workers away from eating areas. 24. A clean-out or infill schedule for portable toilets/pit latrines must be established and implemented to ensure working latrines are available at all times. 25. Local food should be provided at construction site. Guns and weapons not allowed at the site. 26. HIV/AIDS education should be given to workers. 27. Disturbed areas must be restored to original condition after construction completed.	All construction sites	Throughout construction phase	Monthly	No marginal cost	PIC/IA/PIU	contractor
Training and capacity	Prevention of impacts through education	28. Implement training and awareness plan for IA/PIU and contractors.	IA office, construction sites	Beginning of construction	After each event	No marginal cost	PIC	PIC/PIU

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Implement Construction materials acquisition, transport, and storage sub-plan	Pollution, injury, increased traffic, disrupted access	29. If borrow pits are necessary select in areas with low gradient and as close as possible to construction sites. 30. Required pits should not be located near Pazundaung creek, or cultural property or values. 31. If necessary aggregate mining from Pazundaung creek should be avoided. 32. All topsoil and overburden removed should be stockpiled for later restoration. 33. All required borrow pits should have a fence perimeter with signage to keep public away. 34. After use pits should be dewatered and permanent fences installed with signage to keep public out, and restored as much as possible using original overburden, topsoil, and trees. 35. Define and schedule how materials are extracted from borrow pits, transported, and handled and stored at sites. 36. Define and schedule how large fabricated materials such as monopoles and lattice towers will transported and handled. 37. All aggregate loads on trucks should be covered.	For all construction areas.	Throughout construction phase	Monthly	No marginal cost	PIC/IA/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
DBST [low grade asphalt] production, and application to repair/restore all Yangon roads from TL foundations	Air pollution, land and water contamination, and traffic and access problems,	38. Piles of aggregates at tower and substation sites should be used/or removed promptly, or covered and placed in non- traffic areas 39. Stored paving materials e.g., DBST or asphalt, well away from all human activity and settlements, and cultural receptors (e.g., schools, hospitals). Bitumen production and handling areas should be isolated. 40. Contractors must be well trained and experienced with the production, handling, and application of bitumen. 41. All spills should be cleaned immediately and handled as per hazardous waste management plan, and according to MOECAF or YCDC regulations. 42. Bitumen should be spread carefully not near or in any surface waters, or near any human activities. 43. Bitumen should not be used as a fuel.	All affected roads in Yangon where tower foundations will be built	Throughout construction phase	Monthly	No marginal cost	PIC/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Implement Spoil management subplan	Contamination of land and surface waters from excavated spoil, and construction waste	44. Uncontaminated spoil to be disposed of in MOECAF or YCDC-designated sites, which must never be in or adjacent Pazundaung creek. Designated sites must be clearly marked and identified. 45. Spoil must not be disposed of on sloped land near Pazundaung creek, or near cultural property or values. 46. Contaminated spoil disposal must follow MOECAF or YCDC regulations including handling, transport, treatment (if necessary), and disposal. 47. Suspected contaminated soil must be tested, and disposed of in designated sites identified as per MOECAF or YCDC regulations. 48. Before treatment or disposal contaminated spoil must be covered with plastic and isolated from all human activity.	All excavation areas	Throughout construction phase	Monthly	See Monitoring Plan for contaminated soil analyses	PIC/PIU and MOECAF or YCDC	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Implement solid and liquid construction waste sub-plan	Contamination of land and Pazundaung creek from construction waste	49. Management of general solid and liquid waste of construction will follow MOECAF or YCDC regulations, for collection, handling, transport, recycling, and disposal of waste created from construction activities and worker force. 50. Areas of disposal of solid and liquid waste to be determined by MOECAF or YCDC. 51. Construction sites should have large garbage bins. 52. A schedule of solid and liquid waste pickup and disposal must be established and followed that ensures construction sites are as clean as possible. 53. Solid waste should be separated and recyclable old TL materials sold to buyers in community. <u>Hazardous Waste</u> 54. Collection, storage, transport, and disposal of hazardous waste such as used oils, gasoline, paint, and other toxics must follow MOECAF or YCDC regulations. 55. Wastes should be separated (e.g., hydrocarbons, batteries, paints, organic solvents) 56. Wastes must be stored above ground in closed, well labeled, ventilated plastic bins in good condition well away from construction activity areas, all surface water, water supplies, and cultural and ecological sensitive receptors. 57. All spills must be cleaned up completely with all contaminated soil removed and handled with by contaminated spoil sub-plan.	All construction sites and temporary worker camps	Throughout construction phase	Monthly	No marginal cost	PIC/PIU and MOECAF or YCDC	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Implement Noise and dust sub-plan	Dust Noise	58. Regularly apply wetting agents to exposed soil and along construction roads. 59. Cover or keep moist all stockpiles of construction aggregates, and all truck loads of aggregates as per YCDC requirements. 60. Minimize time tower foundation excavations are exposed and left open. Backfill immediately after work completed. 61. As much as possible, restrict working time at substation site between 07:00 and 17:00. 62. Maintain equipment in proper working order 63. Replace unnecessarily noisy vehicles and machinery. 64. Vehicles and machinery to be turned off when not in use. 65. Construct temporary noise barriers around excessively noisy activity areas where possible.	All construction sites.	Fulltime	Monthly	No marginal cost	PIC/PIU	contractor
Implement Utility and power disruption sub-plan	Loss or disruption of utilities and services such as water supply and electricity	66. Develop carefully a plan of days and locations where outages in utilities and services will occur, or are expected. 67. Collaborate with YCDC, YESB, and other Yangon utilities and services with schedule, and identify possible contingency back-up plans for outages. 68. Contact affected community to inform them of planned outages. 69. Try to schedule all outages during low use time such between 24:00 and 06:00.	All construction sites.	Fulltime	Monthly	No marginal cost	PIC/PIU and MOECAF or YCDC	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Implement Tree and vegetation removal, and site restoration sub-plan	Damage or loss of trees, vegetation, and landscape	70. Contact YCDC or MOECAF for direction on how to minimize damage to trees and vegetation along transmission lines 71. Restrict necessary tree and vegetation removal to within ROWs. 72. Within ROWs minimize removals of trees and install protective physical barriers around trees that do not need to be removed. 73. Where possible all ROWs to be re-vegetated and landscaped after construction completed. Consult YCDC or MOECAF to determine the most successful restoration strategy and techniques. Aim to replant three trees for each tree removed. 74. Restore sections of roads damaged by construction of TL foundations.	All construction sites.	Beginning and end of Project	Monthly	No marginal cost	PIC/PIU	contractor
Implement Erosion control sub-plan	Land erosion	75. Berms, and plastic sheet fencing should be placed around all tower excavations and earthwork areas. 76. Earthworks should be conducted during dry periods. 77. Maintain a stockpile of topsoil for immediate site restoration following backfilling. 78. Protect exposed or cut slopes with planted vegetation, and have a slope stabilization protocol ready. 79. Re-vegetate all soil exposure areas immediately after work completed.	All construction sites	Throughout construction phase	Monthly	No marginal cost	PIC/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Implement worker and public safety sub-plan	Public and worker injury, and health	80. Proper fencing, protective barriers, and buffer zones should be provided around all tower construction areas. 81. Sufficient signage and information disclosure, and site supervisors and night guards should be placed at all construction sites along TL ROWs. 82. Worker and public safety guidelines of MOL (ASEAN-OSHNET) should be followed. 83. Speed limits suitable for the size and type of construction vehicles, and current traffic patterns should be developed, posted, and enforced on all roads used by construction vehicles. 84. Standing water suitable for disease vector breeding should be filled in. 85. Worker education and awareness seminars for construction hazards should be given at beginning of construction phase, and at ideal frequency of monthly. A construction site safety program should be developed and distributed to workers. 86. Appropriate safety clothing and footwear should be mandatory for all construction workers. 87. Adequate medical services must be on site or nearby all construction sites. 88. Drinking water must be provided at all construction sites. 89. Sufficient lighting must be used during night work. 90. All construction sites should be examined daily to ensure unsafe conditions are removed.	All construction sites.	Fulltime	Monthly	No marginal cost	PIC/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Civil works	Degradation of water quality of Pazundaung creek	91. Protective berms, or plastic sheet fencing, should be placed between all earthworks and Pazundaung creek. 92. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion. 93. Earthworks should be conducted during dry periods. 94. All construction fluids such as oils, and fuels should be stored and handled well away from Pazundaung creek. 95. No waste of any kind is to be thrown in Pazundaung creek. 96. No washing or repair of machinery near Pazundaung creek. 97. Pit latrines to be located well away from Pazundaung creek. 98. No aggregate mining from Pazundaung creek. 99. All drainage/irrigation canals and channels to be protected the same way as Pazundaung creek.	All construction sites	Throughout construction phase	Monthly	No marginal cost	PIC/PIU	contractor
Civil works	Degradation of terrestrial resources	100. No unnecessary cutting of trees along 230 kV RoWs. 101. All construction fluids such as oils, and fuels should be stored and handled well away from urban gardens and green spaces. 102. No waste of any kind is to be discarded on land or in urban gardens or green spaces.	All construction sites	Throughout construction phase	Monthly	No marginal cost	PIC/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
Implement Construction and urban traffic sub-plan	Traffic disruption, accidents, public injury	103. Schedule construction vehicle activity during light traffic periods. Create adequate traffic detours, and sufficient signage and warning lights. 104. Post speed limits, and create dedicated construction vehicle roads or lanes. 105. Inform community of location of construction traffic areas, and provide them with directions on how to best co-exist with construction vehicles on their roads. 106. Demarcate additional locations where pedestrians can develop road crossings away from construction areas. 107. Increase road and walkway lighting.	All construction sites	Fulltime	Monthly	No marginal cost	PIC/PIU	contractor
Implement Construction Drainage sub-plan	Loss of drainage and flood storage	108. Provide adequate short-term drainage away from construction sites to prevent ponding and flooding. 109. Manage to not allow any required borrow pits to fill with water. Pump periodically to land infiltration or nearby Pazundaung creek. 110. Install temporary storm drains or ditches for construction sites 111. Ensure drains to Pazundaung creek are maintained to sustain continued stormwater drainage capacity. 112. Protect Pazundaung creek from silt and eroded soil.	All areas with surface waters	Design and construction phases	Monthly	No marginal cost	PIC/PIU	contractor
Civil works and Chance finds sub-plan	Damage to cultural property or values, and chance finds	113. As per detailed designs all civil works should be located away from all physical cultural property and values. 114. Chance finds of valued relics and cultural values should be anticipated by contractors. Site supervisors	All construction sites	At the start , and throughout construction phase	Monthly	No marginal cost	PIC/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
		should be on the watch for finds. 115. Upon a chance find all work stops immediately, find left untouched, and EA/IA notified to determine if find is valuable. The Ministry of Culture or YCDC must be notified by telephone if valuable. 116. Work at find site will remain stopped until the Ministry of Culture or YCDC allows work to continue.						
Specific Impact Mitigations for Construction of 230 kV Line between Thaketa, and Kyaikasan S/S								
Lattice tower (4) and monopole (8) foundations on banks Pazundaung Creek	Erosion and sedimentation	117. Placement of tower foundations above high water mark. Complete isolation of creek from earthworks with construction of temporary berms and/or use of plastic sheeting barriers around excavation sites. No heavy equipment operation near creek.	Three locations on Pazundaung Creek	Tower construction phase	Monthly	No marginal cost	PIC/PIU	contractor
Removal of shade trees on Waizayandar road	Damage to major urban environmental component	118. Absolute care to minimize removal of large shade trees along median of Waizayandar road. Replanting at site or replacement elsewhere is mandatory.	Along Waizayandar road	Installation of towers	Monthly	No marginal cost	PIC/PIU	contractor
Post-construction Operation of 230 kV Transmission Lines								
Operation and maintenance of new facilities and equipment		119. Occupational safety and health regulations and guidelines of GOM should be applied to operations and maintenance of TL 120. Ensure TL towers are well marked with clearly visable danger warning signs to keep public out.	For entire TL and substation operations At tower bases of TLs, and	Fulltime	Biannual	O and M	MEPE	

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[38] (USD)	Responsibility	
							Supervision	Implementation
			perimeter fencing of substations					

Table 26. Impact mitigation plan for new South Okkalapa and West University substations

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Pre-Construction, Detailed Design Phase								
Confirmation of required resettlement, and compensation	No negative environmental impacts	1. Affected communities near substation sites well informed well ahead of Project implementation.	All area affected by substations	Before project implemented	See resettlement plans	See resettlement plan	EA/IA/PIU	Resettlement committees
Disclosure, and engagement of community	No negative impacts	2. Initiate Information Disclosure and Grievance process of IEE	For all construction sites.	Beginning of project	Quarterly	No marginal cost[42]	IA/PIU	PIU

[41] Costs will need to be updated during detailed design phase.
[42] No marginal cost indicates that costs to implement mitigation are to be built into cost estimates of bids of contractors

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
GOM approvals	No negative impact	3. Notify MOECAF of project initiation to complete EA requirements, and obtain required project permits and certificates.	Entire project	Before construction	As required	No marginal cost	EA/MOECAF	MOECAF
Detailed designs of substations	Minimize negative environmental impacts	4. Work with PIC[43] to complete detailed designs of the two substations. Ensure the following measures are included: a) identification of spill management prevention plans, and emergency response plans for all construction sites; b) no disturbance or damage to culture property and values; c) minimize acquisition of agriculture lands e) no or minimal disruption to water supplies along access roads, utilities, and electricity with contingency plans for unavoidable disruptions; f) no or minimal disruption to normal pedestrian and vehicle traffic along all roads with contingency alternate routes; g) develop specific plan to notify affected residents and merchants of construction activities, and provide construction activities schedule to minimize disruption of normal commercial and residential activities.	Final siting and access roads of each new substations	Before construction initiated	Once with detailed designs documents	No marginal cost	PIC	EA/IA

[43] Project Implementation Consultant for detailed design phase to be determined

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Update EMP	Positive environmental impacts	6. Identify any new potential environmental or social impacts of detailed designs, and include in EMP 7. PIC to update the public and stakeholder input through follow-up consultations. 8. Update mitigation measures and monitoring requirements of EMP where necessary to meet detailed designs, and to protect affected environments. 9. Submit updated EMP with any new potential impacts to ADB for review. 10. Complete individual management subplans of CEMP for: a) Construction drainage; b) Erosion; c) Noise and Dust; d) Contaminated Spoil Disposal; e) Solid and Liquid Waste Disposal; f) Construction and Urban Traffic; g) Utility and Power Disruption; h) Worker and Public Safety; i) Site Restoration; j) Construction Materials Acquisition, Transport, and Storage, and k) Cultural chance finds.	Substation sites and access roads	Before construction initiated	Once with detailed designs documents		PIC	IA/PIU
Confirm approved construction waste disposal sites	No negative impact	11. Notify MOECAF or YCDC to confirm locations of disposal areas for construction and hazardous waste for Project, and obtain required permits. 12. Create registry for migrant workers.	For both substations	Before construction	As required	No marginal cost	IA/MOECAF/ YCDC	PIU
Develop bid documents	No negative environmental impact	13. Ensure updated EMP is included in contractor tender documents, and that tender documents specify requirements of EMP must be budgeted. 14. Specify in bid documents that contractor must have experience with implementing EMPs, or provide staff with training and experience.	For both substations	Before construction begins	Once for all tenders	No marginal cost	PIC	EA/IA

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Create awareness of physical cultural resources in area	No negative environmental impact	15. EA to review potential locations of affected physical cultural resources, and explain possible PCR to contractors and PIC.	All substation construction areas	Before construction begins	Once	No marginal cost	EA/IA	IA/PIU
Obtain and activate permits and licenses	Prevent or minimize impacts	16. Contractor(s) to comply with all statutory requirements set out by YCDC, MOECAF, and MOT for use of construction equipment, and construction operations such as YCDC approvals for construction vehicle use of city roads, and management of excavation and transport of soil, and from MOT approvals for construction works near river northeast of West university substation site pursuant to the Conservation Water Resources and Rivers Law	All substation construction areas	Beginning of construction	Once	No marginal cost	EA/PIC	PIU and contractors
Capacity development	No negative environmental impact	17. Develop and schedule training plan for IA/PIU to be able to fully implement CEMP, and to manage implementation of mitigation measures by contractors. 18. Create awareness and training plan for contractors whom will implement mitigation measures.	For both substations	Before construction begins	Initially, refresher later if needed	No marginal cost	PIC	PIC
Recruitment of workers	Spread of sexually transmitted disease	19. Use local workers as much as possible thereby reducing number of migrant workers	All work forces.	Throughout construction phase	Worker hiring stages	No marginal cost	EA/IA	Contractor's bid documents
Construction Phase of West University and South Okkalapa Substations								
Initiate EMP and sub-plans,	Prevent or minimize impacts	20. Initiate updated EMP and CEMP including individual management sub-plans for different potential impact areas that are completed in pre-construction phase (see sub-plan guidance below).	For all construction sites	Beginning of construction	Once	No marginal cost	IA/PIC	PIU and contractors

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Construction site	Pollution and social problems	21. Ensure waste disposal facilities including portable toilets and garbage cans. 22. A solid waste collection program must be established and implemented that maintains a clean construction site. 23. Locate separate pit latrines for male and female workers away from eating areas. 24. A clean-out or infill schedule for portable toilets/pit latrines must be established and implemented to ensure working latrines are available at all times. 25. Local food should be provided to construction site. Guns and weapons not allowed at the site. 26. HIV/AIDS education should be given to workers. 27. Disturbed areas must be restored to original condition after construction completed.	All worker camps	Throughout construction phase	Monthly	No marginal cost	PIC/IA/PIU	contractor
Training and capacity	Prevention of impacts through education	28. Implement training and awareness plan for IA/PIU and contractors.	IA office, construction sites	Beginning of construction	After each event	No marginal cost	PIC	PIC/PIU

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Implement Construction materials acquisition, transport, and storage sub-plan	Pollution, injury, increased traffic, disrupted access	29. If borrow pits are necessary select in areas with low gradient and as close as possible to construction sites. 30. Required pits should not be located near surface waters, or cultural property or values. 31. If necessary aggregate mining from local river should be avoided. 32. All topsoil and overburden removed should be stockpiled for later restoration. 33. All required borrow pits should have a fence perimeter with signage to keep public away. 34. After use pits should be dewatered and permanent fences installed with signage to keep public out, and restored as much as possible using original overburden, topsoil, and trees. 35. Define and schedule how materials are extracted from borrow pits, transported, and handled and stored at sites. 36. All aggregate loads on trucks should be covered as per MOT requirement.	For all construction areas.	Throughout construction phase	Monthly	No marginal cost	PIC/IA/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
DBST [low grade asphalt] production, and application to road work for substation access roads	Air pollution, land and water contamination, and traffic and access problems,	37. Piles of aggregates at tower and substation sites should be used/or removed promptly, or covered and placed in non- traffic areas 38. Stored paving materials e.g., DBST or asphalt, well away from all human activity and settlements, and cultural receptors (e.g., schools, hospitals). Bitumen production and handling areas should be isolated. 39. Contractors must be well trained and experienced with the production, handling, and application of bitumen. 40. All spills should be cleaned immediately and handled as per hazardous waste management plan, and according to MOECAF or YCDC regulations. 41. Bitumen should be spread carefully not near or in any surface waters, or near any human activities.	For access roads to substations that will be upgraded, or repaired	Throughout construction phase	Monthly	No marginal cost	PIC/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Implement Spoil management subplan	Contamination of land and surface waters from excavated spoil, and construction waste	42. Uncontaminated spoil to be disposed of in MOECAF or YCDC-designated sites, which must never be in or adjacent surface waters. Designated sites must be clearly marked and identified. 43. Spoil must not be disposed of on sloped land, near local rivers, or near cultural property or values. 44. Where possible spoil should be used at other construction sites, or disposed in spent borrow pits. 45. Contaminated spoil disposal must follow MOECAF or YCDC regulations including handling, transport, treatment (if necessary), and disposal. 46. Suspected contaminated soil must be tested, and disposed of in designated sites identified as per MOECAF or YCDC regulations. 47. Before treatment or disposal contaminated spoil must be covered with plastic and isolated from all human activity.	All excavation areas	Throughout construction phase	Monthly	See Monitoring Plan for contaminated soil analyses	PIC/PIU and MOECAF or YCDC	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Implement Solid and liquid construction waste sub-plan	Contamination of land from construction waste	48. Management of general solid and liquid waste of construction will follow MOECAF or YCDC regulations, and will cover, collection, handling, transport, recycling, and disposal of waste created from construction activities and worker force. 49. Areas of disposal of solid and liquid waste to be determined by MOECAF or YCDC. 50. Construction sites should have large garbage bins. 51. A schedule of solid and liquid waste pickup and disposal must be established and followed that ensures construction sites are as clean as possible. 52. Solid waste should be separated and recyclables sold to buyers in community. <u>Hazardous Waste</u> 53. Collection, storage, transport, and disposal of hazardous waste such as used oils, gasoline, paint, and other toxics must follow MOECAF or YCDC regulations. 54. Wastes should be separated (e.g., hydrocarbons, batteries, paints, organic solvents) 55. Wastes must be stored above ground in closed, well labeled, ventilated plastic bins in good condition well away from construction activity areas, all surface water, water supplies, and cultural and ecological sensitive receptors. 56. All spills must be cleaned up completely with all contaminated soil removed and handled with by contaminated spoil sub-plan.	All construction sites and worker camps	Throughout construction phase	Monthly	No marginal cost	PIC/PIU and MOECAF or YCDC	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Implement Noise and dust sub-plan	Dust Noise	57. Regularly apply wetting agents to exposed soil and construction and access roads to substations roads. 58. Cover or keep moist all stockpiles of construction aggregates, and all truck loads of aggregates. 59. Minimize time excavations for substation building footings are exposed and left open. Backfill immediately after work completed. 60. As much as possible, restrict working time at substation site between 07:00 and 17:00. 61. Maintain equipment in proper working order 62. Replace unnecessarily noisy vehicles and machinery. 63. Vehicles and machinery to be turned off when not in use. 64. Construct temporary noise barriers around excessively noisy activity areas where possible.	All construction sites.	Fulltime	Monthly	No marginal cost	PIC/PIU	contractor
Implement Utility and power disruption sub-plan	Loss or disruption of utilities and services such as water supply and electricity	65. Develop carefully a plan of days and locations where outages in utilities and services will occur, or are expected. 66. Contact local utilities and services with schedule, and identify possible contingency back-up plans for outages. 67. Contact affected community to inform them of planned outages. 68. Try to schedule all outages during low use time such between 24:00 and 06:00.	All construction sites.	Fulltime	Monthly	No marginal cost	PIC/PIU and MOECAF or YCDC	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Implement Erosion control sub-plan	Land erosion	69. Berms, and plastic sheet fencing should be placed around all tower excavations and earthwork areas. 70. Earthworks should be conducted during dry periods. 71. Maintain a stockpile of topsoil for immediate site restoration following backfilling. 72. Protect exposed or cut slopes with planted vegetation, and have a slope stabilization protocol ready. 73. Re-vegetate all soil exposure areas immediately after work completed.	All construction sites	Throughout construction phase	Monthly	No marginal cost	PIC/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Implement worker and public safety sub-plan	Public and worker injury, and health	74. Proper fencing, protective barriers, and buffer zones should be provided around substation construction areas. 75. Sufficient signage and information disclosure, and site supervisors and night guards should be placed at all sites. 76. Worker and public safety guidelines of MOL (ASEAN-OSHNET) should be followed. 77. Speed limits suitable for the size and type of construction vehicles, and current traffic patterns should be developed, posted, and enforced on all roads used by construction vehicles. 78. Standing water suitable for disease vector breeding should be filled in. 79. Worker education and awareness seminars for construction hazards should be given at beginning of construction phase, and at ideal frequency of monthly. A construction site safety program should be developed and distributed to workers. 80. Appropriate safety clothing and footwear should be mandatory for all construction workers. 81. Adequate medical services must be on site or nearby all construction sites. 82. Drinking water must be provided at all construction sites. 83. Sufficient lighting be used during necessary night work. 84. All construction sites should be examined daily to ensure unsafe conditions are removed.	All construction sites.	Fulltime	Monthly	No marginal cost	PIC/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Civil works	Degradation of water quality and aquatic resources	85. Protective berms, or plastic sheet fencing, should be placed between all earthworks and local river. 86. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion. 87. Earthworks should be conducted during dry periods. 88. All construction fluids such as oils, and fuels should be stored and handled well away from local river. 89. No waste of any kind is to be thrown in local river. 90. No washing or repair of machinery near local river. 91. Pit latrines to be located well away from local river. 92. No aggregate mining from local river. 93. All irrigation canals and channels to be protected the same way local rivers	All construction sites	Throughout construction phase	Monthly	No marginal cost	PIC/PIU	contractor
Civil works	Degradation of terrestrial resources	94. No unnecessary cutting of trees at substation sites. 95. All construction fluids such as oils, and fuels should be stored and handled well away from agricultural lands. 96. No waste of any kind is to be discarded on land or on agricultural land.	All construction sites	Throughout construction phase	Monthly	No marginal cost	PIC/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
Implement Construction and urban traffic sub-plan	Traffic disruption, accidents, public injury	97. Schedule construction vehicle activity during light traffic periods. Create adequate traffic detours, and sufficient signage and warning lights. 98. Post speed limits, and create dedicated construction vehicle roads or lanes. 99. Inform community of location of construction traffic areas, and provide them with directions on how to best co-exist with construction vehicles on their roads. 100. Demarcate additional locations where pedestrians can develop road crossings away from construction areas.	All construction sites	Fulltime	Monthly	No marginal cost	PIC/PIU	contractor
Implement Construction Drainage sub-plan	Loss of drainage and flood storage	101. Provide adequate short-term drainage away from construction sites to prevent ponding and flooding. 102. Manage to not allow borrow pits to fill with water. Pump periodically to land infiltration or nearby local river. 103. Install temporary storm drains or ditches for construction sites 104. Protect local river from silt and eroded soil.	Areas near local river	Design and construction phases	Monthly	No marginal cost	PIC/PIU	contractor
Civil works and Chance finds sub-plan	Damage to cultural property or values, and chance finds	105. As per detailed designs all civil works should be located away from all physical cultural property and values. 106. Chance finds of valued relics and cultural values should be anticipated by contractors. Site supervisors should be on the watch for finds. 107. Upon a chance find all work stops immediately, find	All construction sites	At the start , and throughout construction phase	Monthly	No marginal cost	PIC/PIU	contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[41] (USD)	Responsibility	
							Supervision	Implementation
		left untouched, and EA/IA notified to determine if find is valuable. The Ministry of Culture or YCDC must be notified by telephone if valuable. 108. Work at find site will remain stopped until the Ministry of Culture or YCDC allows work to continue.						
Post-construction Operation of South Okkalapa and West University Substations								
Operation and maintenance of new facilities and equipment		109. Occupational safety and health regulations and guidelines of GOM should be applied to operations and maintenance of substations 110. Ensure substations property is well marked with clearly visable danger warning signs to keep public out.	For all substation operations At perimeter fencing of substations	Fulltime	Biannual	O and M	MEPE	

E. Monitoring Plans

199. The separate environmental monitoring plans for the 230 kV transmission lines, and the new substations are provided in Tables 27 and 28. The monitoring plans focus on all three phases (pre-construction, construction, post-construction operation) of the project, and consist of environmental indicators, sampling locations and frequency, method of data collection, responsible parties, and estimated costs. The purpose of the monitoring plans is to determine the effectiveness of the impact mitigations, and to document any unexpected positive or negative environmental impacts of the project.

200. The PIU with assistance of the PIC and contractor will oversee the implementation of the environmental monitoring programs. The contractor will be responsible for the sampling of any environmental parameters that must be analyzed in a laboratory in coordination with the PIU and PIC. The PIU will provide logistical support to the contractor where necessary for the implementation of monitoring plans.

201. The available standards for ambient environmental quality for Myanmar listed in Appendix A will guide the monitoring program. The environmental standards provided by the Environmental, Health and Safety Guidelines of the IFC/World Bank (2007) should be followed to supplement standards that are not provided by the GOM.

202. After construction is completed, the potential impacts of the operation of the four new 230 kV transmission lines, and the new substations will be monitored by MEPE. Monitoring of the success of any minor resettlement in the affected areas will be undertaken as part of the separate RP prepared for the project.

E. Performance Monitoring

203. Performance monitoring is required to assess the overall performance of the EMP. A performance monitoring system is normally developed by the EA for the entire project. Selected indicators of major components of the environment that will be affected primarily by the construction phase are drawn from the mitigation and monitoring plans and summarized in Table 29.

F. Reporting

204. Regular reporting on the implementation of mitigation measures, and on monitoring activities during construction phase of the project is required. Reporting is the responsibility of PIU with assistance of the PIC and should be conducted in conjunction with regular meetings with stakeholders as part of the continuation of stakeholder communications. The mitigation and monitoring plans summarize proposed reporting.

205. A report on environmental monitoring and implementation of EMP will be prepared semi-annually for the EA by the PIU with assistance of the PIC. The report will compile monthly reports provided by the contractor and findings of the PIU and PIC monitoring. The PIU report will also be sent to the MOECAF, YCDC, and ADB. The reports will table all indicators measured with the monitoring plans including performance monitoring indicators (Table 29), and will include relevant GOM environmental quality standards. A semi-annual report on the environment monitoring of the project must be prepared and submitted to the ADB by the EA for uploading to ADB website.

Table 27. Environmental monitoring plan for 230 kV transmission lines

ENVIRONMENTAL EFFECTS MONITORING							
Environmental Indicators	**Location**	**Means of Monitoring**	**Frequency**	**Reporting**	**Responsibility** Supervision / Implementation		**Estimated Cost (USD)**[44]
					Supervision	**Implementation**	
Pre-construction Phase – Update Baseline Conditions							
Update where necessary baseline on sensitive receptors (e.g., cultural property and values, new schools or hospitals) along TL corridors.	ROWs of transmission lines	Original field work, community consultations	Once	Once	PIC/PIU	Environmental Monitoring Consultant	$1,500
Air quality: dust, CO, NOx, SOx, noise	Along both TLs	Using field and analytical methods approved by MOECAF or YCDC.	A) One day and one night measurement	One baseline supplement report before construction phase starts	PIC/PIU	Environmental Monitoring Consultant	$2,000 .
Water quality: TSS/turbidity, oil/grease, solid waste	Pazundaung creek near TL crossings, and along bank where TL of Thaketa-Kyaikasan will be located	Using field and analytical methods approved by MOECAF or YCDC	Once	One baseline supplement report before construction phase starts	PIC/PIU	Environmental Monitoring Consultant	$3,000 .

[44] Estimated costs of monitoring will be updated with monitoring plan and overall EMP at detailed designs stage

Inventory of present and past land uses that could cause contaminated soil.	Possible contaminated lands at all tower excavation sites	Using field and analytical methods approved by MOECAF or YCDC.	Once	Once	PIC/PIU	Environmental Monitoring Consultant	$2,000.
Construction Phase of 230 kV Transmission Lines							
Analysis of soil quality (heavy metals (As, Cd, Pb, oil and grease, hydrocarbons).	Possible contaminated lands at all excavation sites	Using field and analytical methods approved by MOECAF or YCDC.	Once if **needed**	Once	PIU	Environmental Monitoring Consultant	$2,500.
A) Air quality: dust, CO, NOx, SOx, noise B) Water quality: turbidity, solid waste, oil slick C) Analysis of contaminated soil quality (heavy metals (As, Cd, Pb, Hg, Mn), hydrocarbons. D) Domestic (worker) and construction solid waste inside and outside construction sites including temporary worker camps. E) Public comments and complaints F) Incidence of worker or public accident or injury G) EMF levels (baseline)	A): Baseline sites of pre-construction phase. B) Baseline sites on Pazundaung creek C) At sites where contaminated soil is suspected. D) All construction sites and temporary worker camps E) Using hotline number placed at construction areas F) At all construction areas G) Baseline sites of pre-construction phase	A & B: Using <u>field visual observation</u> methods approved by MOECAF, or YCDC. C : Using field and analytical methods approved by MOECAF, or YCDC D) Visual observation E) Information transferred by telephone hotline number posted at all construction sites. F) regular reporting by contractors/PIU G) using EMF meter	A & B): Daily visual records C) Once at start of excavations D) Weekly E) Continuous public input F) Continuous G) once at start of construction	Monthly	(A - D):		A & B: no marginal cost C: $1,000 D: no marginal cost
					PIU	Monitoring Consultant	
					(D and E) and daily observations:		E: $500./yr F no marginal cost
					IA/PIU	contractor	
Operation of 230 kV Transmission Lines							
Incidence of worker or public accidents and injuries, or spills on hazardous materials	Along all transmission line ROWs	Regular documentation and reporting	Continuous		MEPE		O and M

EMF levels	Along all transmission line ROWs	Regular measurement of EMF levels	Continuous		MEPE	O and M

Table 28. Environmental monitoring plan for new substations

ENVIRONMENTAL EFFECTS MONITORING							
Environmental Indicators	**Location**	**Means of Monitoring**	**Frequency**	**Reporting**	**Responsibility** Supervision / Implementation		**Estimated Cost (USD)**
					Supervision	**Implementation**	
Pre-construction Phase – Update Baseline Conditions							
Update where necessary baseline on sensitive receptors (e.g., cultural property and values, new schools or hospitals) along TL corridors and at substation sites.	ROWs of transmission lines, and vicinity of new substation sites	Original field work, community consultations	Once	Once	PIC/PIU	Environmental Monitoring Consultant	$1,500
Air quality: dust, CO, NOx, SOx, noise	At both substation sites and along access roads	Using field and analytical methods approved by MOECAF or YCDC.	A) One day and one night measurement	One baseline supplement report before construction phase starts	PIC/PIU	Environmental Monitoring Consultant	$1,000 .
Inventory of present and past land uses that could cause	Possible contaminated lands at all excavation sites	Using field and analytical methods approved by MOECAF	Once	Once	PIC/PIU	Environmental Monitoring	$2,000.

contaminated soil.		or YCDC.				Consultant	
Construction Phase of Substations							
Analysis of soil quality (heavy metals (As, Cd, Pb, oil and grease, hydrocarbons).	Possible contaminated lands at all excavation sites	Using field and analytical methods approved by MOECAF or YCDC.	Once if **needed**	Once	PIU	Environmental Monitoring Consultant	$2,500.
A) Air quality: dust, CO, NOx, SOx, noise B) Analysis of contaminated soil quality (heavy metals (As, Cd, Pb, Hg, Mn), hydrocarbons. C) Domestic (worker) and construction solid waste inside and outside construction sites including worker camps. D) Public comments and complaints E) Incidence of worker or public accident or injury F) EMF levels (baseline)	A): Baseline sites of pre-construction phase. B) At sites where contaminated soil is suspected. C) All construction sites and worker camps D) Using hotline number placed at construction areas E) At all construction areas F) substation sites	A : Using field visual observation methods approved by MOECAF, or YCDC. B : Using field and analytical methods approved by MOECAF, or YCDC C) Visual observation D) Information transferred by telephone hotline number posted at all construction sites. E) regular reporting by contractors/PIU F) using EMF meter	A): Daily visual records B) Once at start of excavations C) Weekly D) Continuous public input E) Continuous F) once at start of construction	Monthly	(A - C):		
					PIU	Monitoring Consultant	A: no marginal cost B: $2,000 C: no marginal cost
					(D and E) and daily observations:		
					IA/PIU	contractor	D: $500./yr E no marginal cost

Operation of Substations						
Incidence of worker or public accidents and injuries, or spills on hazardous materials	Along all transmission line, and on substation property	Regular documentation and reporting	Continuous		MEPE	O and M
EMF levels	At periphery of substations	Regular measurement of EMF levels	Continuous		MEPE	O and M

Table 29. Performance monitoring environmental indicators

Major Environmental Component	Key Indicator	Performance Objective	Data Source
Pre-construction Phase			
Public Consultation and Disclosure	Affected public and stakeholders	Meetings with public stakeholders contacted during IEE and new stakeholders convened for follow-up consultation and to introduce grievance mechanism	Minutes of meeting, and participants list
EMP	Updated EMP	All stakeholders contacted during IEE re-contacted for follow-up consultation	EMP
Bid Documents	Requirements of EMP (CEMP[45])	EMP appended to bidding documents with clear instructions to bidders for CEMP	Bid documents
Training of IA/PIU	Training course(s) and schedule	By end of pre-construction phase, required course(s) that will be delivered are designed and scheduled	Course(s) outline, participants, and schedule
Construction Phase			
Air quality	dust, CO, NOx, SOx, noise	Levels never exceed pre-construction baseline levels	EMC and contractor monitoring reports
Water quality of Pazundaung creek	Turbidity, oil slicks, solid waste	Levels never exceed pre-construction baseline levels	EMC and contractor monitoring reports
Electromagnetic field	EMF	Baseline EMF levels	EMF meter readings, EMC reports
Soil quality	Solid and liquid waste	Rigorous program of procedures and rules to collect and store all waste from construction sites practiced.	Contractor and EMC monitoring reports
Hazardous materials and waste	Oil, gasoline, grease	Rigorous program of procedures to manage and store all waste from construction camps and sites practiced.	Contractor and EMC monitoring reports
Public and worker safety	Frequency of injuries	Adherence to GOM occupational health and Safety regulations[46]	Contractor reports
Cultural property	Incidence of damage, or complaints	No valued cultural property, or unearthed valuable relic is harmed in any way	Public input, contractor reports, public input, EMC reports
Traffic	Frequency of disruptions and blocked roadways	Disruptions, stoppages, or detours are managed to absolute minimum.	Public input, contractor reports, EMC reports

[45] Contractor Environmental Management Plan developed from EMP in contractor bidding document
[46] OSH Guidelines provided by GOM, *or* IFC World Bank EHS (2007)

Operation Phase of Transmission Lines and Substations			
Worker and Public Safety	Frequency of accidents and spills	No increase in pre-construction frequency	EA
Electromagnetic field	EMF	Levels never exceed construction baseline levels	EMF meter readings, EMC reports

F. Estimated Cost of EMP

206. The estimated marginal costs for implementing the EMP will need to be validated at detailed design phase. The EMP costs are primarily for environmental monitoring because the costs for implementing impact mitigation measures are included with the construction costs in contractor bid documents. The environmental costs in Table 30 are for field sampling and laboratory analyses which include professional per diems of technicians.

Table 30. Estimated costs for Environmental Monitoring Plans of EMP

Project Phase	Activity Type	Estimated Cost (USD)
A. 230KV TRANSMISSION LINES		
Pre-Construction Phase	• updating environmental baseline	$5,000.00
	• socio-cultural receptors	$1,500.00
Construction Phase (estimated 2 yrs)	• environmental quality	$4,500.00
	• public consultation	$1,000.00
	• EMF meter (2 units)	$220.00
Operation Phase	• Training and capacity development	$5,000.00
	• EMF and safety clearance monitoring	$1,000.00
Sub-Total (230kV transmission lines)		**$18,220.00**
B. WEST UNIVERSITY AND SOUTH OKKALAPA SUBSTATIONS		
Pre-Construction Phase	• updating environmental baseline	$3,000.00
	• socio-cultural receptors	$1,500.00
Construction Phase (estimated 2 yrs)	• environmental quality	$4,000.00
	• public consultation	$1,000.00
	• EMF meter (2 units)	$220.00
Operation Phase	• Training and capacity development	$5,000.00
	• EMF and safety clearance monitoring	$1,000.00
Sub-Total (West University and South Okkalapa substations)		**$15,720.00**
GRAND TOTAL		**$33,940.00**

XI. EMERGENCY RESPONSE PLAN

207. The Contractor must develop emergency or incident response procedures during construction and operation phases of the four new 230 kV transmission lines to protect workers and the public. The emergency response plan (ERP) outlines the roles and responsibilities of persons from first identification of an incident or emergency to the final steps of safe and complete closure of the situation. The detailed requirements for the ERP are described in Appendix D.

XII. INSTITUTIONAL CAPACITY REVIEW AND NEEDS

208. Currently there is insufficient experience and capacity for environmental assessment and management in MOEP and MEPE for the implementation of the EMP. The PIC with assistance from the PIU of the project will develop and deliver training courses to the IA staff including the EO of the contractor. The purpose of the course(s) is to strengthen the ability of the project owner including the PIU to oversee implementation of the EMP by construction contractors, and EMC. Costs for training should be included with costs for implementation of the EMP.

209. Training on the implementation of an EMP should address two thematic areas. The first area should be principles of environmental assessment and management focused on the potential impacts of project activities on the natural and social environments. The second area should be environmental safeguard requirements of the ADB and GOM with specific reference to the EMP implementation.

XIII. CONCLUSIONS AND RECOMMENDATION

210. The examination of the power transmission project in Yangon indicates that potential environmental impacts are restricted to the construction phase of the new 230 kV transmission lines and substations. The common construction-related disturbances such as elevated dust and noise levels, traffic disruptions, solid and liquid construction waste, land erosion and sedimentation of Pazundaung creek, and public and worker safety can be managed effectively with standard construction practices.

211. The final MEPE and Fichtner 230 kV transmission alignments do not differ with respect to potential environmental impacts. The differing potential construction impacts of extending the 230 kV transmission lines across Pazundaung creek with shore-based stand-alone lattice towers versus on cable trays attached to the underside of the Thuwannu and Maha Bandoola bridges are insignificant and can be managed. The public and stakeholder concerns of the project underscored the results of the impact assessment of the IEE which will be addressed by the EMP.

212. The IEE concludes that the description of the feasibility design of the project combined with available information on the affected environment is sufficient to identify the scope of potential environmental impacts of the project. Providing that significant changes do not occur to the design of one or more of the project components, and that affected sensitive environmental or social receptors are not subsequently discovered, the project retains the Category B status for environment, and further detailed environmental impact assessment (EIA) of the project is not required.

XIV. REFERENCES CITED

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APPENDIX A: RAPID ENVIRONMENTAL ASSESSMENT

Rapid Environmental Assessment Checklist – Power Transmission

Country / Project Title:	46390-002 MYA Power Transmission Improvement Project
Sector / Division:	Energy / SEEN

Screening Questions	Yes	No	Remarks
A. PROJECT SITING IS THE PROJECT AREA ADJACENT TO OR WITHIN ANY OF THE FOLLOWING ENVIRONMENTALLY SENSITIVE AREAS?			
▪ CULTURAL HERITAGE SITE		X	
▪ PROTECTED AREA		X	
▪ WETLAND		X	
▪ MANGROVE		X	
▪ ESTUARINE		X	
▪ BUFFER ZONE OF PROTECTED AREA		X	
▪ SPECIAL AREA FOR PROTECTING BIODIVERSITY		X	
B. POTENTIAL ENVIRONMENTAL IMPACTS WILL THE PROJECT CAUSE…			
▪ encroachment on historical/cultural areas, disfiguration of landscape and increased waste generation?		X	
▪ encroachment on precious ecosystem (e.g. sensitive or protected areas)?		X	
▪ alteration of surface water hydrology of waterways crossed by roads and resulting in increased sediment in streams affected by increased soil erosion at the construction site?	X		Potential impact of short-term construction-induced erosion and sedimentation of Pazundaung creek in Yangon from tower footing excavations which will be managed with environmental management plans (EMP) which prescribe use of berms or other barriers to contain erosion.
▪ damage to sensitive coastal/marine habitats by construction of submarine cables?		X	
▪ deterioration of surface water quality due to silt runoff, sanitary wastes from worker-based camps and chemicals used in construction?	X		The EMPs include mitigation measures for managing waste from temporary construction camps.
▪ increased local air pollution due to rock crushing, cutting and filling?		X	No such activities on construction sites

Screening Questions	Yes	No	Remarks
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	X		The EMP will provide mitigating measures.
▪ chemical pollution resulting from chemical clearing of vegetation for construction site?		X	
▪ noise and vibration due to blasting and other civil works?		X	Minimal noise is anticipated during construction and installation of towers. There will be no blasting works.
▪ dislocation or involuntary resettlement of people?	X		Zero to minimal resettlement will be defined in a separate Resettlement Plan report after alignments of 230 kV transmission lines are finalized.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ social conflicts relating to inconveniences in living conditions where construction interferes with pre-existing roads?	X		Minor potential impact. The EMPs include mitigation measures for managing traffic caused by construction to prevent of minimize disturbance to regular traffic and local community
▪ hazardous driving conditions where construction interferes with pre-existing roads?	X		As above mitigation measures EMPs exists for managing construction truck traffic to prevent of minimize disturbance to regular traffic and local community
▪ creation of temporary breeding habitats for vectors of disease such as mosquitoes and rodents?		X	
▪ dislocation and compulsory resettlement of people living in right-of-way of the power transmission lines?	X		As above anticipated zero to minimal resettlement will be defined in a separate report after the 230 kV transmission lines are finalized
▪ environmental disturbances associated with the maintenance of lines (e.g. routine control of vegetative height under the lines)?		X	New transmission lines will require regular maintenance causing minor local disturbances
▪ facilitation of access to protected areas in case corridors traverse protected areas?		X	
▪ disturbances (e.g. noise and chemical pollutants) if herbicides are used to control vegetative height?		X	Herbicides will not be used during construction
▪ large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	Migrant worker population will be small, however, EMPs have mitigation measures managing influx and activities of workers and temporary camps. Use of local workers will be maximized.
▪ social conflicts if workers from other regions or countries are hired?		X	As above
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?		X	The EMPs prescribe mitigation measures for solid and liquid waste management in temporary construction worker camps.

Screening Questions	Yes	No	Remarks
▪ risks to community safety associated with maintenance of lines and related facilities?		X	
▪ community health hazards due to electromagnetic fields, land subsidence, lowered groundwater table, and salinization?		X	Human health effects of EMF have not been established by international medical community. Land subsidence, lowering of groundwater table and salinization are not expected to occur .
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	X		Minimal risks if any. Information campaign will be provided to community prior to and during construction. EMP will have provisions to reduce or mitigate these impacts.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., high voltage wires, and transmission towers and lines) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?	X		Minimal risks if any. Information campaign will be provided to community prior to and during construction. EMP will have provisions to reduce or mitigate these impacts.

Checklist for Preliminary Climate Risk Screening

Country/Project Title: 46390-002 MYA Power Transmission Improvement Project

Sector: Power Transmission

Subsector: Transmission

Division/Department: SEEN / SERD

Screening Questions		Score	Remarks
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	Increased severity of rainfall induced flooding could affect the substation sites. Tower and substation foundations must be designed to be resilient to these climate change induced events
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	Peak wind speed will be considered in the project design to ensure safety of adjacent communities against power lines swinging.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	

Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Medium

Other Comments: n/a

APPENDIX B: EXISTING ENVIRONMENTAL STANDARDS

National Ambient Water Quality Standards

Parameter	Unit	Myanmar Standard		WHO Guideline
		1990	**2011** (draft)	
pH	-	6.5-9.2	6.5-8.5	<8.0
turbidity	NTU	20	5	5
colour	PT	6.5-9.0	15	15
aluminum (Al)	mg/l	0.2	0.2	0.2
arsenic (As)	mg/l	0.05	0.05	0.01
calcium (Ca)	mg/l	75-200	100	-
chloride (Cl)	mg/l	200-600	250	250
copper (Cu)	mg/l	1.0	2.0	1.0
cyanide (Cn)	mg/l	0.05	0.07	0.07
hardness	mg/l	500	500	-
iron (Fe)	mg/l	0.0-1.5	1.0	0.3
manganese (Mn)	mg/l	0.3	0.3	0.1
lead (Pb)	mg/l	0.05	0.01	0.01
magnesium (Mg)	mg/l	30-150	500	-
nitrate (NO_3)	mg/l	10.0 as N	50	-
sulphate (SO_2)	mg/l	400	250	250
total dissolved solids (TDS)	mg/l	1000	1000	1000
zinc (Zn)	mg/l	5-15.0	3.0	3.0
total coliform	no/100 ml	0	0	0
E.coli	no/100 ml	0	0	0

Source: JICA (2013). Strategic Urban Development Plan for Yangon, Final report.

Yangon Wastewater Quality Standards

pH = 6.0 – 9.0

COD = <200 ppm

BOD = 20 – 60 ppm

TSS = <500 ppm

TDS = <2000 ppm

Source: Dr. Aung Myint Maw, Head of Department, YCDC Pollution Control and Cleansing Dept.

APPENDIX C: DOCUMENTATION OF PUBLIC CONSULTATIONS

Meeting Title : Public Consultation on Environmental Safeguards
Project Title : TA 8342 MYA- Preparing the Power Transmission and Distribution Improvement Project
Meeting Place : Conference Room, Yangon Electricity Supply Board (YESB), Yangon
Date : 30 May 2014 (Friday)
Time : 10:00 AM – 12:00 NN

Participants:

	Name	Position	Affiliation	Contact Email or Phone Number
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Discussions:

	Discussion Subject	Discussed by
	Presentation of the proposed project The objectives of the project and alignment of the proposed 230kV Ahlone-Thida-Thaketa-Kyaikasan transmission Line was presented. It was emphasized that in Yangon downtown area, there is high demand of electricity, thus, the need to improve the lines to 230 kV.	U Thet Paing Myo, MEPE
	Introduction of the environment safeguards The rationale of the environmental impact assessment and the ADB safeguards requirements was briefly explained. Details of the transmission line alignment and the anticipated environmental impacts and proposed mitigating measures were also presented.	Cherry Rivera, ADB Environment Specialist (Consultant)
	Open Discussion	

1.	The distribution of electricity to Yangon downtown area from Ahlone substation is not sufficient. These lines are only 66 kV which have been in existence for 20 years. The existing lines in Yangon are already overloaded. The decision of MEPE to extend the Thida substation is principally to supply power for Yangon downtown area. Since the project involves high-voltage 230kV lines already, the towers should be kept as high as possible to observe safety clearance.	U Saw Win Maung
2.	The new transmission line in Thaketa will be above ground which will pass through Shukhinthar St. There are anticipated issues and problems related to land acquisition and safety. It will be difficult to reuse the existing 66kV towers, therefore, in order to put new poles or towers, it is necessary to study these in detail. It demands environment and social impact assessment. It is necessary for MEPE staff to coordinate and work together with all the departments and ministries.	U Toe Aung
3.	When the existing lines were installed, there were no issues on agriculture or settlements area. The 66kV line was implemented about 30 – 40 years ago. After the line was built, houses and structures started to appear near the 66kV line. Some houses will have to be removed. In the past, YESB tried to remove the houses by submitting a letter to the authorities but no action was done. If there is some loss or negative impacts, MEPE should deal with the health and safety issues. All the departments and ministries from the ground level should discuss and work together.	U Yan Aung Lin
4.	The line route of the proposed 230 kV and the tower locations should be submitted to the township level general administrative offices (GAOs). Also, MEPE offices (townships and districts) have to coordinate. A survey team should be formed in order to study the tower locations very closely.	U Toe Aung
5.	For the Thaketa to Kyaikasan line, MEPE should consider using the old route.	U Saw Win Maung

6.	Underground drainage lines to the river should be examined thoroughly. It will be ok if the diving pile is 5 feet below. It is necessary to conduct the detailed survey in each township. Some houses might be affected.	U Aung Lwin Myo (YCDC)
7.	Along the Strand Road, between the new road (4 lanes) and old road (6 lanes), there is a drainage system. This area and some areas in Ahlone are prone to flooding. It is very dangerous to do work on the existing underground cables during the raining season.	General Administrative Department, Ahlone Tsp.
8.	It is essential to survey and discuss at each township together with YCDC, Land Use and Settlement Department, and the Electricity Department. It is also necessary to submit the plans to the State Government.	U Soe Min Aung (GAD, Botathaung Tsp.)
9.	YESB and MEPE don't have any experience and technology on constructing and installing 230 kV in the downtown area. External consultant (Engineering and designing) should be selected very carefully. Mr. Romeo Cleto, ADB Consultant, said that a Project Implementation Consultant (PIC) from the technical assistance and during implementation should be utilized by the project since they have limited experience with 230kV underground line. There should be closer link between Fichtner group, the local townships and YCDC to factor in concerns of the townships in the design of the 230kV transmission line.	U Yan Lin Aung
10.	According to the law of Environmental Conservation, if the transmission line is over 100 kV, it is necessary to undertake an EIA. In power generation, there can be many impacts but in power transmission line, there are not much environmental impacts except for potential electromagnetic field (EMF) and electric shocks. The project needs to refer to applicable international guidelines to address these problems.	U Khin Maung Kyi (ECD, MOECAF)

Meeting Title : Public Consultations (Environmental Safeguards)
Project Title : TA 8342 MYA- Preparing the Power Transmission and Distribution Improvement Project
Meeting Place :YESB, Yangon
Date :30-5-2014(Friday)
Time : 10: AM -

Sr. No.	Name	Position	Affiliation	Contact Email or Phone Number	Signature
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2.	ROMEO CLETO	CONSULTANT ON RESETTLEMENT	ADB	rcleto.consultant@adb.org	Romeo B. Cleto
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7	Aung Win	ACE	YESB	2301878	
8.	Dr. Aye San Dar Myo	EE (B)	YESB	ayesandarmyo@gmail.com	

Meeting Title : Public Consultations (Environmental Safeguards)
Project Title : TA 8342 MYA- Preparing the Power Transmission and Distribution Improvement Project
Meeting Place :YESB, Yangon
Date :30-5-2014(Friday)
Time : 10: AM -

Sr. No.	Name	Position	Affiliation	Contact Email or Phone Number	Signature
1	U Tun Maung Khin	GM. (Material Plan	Material Planning	09 860 1029	
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3	D Kolb	Director (Finance)	Finance	09 5055973	
4	Daw Yee Mon Mon	Executive Engineer	YESB	09 5158465	
5	U Kyaw Lwin	P/O	GAD - Yhingan Zay	09 502224 4	
6	U Khin Maung Te	A.D.	Environmental Conservation Dept. Ygn. Div	01. 8011319 09. 73043911	
7	U Zaw Moe	A.E	P.A.D		
8.	Daw Aye Cho	E.E	West Dist.		
9	U Sein Thaung	EIO	YESB	09. 5092734	

Meeting Title : Public Consultations (Environmental Safeguards)
Project Title : TA 8342 MYA- Preparing the Power Transmission and Distribution Improvement Project
Meeting Place : YESB, Yangon
Date :30-5-2014(Friday)
Time : 10: AM -

Sr. No.	Name	Position	Affiliation	Contact Email or Phone Number	Signature
1	U Thet Paing Myo	Project Manager (1)	P.T.P, MEPE	09-8601031	[signature]
2	Tin Maung Maung Oo	Executive Engineer	PTP, MEPE	09-448034938	[signature]
3	U Ye Pa	A.E	P.T.P, MEPE	09-73170490	[signature]
4	U Zaw Win	Deputy Township officer	General Administration (Pazundaung)	09.421060047	[signature]
5	U Myint Sein	-"-	-"- ([illegible])	09-49224989	[signature]
6	U Zaw Lin	DTO	Pabedan Township	09-250054038	[signature]
7	U Khin Maung Zaw	Dy Township	GAD	09 31294222	[signature]
8	U Mg Mg Aye	D.T.O	GAD Kandawnadaw	09-40031743	[signature]
9	U AungLwinMyo	S.A.E	Y.C.D.C (B&R)	09.5193116	[signature]
10	U ZawLwinKhine	F.O	YESB (Latha)	0943036315	[signature]
11	U Aung Thein	AO	YESB (YNRIT)	095198413	[signature]

Ieeting Title : Public Consultations (Environmental Safeguards)
roject Title : TA 8342 MYA- Preparing the Power Transmission and Distribution Improvement Project
Ieeting Place : YESB, Yangon
'ate :30-5-2014(Friday)
'ime : 10: AM -

r. lo.	Name	Position	Affiliation	Contact Email or Phone Number	Signature
1	U Kyaw Oon	AD	LANMADAW	0951600 90	
2	U Soe Win	EE	KyaukTaDa	09 2173993	
3	U Tin Tun	EE	Botahtaung	095024287	
4	U Kadag Aung	SAE	Seikkan T/S	0949300749	
5	U Aung Kyaw Moe	Deputy Township officer	G.A (Dawpone)	09.401517797	
6	U Soe Min Aung	"	" (Botahtaung	09 31547333	
7	U Aye Min Win	AD	Thaketa township	095064476	
8	Daw San Wai	EE (AD)	YESB	095190695	
9	Daw Lei Thein	Head of the branch	Material Planning	09.250286191	
10	U Hla Myint	AD	YESB	0950631983	
	U Tan Mao	EE (B)	YESB	09425026371	

Meeting Title : Public Consultation on Revised 230kV Transmission Line Alignment of Thida-Thaketa-Kyaikasan
Project Title :TA 8342 MYA- Preparing the Power Transmission and Distribution Improvement Project
Date : October 2, 2014 10:00AM
Venue :Myanmar Electric Power Enterprise Project Manager Office, Yangon City

No	Name	Position	Department	Contact No
1	U Pyay Thaung	Township Engineer	YCDC (Tamwe)	09-5035407
2	U Kan Tun Aung		GAO (Thaketa)	09-423740847
3	U Tint Lwin	Administrator	GAO (Thaketa)	09-73167719
4	U Myint Soe	Administrator (Yan Pyay)	GAO (Thaketa)	09-43092996
5	U San Oo	Administrator (4/Ma)	GAO (Thaketa)	09-73015080
6	U Chan Thar	Administrator (Shukinthar)	GAO (Thaketa)	09-254213559
7	U Nyut Wai	A/E (MEPE)	Project Manager Office	09-5151969
8	U Aung Swe	AEO	YCDC(Pazundaung)	09-43119858
9	U Zaw Min Tun	AEO	Thingungyun	09-73037087
10	U Aye Min Win	Township Officer	Tharketa	01-547034
11	Daw Phyo Malar	A/E(MEPE)	Project Manager Office	01-8011034
12	U San Tun	A/Administrator	GAO (DawBon)	0949384622
13	U Hmat Tin	Ward Administrator	Thaketa (Zayyar Thiri)	09-250140199
14	U Ohn Naing	Ward Administrator	Daw Bon(Yamonnar 2)	09-254251770
15	U Aung Naing Kyaw	Ward Administrator	Daw Bon(Yamonnar 1)	09-428193083
16	U Kyaw Taing Hmwe	AEO	DawBon	09-421074787
17	U Tin Maung Maung Oo	E/E	Project Manager Office	09-443404938
18	Ma Zar Chi Win Thein	Team Leader	Trust Survey team	09-420104924
19	Ma Swe Swe Oo	Survey Executive	Trust Survey team	09-43074225
20	U Kyaw Min Tun	E/E	Dawbon	09-5163244
21	Romeo B Cleto	Resettlement Specialist	ADB	
22	Thet Htar Myint	Resettlement Specialist	ADB	09-4211 00475
23	U Myint Oo	Ward Administrator	GAO (Dawbon)	09-420121645
24	U Than Hlaing	Ward Administrator	GAO (Dawbon)	09-73196736
25	U Thet Paing	Ward Administrator	GAO (Dawbon)	09-43027606

No	Name	Position	Department	Contact No
26	U Soe Hlaing Oo	Ward Administrator	GAO (Dawbon)	09-251020887
27	U Maung Maung Oo	Ward Administrator	GAO (Dawbon)	09-5012437
28	U Thet Tin	Ward Administrator	GAO (Dawbon)	09-420071749
29	Daw Ingin Aung	SAE(MEPE)	Project Manager Office	09-8011034
30	U Tin Win	E/E	East Yangon	09-73229414
31	U Sunny	AEO	S/Okkalapa (YCDC)	09-43148847
32	U Toe Toe Win	A/Administrator	GAO (Tamwe)	09-420252020
33	U Kyaw Kyaw Tun	A/Administrator	GAO (S. Okkalapa)	09-49653999
34	U Aung Bwa	Administrator	Dawbon	09-43113448
35	U Sein Win	Administrator	Dawbon	09-5047754
36	U Thaung Nyunt	Administrator	Dawbon	09-73053976
37	U Myo Nyunt	Administrator	Tamwe	09-09-43064578
38	U Khin Maung Lwin	Ward Administrator	Tamwe	09-73505944
39	U Zaw Min	Ward Administrator	Tamwe	09-31340986
40	U Khin Maung Than	A/ Administrator	Pazuntaung	09-256647066
41	U Than Win	Ward Administrator	Pazuntaung (8)	09-43142936

Highlights:

The meeting started at 10:00 a.m. at the office of the MEPE, Yangon City. A consensus was reached to have the brief presentation of the project components, with focus on the Transmission Lines in Thida-Thaketa and in Thaketa-Kyaikasan, to be followed by discussion of opinions and suggestions from the participants of each detailed section of the alignment. Highlights of the meetings and comments of the participants are outlined as follows:

1. The ADB Consultants explained to MEPE officials the need for the holding of the consultations to present and discuss with the stakeholders the new alignment as required by ADB policy.
2. The first section of the transmission line from Thida S/S which was originally planned to pass underneath the Maha Bandoola Bridge was changed because it is very difficult to get the agreement from Ministry of Construction on putting a cable tray system on the bridge. It was added that MEPE Survey Engineer Mr. Nyunt Wai and MEPE Township officer surveyed the area and found the option of avoiding the bridge and passing through creek with special river towers on the banks.

3. Similarly, due to very congested area, in front of the Dawbon Market and Dawbon township YCDC office, a new proposed TL corridor was developed to avoid negative impact on the congested area. Point 6C will use a Special Tower.
4. After this area, the TL will follow the same TL alignment as previously proposed by Fitchner team until Tower 9.
5. At Towers 9-11, the area will not have any problems since the land is owned by YCDC Park and Playground Department. There are plant nurseries and shops with temporary structures.
6. Towers 11 to 14 will also not have a problem with the community.
7. At Towers 15-16, the GAOs suggested that this should be moved a little further to the east because of the wastewater/drainage outlet from nearby area. According to Ward Level Administrator's suggestion, this can be negotiated with the Ministry of Transport which owns the land.
8. Between Towers 23 and 24, the TL should follow the railway alignment which has enough area and is far from the railway but in Towers 26 and 27, MEPE will need to negotiate with the Railway Department.
9. At the entrance to the Thaketa S/S, there will be problems due to informal settlers and MEPE needs to coordinate with the YCDC regarding this matter.
10. For Kyaikasan-Thaketa TL, there is congested area with tall buildings at the junction of Thuwunna Road and Pyitharyar Road near the Orange Supermarket. The alignment should avoid this congested area. MEPE said that they will inform the Chief Engineer of MEPE in Nay Pyi Taw to reconsider the alignment in this area. MEPE Survey Engineer will check the area within this week.

The meeting ended at 12:00.

Meeting Title :**Public Consultation with Civil Society Representatives on Environment and Social Safeguards**
Project Title :**TA 8342 MYA- Preparing the Power Transmission and Distribution Improvement Project**
Meeting Place :**Conference Room, Myanmar Engineering Society, Yangon**
Date :**7 November 12, 2014 (Friday)**
Time :**10:00 AM – 12:00 PM**

Participants:

	Name	Position	Affiliation	Contact Email or Phone Number
1	U Thein Zaw	Consultant	ADB	09254111092 hectazaw@gmail.com
2	Romeo B Cleto	Consultant	ADB	recleto.consultant@adb.org
3	Khine Thwe Wynn	Environment Specialist	ADB consultant	095087891
4	Thet Htar Myint	Consultant	ADB	09421100475 thethtar.m@gmail.com
5	Ei May Khine	Research officer	Environmental & Economic Research Institute (EER.i)	09421134471 eimaykhine@gmail.com
6	Aye Mya Thida		Gold Myanmar	0973045940 kyikyihlaing2009@gmail.com
7	Phyu Phyu Thant	Member	Myanmar Youth Entrepreneur Association	095089143 phwarthant@gmail.com
8	Si Thu Aung	Member	Myanmar Engineering Society	0931571380 st.sithuag@gmail.com
9	Dr. Kyaw Swar Tint	Consultant, Assistant Professor	Yangon Technology University	0943106929 11kyawswar@gmail.com
10	U Ngwe Htay			095405003 9nhtay@gmail.com
11	Phyu Phyu Shein	Social Team	Myanmar Environment Institute	0925014990 snowshein@gmail.com

Highlights of the Meeting:

1) The public have less awareness on environment and no knowledge, thus, some programs to increase public awareness should be developed.	Ei May Khine
2) During construction period, health issue and social conflicts issue are important. For the temporary construction workers, proper toilets should be provided. Moreover, regular medical checkup should be provided as well. The construction workers at temporary construction sites can be the disease carrier.	Phyu Phyu Shein
3) Safety suits and accessories should be provided to the workers and they should be trained on how to use those accessories properly.	Phyu Phyu Shein
4) Proper utilities, design and implementation should be considered to avoid the negative impacts of Electromagnetic Field as the proposed lines seem close to the residential areas. The neighborhood area should be free from any concerns/ dangers of EMF.	Phyu Phyu Thant
5) If the proposed project will be implemented according to ADB procedures, there will be no problem.	Dr. Kyaw Swar Tint
6) Public consultations should be done properly and information disclosure should be done as well.	Dr. Kyaw Swar Tint
7) In the riverbank areas, there is high risk of riverbank erosion. The study on this should be done for long period like 50 years simulation. In addition to that, emergency response plan should be addressed if there will be river bank erosion and damages of the poles/towers and the transmission line. That issue should be considered very well in the EMP.	Dr. Kyaw Swar Tint
8) Consideration of line options should be applied in order to choose the least impact route.	Dr. Kyaw Swar Tint
9) Future city development issue should be considered rather than emphasizing on the current impacts/problems when choosing the best route.	
10) When doing EIA or project implementation, not only the ADB guidelines but also the MOECAF's procedures and other relevant policies should be adapted.	Dr. Kyaw Swar Tint
11) For this project, either IEE or EIA can be applied for each sub project or the whole project according to EIA procedures (draft). But, the only difference between EIA and IEE will be duration if proper EMP is going to be developed in the IEE.	Dr. Kyaw Swar Tint
12) Proper ground study should be done rather than studying from the google earth or satalite maps as more issues can be found by doing ground study.	Phyu Phyu Shein
13) There should be proper plan and management on the traffic issue as the proposed routes have high traffic congestions during these days.	Dr. Kyaw Swar Tint

14) Proper places with enough space should be selected for the construction materials loading to avoid traffic congestions.	Dr. Kyaw Swar Tint
15) During construction period, proper safety barriers, signs and fences should be placed in order to avoid vehicular accidents.	Si Thu Aung
16) Safety officers should be assigned at the construction sites.	Si Thu Aung
17) Impacts for whole project cycle; site cleaning phase, construction phase, operation phase and decommissioning phase should be considered.	Dr. Kyaw Swar Tint

Meeting Title : Stakeholder Survey and Interviews on Environmental Issues
Project Title : TA 8342 MYA- Preparing the Power Transmission and Distribution Improvement Project
Date : 26 – 28 July 2014
Participants list:

	Name	Date of interview	Time of interview	Address/ GPS location
1	Daw Hla Tin	26 July 2014	10:45 AM	Kyaikasan Sport compound, Tamwe 16 49' 24 N 96 10'16 E
2	U Aye Thaung	26 July 2014	11:11 AM	Kyaikasan Sport compound, Tamwe 16 49 23 N 96 10 16 E
3	U Kyaw	26 July 2014	12:00 PM	54, Tarmwe township, Laydaunt Kan Road 16 49 09 N 96 10 48 E
4	U Nyan Myint	26 July 2014	1:00 PM	Building 2, room 202, Myakhwar Nyo Avenue, 8 ward, Thakata Township 16 48 19 N 96 13 14 E
5	U Khin Maung Aye	26 July 2014	2:30 PM	No D7, Ayeyarwun Rd, Thakata 16 48 09 N 96 12 27 E

	Name	Date of interview	Time of interview	Address/ GPS location
6	U Than Sein	27 July 2014	10:25 AM	Room 003, Building 5, Dagon Lwin Street, Myittarnyunt Ward, Tamwe. 16 48 39 N 96 11 11 E
7	Daw Ni Ni	27 July 2014	11:45 AM	Room 4, No 190, Kamar Kyi Road, Thuwanna Tsp. 16 49 22 N 96 12 51 E
8	U Zaw Win	27 July 2014	12:53 PM	No 6, Bawgathiri Street, 3+4 ward, Pazuntaung township (back of Thida SS) 16 46 27 N 96 11 03E
9	U Bo Ni	27 July 2014	2:11 PM	No 54, Kyaung Street, Thaketa TSP 16 46 36 N 96 11 58 E
10	U San Hlaing	27 July 2014	2:58 PM	No 1317, Shukhinthar Road, East 6 ward, Thaketa Tsp. 16 47 23 N 96 12 54 E
11	U Nyi Nyi Tun	28 July 2014	12:26 PM	Pauktan village, Htantapin 16 56 13 N 96 02 24 E
12	U Than Zaw	28 July 2014	12:56 PM	Pauktan village, Htantapin 16 56 11 N 96 02 40 E
13	U Pauk Kyine	28 July 2014	1:32 PM	Pauktan village, Htantapin 16 56 21 N 96 02 40 E
14	U Ko Ko Lay	28 July 2014	2:12 PM	Date Kone Village, Htantapin tsp 16 55 58 N 96 02 32 E
15	U Myint Soe	28 July 2013	2:58 PM	No. 169 Date Kone Village, Htantapin tsp

Discussion:

Discussion Subject
A. Positive views about the project: - Electricity can be provided fully as there are currently frequent electricity black outs. - Full voltage can be provided. Currently, they have very low voltage and frequent black outs. - Better electric supply. - It is good for country development. Industries can access full electricity. - The towers and the lines will be stronger and better. - The improvement of living standards and regional development. **B. Negative views about the project/ concerns** - Explosion/ accidents of the transformer - We heard frequent explosions and sparks from the substations and transmission lines. - During construction, it will be noise pollution and many outsiders will come to the compound. - The electric cables can fall and cause accidents. As the voltage is going to be upgraded, it will be more dangerous. - Explosions/ shocks can occur from the cables. The existing lines/cables caused frequent shocks and overheated before 2012. - It is dangerous in summer when the trees touch the cables and cause electric shocks. Also worried for falling cables. - Worried for the high frequency of electricity. - Concerns for the line falling as people are passing under the existing line. If there is an earthquake, it is more worrying. - It can be dangerous. Experienced the sparks from the existing lines when the tree touched. - On 2 May 2014, there was explosion at the Thida SS and fire in the yard. Safety issue is very important. The power lines will be dangerous if it is lower than the clearance height. Also worried about land acquisition issue. - Children can be affected in their physical development if they live nearby the substation. - The access road to Thida SS and the street at the back of Thida SS are too narrow for the fire engines to access and cars to escape in case of fire and explosion. - Electrical waves can affect human health. - Had experience the electric shocks in the existing (11 Kv) lines. Higher voltage lines will be more dangerous. - Danger of explosion and the concerns of land taking at West University SS. **C. Suggestion on how to address their concerns**

- Proper health, safety and environment (HSE) programs should be implemented to avoid the accidents and electric shocks.
- Good quality poles and cables should be used.
- The voltage fluctuation should be controlled.
- Regular tree trimming or topping (every 3 months) should be performed by YCDC or MEPE rather than when it is reported only.
- Both lines and towers should be checked regularly.
- The underground lines will be safer.
- Good quality materials should be used and it should be designed for long term use.
- The responsible persons should work honestly.

D. Suggestions on how to help ensure that local residents are always updated or informed about developments on the projects

- Sharing information with each household.
- To announce through newspapers or TV.
- Announce through media.
- Announce via journals and periodicals as 90% of population read journals.
- Pamphlets should be distributed as some people cannot afford to buy journals.
- Should inform via ward authority.
- Should advertise at the shops and restaurants.
- The ward authorities should hold the meetings and inform the locals.
- Ward authorities and heads should be informed and meetings with locals should be held.
- The information leaflets should be distributed to every house after informing the ward authority. They have to be transparent or MEPE should distribute on their own.
- Inform the village administrators and monastery. Then, the villagers will be informed via monastery at West University SS.

E. Perceived benefits which can be derived by affected persons

- Reduction of electricity cost.
- Provision of full electricity with less electricity blackout.
- Fully access of electricity
- The local business will benefit from it.
- People can access more electricity and it will be more convenient.
- The locals (Pauktan village extension) can access the electricity
- Employment opportunity for locals (both in construction labour posts and government staff positions).

F. Grievance Redress Mechanism

- Through in-charge of compound (Sport ministry, Tamwe)
- Through Township GAO
- Project manager, ward administrative officer and township GAO
- Police Station
- MOEP
- Ward authority and then township authority. If there is some problem with the substation, the complaints will go directly to YESB.
- Inform the MEPE/YESB and the ward authority.
- Starting from GAO and will go to state level. If it doesn't work, the letter will be sent to parliament. (Currently, there is no best way for it. Even though we submitted complaint letters step by step, there was no good action taken).
- Police station at West University SS.

G. Other suggestions/concerns

- There should be proper implementation to prevent the explosions or electric shocks
- The cables and poles should be regularly tested for the strength.
- The underground cable is the safest and the best.
- Trees trimming should be done regularly.
- Locals and public should be informed very well.
- Safety should be prioritized.
- We are worried for the negative impacts due to the proposed project. It should be very well planned ahead.
- Everything should be done in the right way according to the procedures.
- For the purpose of clearance area of substation (West University), locals are worried for the land taking.
- There should not be environmental impact because of the project.

TA-8342 MYA: Preparing the Power Transmission and Distribution Improvement Project
Public Consultation Meeting for Social Impact Assessment

Vanue: Dawbon Township Township Administration Office Date: 14.10.14 (Tuesday) Time: 10:00 a.m.

စဉ်	အမည်	နေရပ်လိပ်စာ	မြို့နယ်	ဖုန်းနံပါတ်	
1.	[illegible]	[illegible]	ဒေါပုံ	09.49581076.	
2.	[illegible]	〃 [illegible]	〃	09850140199	
3.	[illegible]	〃 [illegible]	〃	0942007|749	
4.	[illegible]	〃 [illegible]	〃	092510200887	
5	[illegible]	〃 [illegible] 〃 〃	〃	09.73155614	
6.	Khine Thwe Wynn	7(A) Thukhi tar St.		09 5087891	(A

TA-8342 MYA: Preparing the Power Transmission and Distribution Improvement Project
Public Consultation Meeting for Social Impact Assessment

Vanue: Thingungyun Township General Administration Office Date: 15.10.14 Time: 9:45 a.m

စဉ်	အမည်	နေရပ်လိပ်စာ	မြို့နယ်	ဖုန်းနံပါတ်
1.	[illegible]	သင်္ဃန်းကျွန်း မြို့နယ် အထွေ/အုပ်၊ မြို့နယ်ဦးစီးမှူး	သင်္ဃန်းကျွန်း	၀၉၅၀၂၂၇၆၄
2.	ဦး [illegible]	"	"	[illegible]
3.	[illegible]	[illegible]	"	09420157681
4.	[illegible]	" [illegible]	"	[illegible]
5.	[illegible]	[illegible]		5-119931
6.	ဦးသိန်းအောင်	[illegible] (၀၃)၊ [illegible]	"	09-450013234

Project Title : TA 8342 MYA- Preparing the Power Transmission and Distribution Improvement Project
Meeting Place :
Date : 27 OCT 2014, 28 OCT 2014, 29 OCT 2014, 31 OCT 2014 .
Time : 9:00 AM ~ 5:00 PM

Sr. No.	Name	Position	Affiliation	Contact Email or Phone Number	Signature
1.	U Yi Htun	EO Executive Officer	Thingangyun Tsp YCDC	09 - 73144156	
2.	U Zaw Min Htun	AEO	" "	09 73037087	
3.	U Than Oo	EO	Tamwe	09 73144172	
4.	Daw Thandar Aung	AE [illegible]	Water Department Tamway	0973067253	
5.	U Myo Lwin	Dir. ECD Ygn.		01. 8011320	
6.	U Khin Mg Te	Asst. Dir.	ECD, Ygn.	01. 8011319 09. 73043941	
7	Daw Khin Htet Tay Zar Maung	Assistant Director	ECD (YGN	09 250963746 khtzm.env.9978@gmail.com	
8.	U Myint Swe Oo	EO	DDKA		
9.	U Aye Kyaw	AEO	S. Okkalapa	75 Arawmar 3rd, 18 ward. S. Okkala	
10	U Thein Kywel Htay	AEO	THARKAYTA YCDC	09430 51856	
11.	U Sein Tun	Director	DWIR, Ministry of project	095035127	
12.	U Myat Kyaw	EO	Yankin, YCDC	09-73144179	
13.	U Aye Thaung	EO	Mayangon, YCDC	09-731 44182	

Photographs of the Public Consultation Activities

A. Public Consultation held on 30 May 2014

		
Presentation of project rationale and components, MEPE	Presentation of TL alignment, MEPE.	Presentation of rationale of EIA and environment safeguards, ADB Consultant
		
Comments from MOECAF Yangon.	Discussion of comments and issues.	Clarification by MEPE on the alignment.

B. Stakeholder interviews

Interview with ward elders at Htantabin on 22 Oct 2014

Interview with a household head at West University SS on 22 Oct 2014

Interview with residents at Htantabin on 22 Oct 2014

Interview with a housewife at West University SS on 22 Oct 2014

Interview with a resident at West University SS on 22 Oct 2014

Interview with residents in Thekata Township, 27 July 2014

Interview with residents near Kyaikasan SS, Tamwe Township, 26 July 2014

Interview with residents near Kyaikasan SS, Tamwe Township, 26 July 2014

Interview with a resident, Tamwe Township, 26 July 2014

Interview with a resident, Thaketa Township, 27 July 2014

Interview with a resident, Tamwe Township, 26 July 2014

Interview with a resident, Thekata Township, 27 July 2014

Interview with residents Htantapin Township, 28 July 2014

Interview with a resident in Htantapin Township, 28 July 2014

Interview with residents in Htantapin Township, 28 July 2014

C. Key Informant Interviews

Meeting with MOECAF Yangon, 28 Oct 2014

Meeting with YCDC Tamwe, 27 Oct 2014

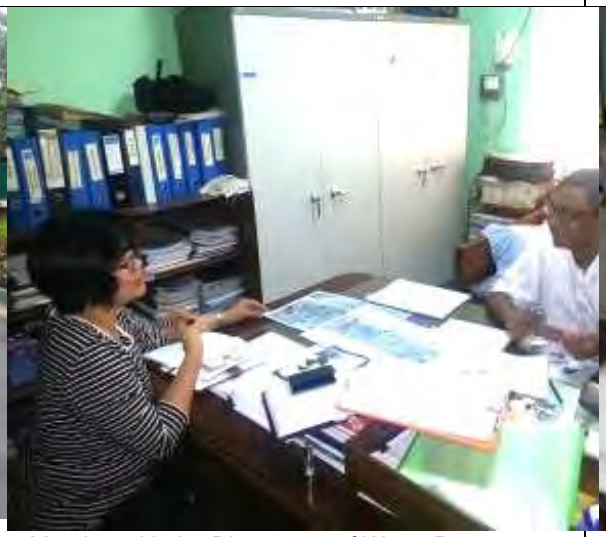
Meeting with YCDC Thinganyun, 27 Oct 2014

Meeting with YCDC South Okkalapa, 28 Oct 2014

Meeting with YCDC Thaketa, 28 Oct 2014

Meeting with YCDC Miyangon,, 28 Oct 2014

Meeting with the Ward Authorities (Thekata)



Meeting with the Directorate of Water Resources Improvement of River Systems, Ministry of Transport, 29 Oct 2014

Meeting at the General Administrative Office, Thekata Township on 13 November 2014

	
Meeting at the General Administrative Office, Thuwunna Township on 15 November 2014	Public Consultation with civil society on 7 Oct 2014

APPENDIX D: EMERGENCY RESPONSE PLAN

The Contractor(s) must develop emergency or incident response procedures (ERP) during construction. In the operational phase the operator/civil authorities will have responsibility for any emergencies or serious incidents. The construction phase should ensure:

i) Emergency Response Team (ERT) of the Contractor as initial responder;
ii) the local fire and police departments, emergency medical service, the Public Health Authorities (PHA), collectively referred to as the External Emergency Response Team (EERT), as ultimate responders.

213. The Contractor will provide and sustain the required technical, human and financial resources for quick response during construction.

Table 31. Roles and Responsibilities in Emergency Incident Response

Entity	Responsibilities
Contractor Team (ERT)	- Communicates / alerts the EERT. - Prepares the emergency site to facilitate the response action of the EERT, e.g., vacating, clearing, restricting site. - When necessary and requested by the EERT, lends support / provides assistance during EERT's response operations.
External Emergency Response Team (EERT)	- Solves the emergency/incident
Contractor Resources	- Provide and sustain the people, equipment, tools and funds necessary to ensure Subproject's quick response to emergency situations. - Maintain good communication lines with the EERT to ensure prompt help response and adequate protection, by keeping them informed of Subproject progress.

214. The ERT will be led by the senior Contractor engineer (designated ERTL) on site with a suitably trained foreman or junior engineer as deputy. Trained first-aiders and security crew will be the core members of the ERT.

215. The Contractor will ensure that ERT members are physically, technically and psychologically fit for their emergency response roles and responsibilities.

216. Prior to the mobilization of civil works, the Contractor, through its Construction Manager, ERTL, in coordination with the EA/IA, will meet with the ultimate response institutions to discuss the overall construction process, including, but not limited to:

i) Subproject sites;
ii) construction time frame and phasing;

iii) any special construction techniques and equipment that will be used; i
iv) any hazardous materials that will be brought to and stored in the construction premise and details on their applications and handling/management system;
v) the Contractor's Emergency Management Plan
vi) names and contact details of the ERT members

217. The objective of this meeting is to provide the ultimate response institutions the context for:

i) their comments on the adequacy of the respective Emergency Management Plans
ii) their own assessment of what types, likely magnitude and likely incidence rate of potential hazards are anticipated
iii) the arrangements for coordination and collaboration.

218. To ensure effective emergency response, prior to mobilization of civil works, the Contractor will:

i) set up the ERT;
ii) set up all support equipment and facilities in working condition
iii) made arrangements with the EERT;
iv) conducted proper training of ERT members, and encouraged and trained volunteers from the work force; v) conducted orientation to all construction workers on the emergency response procedures and facilities, particularly evacuation procedures, evacuation routes, evacuation assembly points, and self-first response, among others; and vi) conducted drills for different possible situations.

219. To sustain effective emergency response throughout Subproject implementation an adequate budget shall be provided to sustain the capabilities and efficiency of the emergency response mechanism, the emergency response equipment, tools, facilities and supplies. Drills and reminders will take place regularly, the former at least every two months and the latter at least every month.

Alert Procedures

220. Means of communicating, reporting and alerting an emergency situation may be any combination of the following: i) audible alarm (siren, bell or gong); ii) visual alarm (blinking/rotating red light or orange safety flag); iii) telephone (landline); iv) mobile phone; v) two-way radio; and vi) public address system/loud speakers. Some rules relative to communicating/alerting will be:

(i) Whoever detects an emergency situation first shall immediately :
- call the attention of other people in the emergency site,
- sound the nearest alarm, and/or
- report/communicate the emergency situation to the ERT.

(ii) Only the ERTL and, if ERTL is not available, the Deputy ERTL are authorized to communicate with the EERT. Exceptional cases to this rule may be necessary and should be defined in the Emergency Management Plans.

(iii) When communicating/alerting an emergency to the EERT, it is important to provide them with at least: i) the type of emergency situation; ii) correct location of the emergency; ii) estimated magnitude of the situation; iii) estimated persons harmed; iv) time it happened; v) in case of a spill, which hazardous substance spilled; and vi) in case of fire and explosion, what caused it. Such details would allow the EERT to prepare for the appropriate response actions. For an effective reporting/alerting of an emergency situation:

(i) The names and contact details of the relevant persons and institutions should be readily available in, or near to, all forms of communication equipment, and strategically posted (at legible size) in all Subproject sites and vehicles:

- Most relevant construction/operations staffs namely, the ERTL, Deputy ERTL, first-aiders, supervising engineers, foremen
- EERT institutions/organizations
- Concerned village authority/ies
- IA Office, SS

(ii) All Subproject sites should have good access to any combination of audible and visual alarms, landline phones, mobile phones and two-way radio communication at all times.

(iii) Contractor's construction vehicles should also be equipped with the appropriate communication facilities.

Emergency Response Situations

The following tables suggest general procedures that will be refined in the final EMP during detailed design, and described in more detail in the Emergency Management Plans of the Contractor.

Table 32. Evacuation Procedure

Procedure	Remarks
▪ Move out as quickly as possible as a group, but avoid panic.	▪ All workers/staff, sub-contractors, site visitors to move out, guided by the ERT.
▪ Evacuate through the directed evacuation route.	▪ The safe evacuation shall have been determined fast by the ERTL/Deputy ERTL and immediately communicated to ERT members.
▪ Keep moving until everyone is safely away from the emergency site and its influence area.	▪ A restricted area must be established outside the emergency site, all to stay beyond the restricted area.
▪ Once outside, conduct head counts.	▪ Foremen to do head counts of their sub-groups; ERTL/Deputy ERTL of the ERT.
▪ Once outside, conduct head counts.	▪ Foremen to do head counts of their sub-groups; ERTL/Deputy ERTL of the ERT.
▪ Once outside, conduct head counts.	▪ Foremen to do head counts of their sub-groups; ERTL/Deputy ERTL of the

	ERT.
▪ Report missing persons to EERT immediately.	▪ ERTL/Deputy ERTL to communicate with the EERT.
▪ Assist the injured in evacuation and hand them over to the ERT first-aiders or EERT medical group	▪ ERT to manage injured persons to ensure proper handling.
▪ If injury warrants special care, DO NOT MOVE them, unless necessary and instructed/directed by the EERT.	▪ ERTL/Deputy ERTL communicates with EERT to get instructions/directions in handling the injured.

Table 33. Response Procedure During Medical Emergency

Procedure	Remarks
▪ Administer First Aid regardless of severity immediately.	▪ Fundamentals when giving First Aid: - Safety first of both the rescuer and the victim. - Do not move an injured person unless: - victim is exposed to more danger when left where they are, e.g., during fire, chemical spill - it would be impossible for EERT to aid victims in their locations, e.g., under a collapsed structure - instructed or directed by the EERT. ▪ First AID to be conducted only by a person who has been properly trained in giving First Aid.
▪ Call the EERT emergency medical services and/or nearest hospital.	▪ ERTL/Deputy ERTL or authorized on-site emergency communicator
▪ Facilitate leading the EERT to the emergency site.	▪ ERTL/Deputy ERTL to instruct: - an ERT member on- site to meet EERT in access road/strategic location. He/she shall hold orange safety flag to get their attention and lead them to site. - Other ERT members to clear access road for smooth passage of the EERT.
▪ If applicable, vacate site and influence area at once, restrict site, suspend work until further notice.	▪ Follow evacuation procedure.

Table 34. Response Procedure in Case of Fire

Procedure	Remarks
▪ Alert a fire situation.	▪ Whoever detects the fire shall immediately:

Procedure	Remarks
	- call the attention of other people in the site, - sound the nearest alarm, and/or - Foreman or any ERT member among the construction sub-group contacts the fire department (in this case it should be agreed on that it is alright for any ERT member in the sub-group to alert the fire department) - report/communicate the emergency situation to the ERTL/Deputy ERTL.
▪ Stop all activities/operations and evacuate.	▪ All (non-ERT) workers/staff sub-contractors, site visitors and concerned public to move out to safe grounds following the evacuation procedure.
▪ Activate ERT to contain fire/control fire from spreading.	▪ Guided by the training they undertook, ERT members assigned to mitigate the fire shall assess their own safety situation first before attempting to control fire spread.
▪ Call the nearest fire and police stations and, if applicable, emergency medical services.	▪ When alerting the EERT, ERTL will give the location, cause of fire, estimated fire alarm rating, any injuries.
▪ Facilitate leading the EERT to the emergency site.	▪ ERTL/Deputy ERTL to instruct: - an ERT member to meet the EERT in the access road or strategic location and lead them to the site. He/she shall hold the orange safety flag to get their attention and lead them to the site. - some ERT members to stop traffic in, and clear, the access road to facilitate passage of the EERT.
▪ ERT to vacate the site as soon as their safety is assessed as in danger.	▪ Follow appropriate evacuation procedure.

APPENDIX E: HEALTH EFFECTS OF ELECTROMAGNETIC RADIATION EMF

221. The popular concern of negative health effects of exposure to electromagnetic fields (EMF) which originally arose primarily from exposure to high voltage transmission lines has increased with the proliferation of personal electronic sources of EMF such as microwave ovens and cellular phones. The World Health organization (WHO) as part of their mandate for monitoring global human health with specific focus on developing countries recently conducted an extensive review and assessment http://www.who.int/peh-emf/en/ of the validity of the concerns of EMF.

222. Provided below is the recent review and critical summary conducted by WHO of the extensive research on human health and EMF which is reprinted verbatim below. The portion of the research database published in primary is referenced follows the summary.

223. In the area of biological effects and medical applications of non-ionizing radiation approximately 25,000 articles have been published over the past 30 years. Despite the feeling of some people that more research needs to be done, scientific knowledge in this area is now more extensive than for most chemicals. Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields. However, it is believed that some gaps in knowledge about biological effects exist and need further research.

Effects on general health:

224. Some members of the public have attributed a diffuse collection of symptoms to low levels of exposure to electromagnetic fields at home. Reported symptoms include headaches, anxiety, suicide and depression, nausea, fatigue and loss of libido. To date, scientific evidence does not support a link between these symptoms and exposure to electromagnetic fields. At least some of these health problems may be caused by noise or other factors in the environment, or by anxiety related to the presence of new technologies.

Effects on pregnancy outcome

225. Many different sources and exposures to electromagnetic fields in the living and working environment, including computer screens, water beds and electric blankets, radiofrequency welding machines, diathermy equipment and radar, have been evaluated by the WHO and other organizations. The overall weight of evidence shows that exposure to fields at typical environmental levels does not increase the risk of any adverse outcome such as spontaneous abortions, malformations, low birth weight, and congenital diseases. There have been occasional reports of associations between health problems and presumed exposure to electromagnetic fields, such as reports of prematurity and low birth weight in children of workers in the electronics industry, but these have not been regarded by the scientific community as being necessarily caused by the field exposures (as opposed to factors such as exposure to solvents).

Cataracts

226. General eye irritation and cataracts have sometimes been reported in workers exposed to high levels of radiofrequency and microwave radiation, but animal studies do not support the idea that such forms of eye damage can be produced at levels that are not thermally hazardous. There is no evidence that these effects occur at levels experienced by the general public.

Electromagnetic fields and cancer

227. Despite many studies, the evidence for any effect remains highly controversial. However, it is clear that if electromagnetic fields do have an effect on cancer, then any increase in risk will be extremely small. The results to date contain many inconsistencies, but no large increases in risk have been found for any cancer in children or adults.

228. A number of epidemiological studies suggest small increases in risk of childhood leukemia with exposure to low frequency magnetic fields in the home. However, scientists have not generally concluded that these results indicate a cause-effect relation between exposure to the fields and disease (as opposed to artifacts in the study or effects unrelated to field exposure). In part, this conclusion has been reached because animal and laboratory studies fail to demonstrate any reproducible effects that are consistent with the hypothesis that fields cause or promote cancer. Large-scale studies are currently underway in several countries and may help resolve these issues.

Electromagnetic hypersensitivity and depression

229. Some individuals report "hypersensitivity" to electric or magnetic fields. They ask whether aches and pains, headaches, depression, lethargy, sleeping disorders, and even convulsions and epileptic seizures could be associated with electromagnetic field exposure.

230. There is little scientific evidence to support the idea of electromagnetic hypersensitivity. Recent Scandinavian studies found that individuals do not show consistent reactions under properly controlled conditions of electromagnetic field exposure. Nor is there any accepted biological mechanism to explain hypersensitivity. Research on this subject is difficult because many other subjective responses may be involved, apart from direct effects of fields themselves. More studies are continuing on the subject.

The focus of current and future research

231. Much effort is currently being directed towards the study of electromagnetic fields in relation to cancer. Studies in search for possible carcinogenic (cancer-producing) effects of power frequency fields is continuing, although at a reduced level compared to that of the late 1990's.

232. The long-term health effects of mobile telephone usage is another topic of much recent research. No obvious adverse effect of exposure to low level radiofrequency fields has been discovered. However, given public concerns regarding the safety of cellular telephones, further research aims to determine whether any less obvious effects might occur at very low exposure levels.

a. Key emergent points

- A wide range of environmental influences causes biological effects. 'Biological effect' does not equal 'health hazard'. Special research is needed to identify and measure health hazards.
- At low frequencies, external electric and magnetic fields induce small circulating currents within the body. In virtually all ordinary environments, the levels of induced currents inside the body are too small to produce obvious effects.
- The main effect of radiofrequency electromagnetic fields is heating of body tissues.
- There is no doubt that short-term exposure to very high levels of electromagnetic fields can be harmful to health. Current public concern focuses on possible long-term health effects caused by exposure to electromagnetic fields at levels below those required to trigger acute biological responses.
- WHO's International EMF Project was launched to provide scientifically sound and objective answers to public concerns about possible hazards of low level electromagnetic fields.
- Despite extensive research, to date there is no evidence to conclude that exposure to low level electromagnetic fields is harmful to human health.
- The focus of international research is the investigation of possible links between cancer and electromagnetic fields, at power line and radio frequencies.

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APPENDIX F: ENVIRONMENTAL DUE DILIGENCE OF EXISTING SUBSTATIONS

A. INTRODUCTION

233. The Ministry of Electric Power (MOEP) has identified two new 230kV transmission lines and two new substations to be constructed in Yangon with assistance from the Asian Development Bank (ADB). The transmission lines will be constructed between the existing substations of Thida and Thaketa and another line from Thaketa to Kyaikasan.

234. In order to accommodate the new 230 kV transmission lines, the 230 kV Thaketa substation has to be extended by two transmission feeder bays, i.e. one for the line to Thida and another for the line to the new 230 kV Kyaikasan substation. At the Thida substation, the 230 kV feeder bay for the line to Thaketa will be installed under another project. Kyaikasan substation will be a completely new substation located beside the existing 66 kV substation.

235. According to the ADB SPS (2009), the conduct of environmental audits for projects involving existing activities or facilities is needed to determine existence of any areas which may cause or is causing environmental risks or impacts. Considering that the proposed ADB-funded project will be located within the same compound of existing substations, an environmental audit was undertaken at Thida, Thaketa and Kyaikasan substations.

B. OBJECTIVE

236. The main objectives of the environmental due diligence are:

- To determine existence of any areas where the existing substations may cause or is causing environmental impacts or risks;
- To assess compliance with environmental requirements of the Government of Myanmar;
- Evaluate adequacy of mitigation measures, monitoring plan, and institutional arrangements to manage environmental impacts;
- To propose corrective action and recommendations consistent with GOM and SPS.

C. AUDIT AND SITE INVESTIGATION PROCEDURE

237. This environmental due diligence or environmental compliance audit is focused on the existing substations located at Thida, Thaketa and Kyaikasan in Yangon. The audit was conducted through site visit and inspection of the substation facilities and premises, interview with substation staff and validation of substation records and reports related to environmental management. The site visits were conducted from the period March 9 to 11, 2015. The following substation staff were interviewed during this environmental audit: (i) Kyaw Kyaw, Engineer in-Charge, Thida Substation; (ii) U Ban Soe, Chief Engineer, Thaketa Substation, MOEP; (iii) U Zaw Win Htay, Substation assistant engineer, Thaketa Substation, MOEP; and (iv) Maw Si Tun, Head of substation, Kyaikasan substation.

D. DESCRIPTION OF EXISTING SUBSTATIONS AND FACILITIES

Thida Substation

238. The Thida substation operates within a property covering an area of approximately 8,000 square meter. The property is owned and operated by the Yangon Electricity Supply Board (YESB) since 1988.

239. The substation is a synchronizing substation in Yangon. It transmits 66kV from Thaketa substation and Alone substation and then distributes power to the township substations such as Botahtaung, Pazuntaung, Kyaukkatatar, Satekan, Tamway, Taungnyunt, and Dawpon. Facilities within the Thida substation include the following:

- 66/33 kV, 30 MVA x 3
- 66/33 kV, 20 MVA x 1
- oil circuit breakers
- 4 switchgears (33 kV)
- 5 switchgears (6 kV)
- Substation building with office and control room

240. There are 7 people who are assigned to operate and conduct minor maintenance works on the substation. These staff are assigned for 24 hours alternative days with 1 day shift in 3 days. All the major maintenance and inspections are done by the maintenance department of YESB. Once the substation staff notice any problem, they immediately inform YESB to determine if major maintenance works is necessary.

Thaketa Substation

241. The Thaketa substation is owned and operated by the MOEP. It started operating in 1985. The substation transmits 230 kV from Thanyln and Hlawgar substations. It also operates at 66 kV and 33 kV from Thaketa SS to distribute power to the township level substations such as Dagon, Kyaikasan, and Patheinnyuint.

242. The following are the major facilities at the Thaketa substation:

- 7 switchgears, 5 transformer bays (230kV)
- 8 switchgears, 3 tranformer bays (66 kV)
- 5 switchgears, 2 transformer bays (33 kV)
- battery room
- substation building.

243. The substation has a total of 28 staff and workers who operate and maintain the substation. The staff are assigned with two shifts, I,e, 8:30AM – 5:30 PM and 5:30PM – 8:30 AM.

244. Transformer maintenance and regular checking of transformers and equipment are done by the maintenance team of the substation. However, if there is a transformer or big equipment that needs to be changed due to damage, a contracting company is

invited to tender services such as changing the transformer oil or changing to a new transformer.

Kyaikasan Substation

245. The Kyaikasan substation is owned by YESB. It operates in a land with an area of approximately 9,000 square meter. The substation started operating in 2003. The substation transmits power from Thaketa and Alone substation. The following are the facilities at the Kyaikasan substation:

- 30 MVA x 3, 90 MVA gas circuit breaker type transformer
- 8 switchgears
- 5 transformer bats
- substation building with office, battery room and control room.

246. There are 9 workers assigned at the substation who are involved on substation operation only. Similar to the Thida substation, all maintenance and inspection works are done by the 24-hour maintenance department under YESB. The staff at the substation are assigned for 24 hours alternative days (1 day shift in 3 days).

E. AUDIT FINDINGS

247. The following are the observations at each of the substations:

Thida Substation

1. Measures to prevent oil spill and leaks from transformers

There is no oil containment around transformer areas hence during oil changing, several containers are used to catch the oil dripping to avoid spill over on land or on concrete pavement. Collected used oil is brought to the YESB maintenance department.

2. Implementation of safety policies and procedures

Safety signages are found all around the transformer and switchyard area. In addition, the transfer and switchyard area is wire fenced to avoid unauthorized entry.

The YESB conducts safety training to all staff every one to three months at the Hlaing Thar Yar training school. This includes safety orientation and briefing of staff at the YESB main office.

When the workers were asked about their awareness of the safety policies, they said that they are fully aware of the safety policies and that they are required to strictly observe the safety procedures. However, it was observed that some of the workers are not wearing PPEs or hard hats while moving around the switchyard.

The substation monitors safety implementation by recording the following:

- Temperature on a daily basis
- Laser checking of radiation once every six months.

3. Maintenance of equipment

Regular maintenance of equipment is done by YESB. Oil samples are sent to the laboratory once every six months. In case there is abnormal noise at the on/off time of the circuit breaker, oil analysis is done to check the dielectric strength and moisture content.

4. Management of hazardous/liquid waste

Hazardous wastes such as old batteries are sent back to YESB maintenance department.

5. Management of fire incidents

A huge explosion occurred on 2 May 2012 due to an old transformer which overloaded. Most of the transformers at the substation are over 30 years. During this incident, the fire engines had difficulty entering the site because of the narrow access road to the substation.

In this case, it is important for the substation to have fire extinguishers at the office building and water tank to be used in case of fire incidents.

Thaketa Substation

1. Management of transformer oil

Minor maintenance such as transformer oil refilling is done at the compound but major maintenance works are done outside thru service contractors. Based on the inspection of the transformer, the oil was labeled as PCB free.

The maintenance team of the substation performs regular inspection on the equipment and noise detection. If there is any abnormal condition that was detected during the daily inspection, check on the insulation oil is administered. The testing of oil is done by an oil tester or oil sample is collected and then sent to the laboratory. Normally, without any abnormal findings on the equipment, oil analysis is done once a year with oil change every 10 years.

Transformer oil change is done outside the substation compound. The whole transformer is brought to the contractor's workshop. Only oil refilling is done inside the substation compound.

There was no evidence of oil spillage during the site visit at Thaketa substation. New oil barrels were found and kept at the concrete warehouse building. Similarly, there was no oil spillage observed at the warehouse building. Used oil is not disposed at the site. It is collected by the service contractor and sold to recyclers or used for secondary purposes.

2. Management of old batteries

Batteries are replaced approximately every eight years. The used batteries are sold to recyclers.

3. Management of solid waste

Recyclable solid waste is sold to recyclers. Office waste such as paper and debris are dumped through the municipal waste collection system.

4. Safety policies

There is safety signage found in the switchyards.

In terms of safety training and orientation, there seems to be a lack of proper training on safety policies as disclosed by workers at the substation. There are also no safety guidelines or policies for the workers. Safety monitoring is also not being conducted. There is informal safety orientation conducted to make sure that all workers are wearing PPEs and safety shoes when working at the switchyard. Hard hats were found at the control room.

5. Fire prevention

There are a few fire extinguishers kept at the office building.

Kyaikasan Substation

The Kyaikasan substation is operated by YESB, hence, all management and maintenance procedures are the same as the Thida substation. All the minor equipment maintenance work is carried out by the substation staff inside the compound while the major maintenance work is serviced outside through the maintenance department of YESB. The maintenance department of YESB conducts regular visits to the substation.

1. Management of oil

Oil analysis is being conducted once a year by YESB. Changing of transformer oil is done outside the substation. However, there was evidence of oil drippings on the concrete floor at one of the transformers.

2. Management of old batteries and used oil

Old batteries are sent to the YESB maintenance department (main office). Used oil is also collected by the same department of YESB.

3. Safety policies

In terms of safety awareness of workers, they are required to undergo orientation and safety training at the Hlaing Thar Yar YESB training school. There is also safety briefing at the YESB main office. Safety is monitored regularly by the head of the substation. There has been no reported accident at the substation.

F. AREAS OF CONCERN AND CORRECTIVE ACTION PLAN

248. The Thida and Kyaikasan substations are owned and operated by the YESB while the Thaketa substation is owned by MOEP. The proposal for the 230kV Thida-Thaketa-Kyaikasan transmission lines requires the installation of equipment inside the Thaketa substation and at the Kyaikasan substation. There is still vacant area inside the Thaketa substation where the feeder bays to receive the 230 kV Thida-Thaketa-Kyaikasan transmission line will be installed. At the Kyaikasan substation, an area beside the existing 66 kV substation is being proposed to receive the 230 kV line.

249. The following are the recommended improvements in the existing facilities that need to be considered in the design and operation of the proposed ADB-funded project:

1. Compliance with environmental laws of Myanmar

All of the substations do not hold any environmental permit or clearance from MOECAF since the substations started operating prior to the drafting of the Environmental Impact Assessment (EIA) rules in 2012. Prior to the issuance of the draft EIA rules, the conduct of an EIA was not a requirement for development projects in the country.

Notwithstanding the draft status of the EIA rules, the Ministry of Electric Power (MOEP) will be obliged to apply the draft rules in their preparation of the required EIA for the ADB-funded project pursuant to the Environmental Conservation Law (ECL).

2. Management of hazardous wastes

The management of hazardous wastes such as used oil and old batteries need to be incorporated in the operation of the substations and transmission lines. While there is a current system for changing of oil, the proper disposal of used oil and old batteries remains uncertain since these are just reportedly brought to the YESB maintenance department for Thida and Kyaikasan substations or collected by the service contractor as in the case of Thaketa substation. Hazardous wastes management should be done in an environmentally safe practice.

3. Ensuring occupational and community safety

Safety training is being conducted rigorously by YESB for its staff. However, there seems to be a lack of discipline among workers during its implementation. There is safety signage at the sites to warn workers of the dangers of working near the substation equipment. Despite this, the workers were still not wearing hard hats or safety shoes. Safety training and orientation will form part of the institutional and capacity building plan of the ADB project.

4. Monitoring of electromagnetic field (EMF)

EMF levels have not been measured at the substations. To safeguard the health and wellness of workers and the immediate community, EMF monitoring is recommended as part of the environmental monitoring plan of the ADB project.

5. Institutional plan for environmental management

In all the substations, there is no staff in-charge of environmental management and monitoring. An institutional plan will be developed to strengthen the capacity of MOEP

on the aspect of environmental compliance with Myanmar's environmental laws and in ensuring that all environmental issues related to substation operation are properly addressed in the future. This will include concerns related to solid and hazardous waste management, preventing oil spills/leaks, oil containment, fire prevention, and ensuring occupational and community health and safety.

Photographs of the Substations

Safety warning and wire fence at the switchyard of Thida SS

Transformer at Thida SS.

Warning signage on the fence of the switchyard

Empty used oil barrel in the switchyard

Transformer oil

Container of transformer oil at the yard.

THIDA SUBSTATION

Warning signage at the switchyard


Transformer


PPEs at the control room

High voltage warning sign on the transformer


Fire extinguishers at the control room

Safety sign


transformer oil barrels in the storage room


No smoking sign outside the warehouse

THAKETA SUBSTATION

Sign showing voltage of transformer

Transformer and switchyard

Signs of transformer oil leak on the pavement

Fire extinguishers at the control room

safety warning sign at the office/control room

KYAIKASAN SUBSTATION