Chipwi Nge Hydropower Station (Construction Power Plant) for Hydropower Project in Upper Reaches of Ayeyawady River

Environmental Impact Report

Changjiang Survey, Planning, Design and Research Limited Co.

February 2023

Chipwi Nge Hydropower Station (Construction Power Plant) for Hydropower Project in Upper Reaches of AyeyawadyRiver

Environmental Impact Report

Statement

Changjiang Survey, Planning, Design and Research Limited Co.

Dec., 2013

Chipwi Nge Hydropower Station (Construction Power Plant) for Hydropower Project in Upper Reaches of AyeyawadyRiver

Environmental Impact Report

Compiling unit: Changjiang Survey, Planning, Design and Research Limited Co.

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Wang Ying, Li Huiling, Li Xiaoling, Xu Tao

Units and persons involved in environmental impact assessment of hydropower development in upper reaches of AyeyawadyRiver:

Changjiang Survey, Planning, Design and Research Limited Co.: --EIA

Wang Xiaomao	Zhang Hui	Tan Changli	Huang Jiawen
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Quan Hui	Chen Zhang	Zheng Xiandong	Hu Jianhua
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Ministry of WaterResources&ChineseAcademy of Sciences, Institute of Hydroecology--Aquatic organism

Qiao Ye	Hu Juxiang	Xu Wei	Zheng Haitao
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Ma Peiming	Chen Mingxiu	Wang Li	Cai Yupeng
Wang Xiang	Zhang Yichao		

SouthChinaBotanical Garden, ChineseAcademy of Sciences: --Terrestrial plants

Xia Nianhe	Gao Xinfen	Cao Honglin	Deng Yunfei
Xu Bingqiang	Zhang Jinping	Zhou Lianxuan	Wang Jun
Zhou Wei	Wu Linfang	Fang Zhiqiang	Hu Qiming
Li Zexian	Wu Deling	Chen Wenjin	Wu Guangnan

South China Institute of Endangered Animal: --Terrestrial animals

Hu Huijian	Hou Baihua	An Xincheng	Peng Boyong
Liu Jincheng	Wang Xincai	He Bing	Wei Qilang
Fei Dongbo			

Biodiversity And Nature Conservation Association:

Htin Hla	U Nyo Maung	Su Su	Zau Lunn
Myint Pe	Tint Wai	Thaung Htut	Di Moe Htun
Thaung Htut	Than Htay Oo	Aung Kyaw Win	L. Tue Nam
Myint Aung	Win Myint	Thin Thin Su	Khin Swe Lwin
Khin Khin Soe	Nay Phyo Aung	Kyaw Soe Naing	Swe Swe aung
Kalaya Lu	Tazar Aung	Mg Aung Aung	Thandar Win
Thida Nyein	Maythu Htun	Myo Min Htun	Kyaw Naing Oo
Aung Than Soe	Yan Naing Hein	Oum Kwe Shein	Thaw Zin
Kyaw Swar Aung	Nay Myo Win	Myin Thura Kyaw	Min Thein Htet
Aung Ko Ko	Khin Mar Lwin	Khin Sandar Hlaing	Naing Naing Win
Phyo Thidar	San Wai Tint	Than Than Htay	Nay Myo Aung
Aung Moe			

小其培水电有限责任公司
CHIPWI NGE HYDROPOWER COMPANY LIMITED
Add: S（217）/（219）Dapyaygone, Zabu Thiri Township, Naypyitaw
Tel: 0095-67-8108355 Fax: 0095-67-8108399

Director General

Environmental Conservation Department

Ministry of Natural Resources and Environmental Conservation

Nay Pyi Taw, the Republic of the Union of Myanmar

Ref. No. CNHC MNREC1 2023-1

February 17, 2023

Subject: Commitment Letter for comply and follow the Environmental Management Plan that mentioned in the ESIA report that prepared for construction of 99 MW Chipwi Nge Hydropower Station for Electricity Generation and Power Supply

Dear Sir,

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

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

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

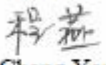
We hereby undertake that;

Chipwi Nge Hydropower Co., Ltd. in respect of the "construction of 99 MW Hydropower Plant for Electricity Generation and Power Supply" will at all times comply fully with: (i) any and all commitments and obligations as set forth in the ESIA report which has been reviewed by Review Team of MONREC, and (ii) any and all plans and the various components thereof, including without limitation, impacts avoidance, mitigation, and remediation measures, and with respect to both (i) and (ii), including but not limited to such commitments, obligations, plans and measures related to the development, construction, commissioning, operation and maintenance of the project, and any circumstance in which work done or to be done, or services performed or to be performed, in connection with the projects development, construction, commissioning, operation and maintenance is carried out our intended or required to be carried out by any contractor, subcontractor or other party.

When the proposed project will be constructed and operated in Myanmar, Chipwi Nge

Hydropower Co., Ltd. will comply and follow the Environmental Management Plan that mentioned in the ESIA report that prepared by Resource & Environment Myanmar Co., Ltd.
Besides, Chipwi Nge Hydropower Co., Ltd. will submit the Environmental Monitoring
Report during construction and operation of the proposed project to Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation.
Thank you for your vigorous support and help to Chipwi Nge HPP.

Yours Sincerely,



Cheng Yan
Managing Director
Chipwi Nge Hydropower Co., Ltd.

Resource and Environment Myanmar Ltd.(REM)
702 Delta Plaza, Shwegondaing Rd., Bahan, Yangon, Myanmar
Tel: 09 73013448, Fax: (01) 552901

Third Party Consultants Commitments

Resource & Environment Myanmar Co., Ltd. (REM); a local environmental consultant firm, conducted environmental impact assessment and prepared ESIA report for construction of 99 MW Chipwi Nge Hydropower Station for Electricity Generation and Power Supply in compliance with EIA Procedure (December 2015) and other relevant laws/rules and formally submitted to the Environmental Conservation Department (ECD) for final approval.

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

- the accuracy and completeness of the EIA report,
- the EIA has been prepared in strict compliance with applicable laws including the EIA Procedure, and

We also consulted to CPI Yunnan International Power Investment Co., Ltd. in respect of the "**construction of 99 MW Chipwi Nge Hydropower Plant for Electricity Generation and Power Supply"** for Electricity Generation and Power Supply" will at all times comply fully with any and all plans and various components therefore, including without limitation, impact avoidance, mitigation, and remediation measures and with respect to such commitments, obligations, plans and measures related to development, operation and closure of the project, and any circumstance in which work done or to be done, or services performed or to be performed, in connection with the project's development.

Min Thant Tun Date: 8.2.2023

Director

Resource & Environment Myanmar (REM)

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်
မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုကော်မရှင်
ခွင့်ပြုမိန့်

ခွင့်ပြုမိန့်အမှတ် ၀၄၄/၂၀၁၇ ၂၀၁၇ ခုနှစ်၊ ဒီဇင်ဘာ လ ၁၀ ရက်

မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှု ကော်မရှင်သည် မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှု ဥပဒေပုဒ်မ ၂၅၊ ပုဒ်မခွဲ (ဂ) အရ ဤခွင့်ပြုမိန့်ကို ထုတ်ပေးလိုက်သည် -

(၁) ရင်းနှီးမြှုပ်နှံသူအမည် ညွှန်ကြားရေးမှူးချုပ်၊ လျှပ်စစ်စွမ်းအားစီမံရေးဦးစီးဌာန

(၂) နိုင်ငံသား မြန်မာ

(၃) နေရပ်လိပ်စာ ရုံးအမှတ်-၂၆၊ နေပြည်တော်

(၄) ပင်မအဖွဲ့အစည်းအမည်နှင့်လိပ်စာ လျှပ်စစ်နှင့် စွမ်းအင်ဝန်ကြီးဌာန၊ ရုံးအမှတ်-၂၆၊ နေပြည်တော်

(၅) ဖွဲ့စည်းရာအရပ် မြန်မာနိုင်ငံ

(၆) ရင်းနှီးမြှုပ်နှံသည့်လုပ်ငန်းအမျိုးအစား ၉၉ မဂ္ဂါဝပ်ရှိ ချီဖွေငယ်ရေအား လျှပ်စစ်မာတ်အားပေး စက်ရုံတည်ဆောက်၍ လျှပ်စစ်မာတ်အား ထုတ်လုပ်ရောင်းချခြင်း လုပ်ငန်း

(၇) ရင်းနှီးမြှုပ်နှံသည့်အရပ်ဒေသ(များ) ကချင်ပြည်နယ်၊ ချီဖွေမြို့၏ အရှေ့တောင်ဘက် ၁၁ မိုင်ခန့်အကွာနှင့် အရှေ့ဘက် ၁၈ ကီလိုမီတာအကွာ ချီဖွေမျောင်းအနီး၊ ရစ်ကျော်ကျေးရွာအုပ်စု၊ ကွင်းအမှတ် (OSS) ရှိမြေ ၂၂၂.၁၇ ဧက

(၈) နိုင်ငံခြားမတည်ငွေရင်းပမာဏ အမေရိကန် ဒေါ်လာ ၂၄၂.၃၉ သန်း

(၉) နိုင်ငံခြားမတည်ငွေရင်းယူဆောင်လာရမည့်ကာလ ၃ နှစ်

(၁၀) စုစုပေါင်းမတည်ငွေရင်းပမာဏ(ကျပ်) အမေရိကန်ဒေါ်လာ ၂၄၂.၃၉ သန်းနှင့် ညီမျှသော မြန်မာကျပ်ငွေ

(၁၁) တည်ဆောက်မှု/ပြင်ဆင်မှုကာလ -

(၁၂) ရင်းနှီးမြှုပ်နှံမှုခွင့်ပြုသည့် သက်တမ်း ၄၀ နှစ်

(၁၃) ရင်းနှီးမြှုပ်နှံမှုပုံစံ ဖက်စပ်နိုင်ငံခြားရင်းနှီးမြှုပ်နှံမှု

(၁၄) မြန်မာနိုင်ငံတွင်ဖွဲ့စည်းမည့်ကုမ္ပဏီအမည် ချီဖွေငယ်ရေအားလျှပ်စစ်ကုမ္ပဏီလီမိတက်

30.12.17

ဥက္ကဋ္ဌ
မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုကော်မရှင်

Form (3)

THE REPUBLIC OF THE UNION OF MYANMAR
Myanmar Investment Commission
Permit

Republic of the Union of Myanmar
Myanmar Investment Commission
Sr.No. 591-B
Date 30.12.2017

Permit No. 044/ 2017 Date 30th December 2017

This permit is issued by the Myanmar Investment Commission according to the section 25, sub-section (c) of the Myanmar Investment Law:-

(1) Name of Investor DIRECTOR GENERAL, DEPARTMENT OF ELECTRIC POWER PLANNING

(2) Citizenship MYANMAR

(3) Residence Address BUILDING NO-26, NAY PYI TAW

(4) Name and Address of Principal Organization MINISTRY OF ELECTRICITY AND ENERGY BUILDING NO - 26, NAY PYI TAW

(5) Place of Incorporation MYANMAR

(6) Type of Business CONSTRUCTION OF 99 MW HYDROPOWER PLANT FOR ELECTRICITY GENERATION AND POWER SUPPLY

(7) Place(s) of Investment Project FIELD NO-(OSS), YIT GYAW VILLAGE TRACT, NEAR CHIPWI RIVER, 18KM EAST AND 11 MILE SOUTH EAST OF CHIPWI TOWNSHIP, KACHIN STATE

(8) Amount of Foreign Capital US$ 242.39 MILLION

(9) Period for Foreign Capital to be Brought in THREE YEARS

(10) Total Amount of Capital (Kyat) EQUIVALENT IN KYAT OF US$ 242.39 MILLION

(11) Construction Period -

(12) Validity of Investment Permit 40 YEARS

(13) Form of Investment JOINT VENTURE

(14) Name of Company Incorporated in Myanmar CHIPWI NGE HYDROPOWER COMPANY LIMTTED

30.12.17

Chairman
Myanmar Investment Commission

THE REPUBLIC OF THE UNION OF MYANMAR
MYANMAR INVESTMENT COMMISSION
No.(1), Thitsar Road, Yankin Township, Yangon

Tel: 95-1- 658130
Fax: 95-1-658142

Our ref : MIC-5(P)/Kha-004/2017(591-B)
Date : 30th December 2017

Subject: **Decision of the Myanmar Investment Commission on the Proposal for construction of 99 MW hydropower plant for electricity generation and power supply under the name of Chipwi Nge Hydropower Company Limited**

Reference: Ministry of Electricity and Energy, Letter dated 16th October 2017, letter no. Electric-2/(Chipwi Nge)(10047)/ 2017

1. The Myanmar Investment Commission, at its meeting (17/2017) held on 22nd December 2017, approved the Permit for investment in construction of 99 MW hydropower plant for electricity generation and power supply under the name of Chipwi Nge Hydropower Co., Ltd. submitted by CPI Yunnan International Power Investment Co., Ltd. (80%) from the People's Republic of China, Department of Electric Power Planning, Ministry of Electricity and Energy (15%) and Royal Victory Services Ltd. (5%) from the Republic of the Union of Myanmar as a joint venture investment in accordance with the Myanmar Investment Law and Rules.

2. The terms and conditions of the Permit are stated in the following paragraphs:

(a) The term of the Permit shall be initial 40 (forty) years commencing from the commercial operation date of Chipwi Nge hydropower station. After the expiration of the concession period of Chipwi Nge hydropower station, Chipwi Nge Hydropower Co., Ltd. shall transfer the fully operational facility in good conditions at no cost to Department of Electric Power Planning (the then Department of Hydropower Planning) or its successor. Chipwi Nge Hydropower Co., Ltd. shall abide by the joint venture agreement between CPI

Yunnan International Power Investment Co., Ltd., Department of Electric Power Planning and and Royal Victory Services Ltd.

(b) Chipwi Nge Hydropower Co., Ltd. which has obtained this permit to receive benefits relating to the right to use land under Chapter XII and exemptions and reliefs under section 75,77 and 78 of the Chapter XVIII of Myanmar Investment Law may submit the application form.

(c) Chipwi Nge Hydropower Co., Ltd. shall use its best efforts to achieve a timely realization of the work stated in the permit application.

(d) Chipwi Nge Hydropower Co., Ltd. shall obey and respect the responsibilities of investors under section 65 of Myanmar Investment Law and Chapter XX of Myanmar Investment Rules.

(e) Chipwi Nge Hydropower Co., Ltd. shall carry out Environmental Social Impact Assessment (ESIA) and Environmental Management Plan (EMP) according to the type of investment activities in accordance with the relevant laws, rules, regulations and procedures.

(f) Chipwi Nge Hydropower Co., Ltd. shall submit to the Commission any sublease, mortgage, transfer of shares or transfer of the business to any person during the investment period in accordance with section 72 of Myanmar Investment Law and rule 191 of Myanmar Investment Rules.

(g) Chipwi Nge Hydropower Co., Ltd. which has benefited from the permit or the exemptions and reliefs shall submit an annual report in the prescribed form to the Commission within three (3) months of the end of the financial year in accordance with rule 196 of Myanmar Investment Rules and shall publish a summary of the report on its website or the Commission's website.

(h) Chipwi Nge Hydropower Co., Ltd. must, during the operation period under the permit of the Commission, submit its operating report

quarterly in the prescribed form in accordance with rule 197 of Myanmar Investment Rules.

3. Chipwi Nge Hydropower Co., Ltd. shall submit five (5) copies of all approvals, licences, permits and similar authorizations relevant to the initial implementation of the investment to the Commission.

30.12.17

(Kyaw Win)
Chairman

Managing Director

Department of Electric Power Planning

cc: 1. Ministry of Home Affairs
2. Ministry of Office of the Union Government
3. Ministry of Natural Resources and Environmental Conservation
4. Ministry of Electricity and Energy
5. Ministry of Labour, Immigration and Population
6. Ministry of Commerce
7. Ministry of Planning and Finance
8. Kachin State Investment Committee
9. Office of the Kachin State Government
10. Director General, Fire Services Department
11. Director General, Department of Environmental Conservation
12. Director General, Directorate of Labour
13. Director General, Immigration and National Registration Department
14. Managing Director, Myanma Oil and Gas Enterprise
15. Director General, Department of Trade
16. Director General, National Archive Department
17. Director General, Internal Revenue Department
18. Director General, Customs Department

19. Managing Director, Myanma Foreign Trade Bank
20. Managing Director, Myanma Investment and Commercial Bank
21. Division Head, Kachin State, Directorate of Investment and Company Administration
22. Chipwi Nge Hydropower Co., Ltd.

Table of Contents

Attached Figures:

Appendix

ACRONYMS AND ABBREVIATIONS

BANCA	Biodiversity And Nature Conservation Association
BIA	Biological Impact Assessment
BOT	Build, operate, and transfer
CBD	Convention on Biological Diversity
CISPDR	Changjiang Institute of Survey, Planning, Design & Research
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on Migratory Species
CPI	China Power Investment Corporation
CR	Critically Endangered
DBH	Diameter at Breast Height of a plant
DD	Data Deficient
DHPI	Department of Hydroelectric Power Implementation
EIA	Environmental Impact Assessment
EN	Endangered
EIS	Environmental Impact Statement
EW	Extinct in the Wild
EX	Extinct
GPS	Global Positioning System
IUCN	The World Conservation Union (International Union for Conservation of Nature and Natural Resources)
KIA	Kachin Independent Army
kW	Kilowatt
kWh	Kilowatt hour
LC	Least Concerned
MW	Megawatts
mg/l	Milligram per liter
NDAK	New Democratic Army of Kachin
NP	National Park
NT	Near Threatened
NTFP	Non TimberForest Product
NWCD	Nature and Wildlife Conservation Division
PAS	Protected Areas System
VU	Vulnerable
WCD	World Commission on Dams
WCS	Wildlife Conservation Society
WS	Wildlife Sanctuary
WWF	World Wide Fund For Nature

၁. စီမံကိန်း အကျဉ်းချုပ်

၁.၁ စီမံကိန်းနောက်ခံ အကြောင်းအရာ

မြစ်ကြီးနားအထက်ဘက် ဧရာဝတီမြစ်ဝှမ်းဒေသသည် ရေအရင်းအမြစ်ပေါပေါများများ ပိုင်ဆိုင်ထားပြီး ဖွံ့ဖြိုးတိုးတက်မည့် အခြေအနေများဖြင့်နိုင်းစာလျှင် မြင့်မားစွာတည်ရှိနေပါသည်။ မကြာသေးမီနှစ်များအတွင်း မြန်မာနိုင်ငံအစိုးရသည် လူမှုစီးပွားဖွံ့ဖြိုးတိုးတက်မှု လိုအပ်ချက်အရ ရေအားလျှပ်စစ်ဖွံ့ဖြိုးတိုးတက်ရေးကို နိုင်ငံတော်အဆင့် ဦးစားပေးအနေဖြင့် အမျိုးအစားခွဲခြားထားပြီး တစ်ချိန်တည်းမှာပင် ယင်းအရင်းအမြစ်များ၏ အကျိုးရလဒ်ကို စီးပွားရေးသာလွန်ချက် တစ်ရပ်အနေဖြင့် ပြောင်းလဲသွားမည်။ ၂၀၁၅ ခုနှစ် နိုင်ငံခြားရင်းနှီးမြှုပ်နှံမှုအနေဖြင့် မြန်မာနိုင်ငံအတွင်း တရုတ်ရင်းနှီးမြှုပ်နှံမှုသည် အဆင့် ၁၁ ရှိခဲ့သည်။ မြန်မာအစိုးရအနေဖြင့် ကိုယ်ပိုင် ရေအားလျှပ်စစ်အရင်းအမြစ်များ တိုးတက်ရန်အတွက် တရုတ်ရင်းနှီးငွေနှင့် နည်းပညာကို အသုံးပြုရန် မျှော်လင့်ထားခဲ့သည်။ ဧရာဝတီမြစ်နှင့် ချင်းတွင်းမြစ် များ၏ ရေအားလျှပ်စစ်အရင်းအမြစ်များ ဖွံ့ဖြိုးတိုးတက်စေရန် မြန်မာနိုင်ငံအစိုးရသည် China Power Investment Corporation (CPI) ကို third China-ASEAN Expo (CAEXPO) အဆက်အစပ်ဖြင့် ၂၀၀၆ ခုနှစ် အောက်တိုဘာလတွင် ဖိတ်ခေါ်ခဲ့ပါသည်။ သို့သော်လည်း ဈေးကွက်စိန်ခေါ်မှုများနှင့် ဆက်စပ်အကြောင်းအရာများအရ CPI သည် ရေအားလျှပ်စစ်စီမံကိန်းကို ဧရာဝတီမြစ် အထက်ပိုင်းတွင်သာ ရင်းနှီးမြှုပ်နှံ သွားရန် ဆုံးဖြတ်ခဲ့သည်။

မြန်မာနိုင်ငံရှိ ဧရာဝတီမြစ်၏ အင်မိုင်ခမြစ်၊ မလိခမြစ် နှင့် ချီဗွေငယ်တွင် ဆောင်ရွက်မည့် ရေအားလျှပ်စစ်စီမံကိန်းများအတွက် လျှပ်စစ်စွမ်းအား ဝန်ကြီးဌာန အမှတ် (၁) (MOEP1) သည် ၂၀၀၆ ခုနှစ် ဒီဇင်ဘာလအတွင်း နားလည်မှုစာချွန်လွှာ ရေးထိုးခဲ့ပါသည်။ ၂၀၀၇ ခုနှစ် ဇန်နဝါရီလတွင် Changjiang Survey, Planning, Design and Research Limited Co.Ltd., (CDC) သည် ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံ လုပ်ငန်းစဉ် တစ်ခုလုံးအတွက် စစ်တမ်းကောက်ယူခြင်း၊ စီမံကိန်းရေးဆွဲခြင်း၊ စီမံကိန်းပုံစံ နှင့် သုတေသန လုပ်ငန်းများ စသည်တို့ကို ဆောင်ရွက်သွားရန် CPI မှ အပ်နှင်းထားသည့် ကုမ္ပဏီဖြစ်ပါသည်။ ကွင်းဆင်းလေ့လာချက်အရ CDC သည် မြစ်ဆုံနှင့် ချီဗွေရေအားလျှပ်စစ်စက်ရုံများ အနီးရှိ မြစ်လက်တက် ၁၂ ခု၏ ရေအားလျှပ်စစ် အရင်းအမြစ်များနှင့် ဖွဲ့စည်းတည်ရှိပုံ အခြေအနေများကို စီစစ်လေ့လာခဲ့ပြီး CPI နှင့် အကြေအလည် ဆွေးနွေးပြီးနောက် ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံကို ချီဗွေမြစ်တွင် တည်ဆောက်ရန် ဆုံးဖြတ်ချက်ချခဲ့သည်။။

CDC သည် စီမံကိန်းနေရာ စုံစမ်းစစ်ဆေးခြင်း နှင့် ဇလဗေဒ စစ်တမ်းကောက်ယူခြင်းများကို ၂၀၀၇ ခုနှစ် မတ်လအကုန်တွင် စတင်ခဲ့ပြီး ယင်းနေရာကို အခြေခံ၍ စီမံကိန်းရေးဆွဲခြင်းနှင့် စီမံကိန်းပုံစံများ အကောင်အထည်ဖော်ခြင်းကို ဆောင်ရွက်ခဲ့ပါသည်။ ထပ်မံဖြည့်စွက်ရလျှင် CDC သည် ဧရာဝတီမြစ်အထက်ပိုင်းရှိ ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံ ဖြစ်နိုင်ခြေ ဆန်းစစ်လေ့လာခြင်း အစီရင်ခံစာ (*Feasibility Study Report of Chipwi Nge Hydropower Station in Upper Reaches of Ayeyawady River*) ကို ၂၀၀၇ ခုနှစ် စက်တင်ဘာလတွင် ပြီးစီးခဲ့ပါသည်။

CPI Yunnan International Power Investment Co., Ltd. (CPIYN) မှ ခန့်အပ်ထားသော CDC သည် Institute of Hydroecology of Ministry of Water Resources & Chinese Academy of Sciences (IHE)၊South China Botanical Garden, Chinese Academy of Sciences (SCBG)၊South China Institute of Endangered Animals (SCIEA)၊ ဇီဝမျိုးစုံမျိုးကွဲနှင့် သဘာဝထိန်းသိမ်းရေးအသင်း (BANCA) စသည်တို့နှင့်အတူ ဧရာဝတီမြစ်အထက်ပိုင်းရှိ ရေအားလျှပ်စစ် ဖွံ့ဖြိုးတိုးတက်ရေးအတွက်

ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း နှင့် စစ်တမ်းကောက်ယူခြင်းများကို ဆောင်ရွက်ခဲ့ပါသည်။ ၂၀၁၉ ခုနှစ်တွင် မြစ်ဝှမ်းရှိ ဇီဝဝန်းကျင်အခြေအနေကို ရှာဖွေရန်ရည်ရွယ်ချက်ဖြင့် တရုတ်ပညာရှင်များနှင့် မြန်မာပညာရှင်များပါဝင်သော ပူးတွဲလေ့လာရေးအသင်းသည် ဧရာဝတီမြစ်အထက်ပိုင်းရှိ (မြစ်ဆုံအပါအဝင် ရေအားလျှပ်စစ် စက်ရုံ ၇ ခုမှ ထိခိုက်စေမည့်နေရာများ အပါအဝင်) ဇီဝဝန်းကျင်အခြေအနေကို ထဲထဲဝင်ဝင် စုံစမ်းစစ်ဆေးခြင်းများ ဆောင်ရွက်ခဲ့ပြီး ရေအားလျှပ်စစ်စီမံကိန်းဆောက်လုပ်ခြင်းမှ သက်ရောက်ခံရသည့် ဒေသခံလူများ၏ သဘောထားများ၊ ပတ်ဝန်းကျင်ဆိုင်ရာပြဿနာရပ်များအတွက် စိုးရိမ်ပူပန်မှုများ၊ မေးခွန်းလွှာနှင့် လူတွေ့မေးမြန်းခြင်းမှ လိုအပ်ချက်များ စသည်တို့နှင့် ပတ်သက်သည့် အချက်အလက်များကို စုဆောင်းရယူခဲ့ပါသည်။ လေ့လာရေးအသင်းသည် ယင်းတို့၏လုပ်ငန်း ဆောင်တာများကို ၂၀၁၉ ခုနှစ် ဇန်နဝါရီလတွင် စတင်ဆောင်ရွက်ခဲ့ပြီး စုစုပေါင်းကြာချိန် ၅ လတာ ကာလဖြင့် မေလတွင် ပြီးစီးခဲ့ပါသည်။ ကျန်ရှိနေသေးသည့် လုပ်ငန်းရပ်များကို BANCA မှ ဇူလိုင်လတွင် ဆောင်ရွက်ပြီးစီးခဲ့ပါသည်။ တရုတ်ပညာရှင် တစ်ရာကျော် နှင့် မြန်မာကျွမ်းကျင်ပညာရှင်များ ပါဝင်သည့် လူဦးရေ ၂၆၀ ခန့်သည် ပူးတွဲလေ့လာရေးအသင်းတွင် ပါဝင်ခဲ့ပါသည်။ ကွင်းဆင်းလေ့လာခြင်းများ ဆောင်ရွက်ပြီးသည့်နောက်တွင် IHE, SCBG နှင့် SCIEA တို့သည် ရေနေနှင့် ကုန်းနေ ဂေဟစနစ် အထူးလေ့လာခြင်း၏ ရလဒ်များကို သီးခြားစီခွဲ၍ ပြီးဆုံးအောင်ဆောင်ရွက်ခဲ့ပါသည်။ BANCA သည်လည်း တရုတ်ကျွမ်းကျင်ပညာရှင်များနှင့်အတူ နမူနာများခွဲခြားသတ်မှတ်ခြင်း၊ စစ်တမ်းကောက်ယူထားသည့် အချက်အလက်များအရ စစ်တမ်းရလဒ်များ၏ ဆက်စပ်သည်များကို ဆောင်ရွက်ခဲ့ပြီး သက်ဆိုင်ရာ စုံစမ်းစစ်ဆေးမှုကို ပြီးဆုံးအောင်လုပ်ဆောင်၍ ရလာသည့် စစ်တမ်းရလဒ်အစီရင်ခံစာကို CPIYN သို့ ၂၀၂၉ ခုနှစ် အောက်တိုဘာလတွင် တင်သွင်းခဲ့ပါသည်။

CDC သည် ဧရာဝတီမြစ်အထက်ပိုင်းရှိ ရေးအားလျှပ်စစ် ဖွံ့ဖြိုးတိုးတက်ရေး ပတ်ဝန်းကျင်ထိခိုက်မှု အစီရင်ခံစာကို ၂၀၁၀ ခုနှစ် မတ်လတွင် ပြီးစီးခဲ့ပြီး CPIYN မှ MOEP1 သို့ ၂၀၁၀ ခုနှစ် မေလတွင် တင်သွင်းခဲ့ပြီးသည့်နောက် ၂၀၁၁ ခုနှစ် ဇန်နဝါရီလတွင် MOEP1 မှ အတည်ပြုပေးခဲ့ပါသည်။

မြန်မာနိုင်ငံတွင် ၂၀၁၂ ခုနှစ်၌ ပြဋ္ဌာန်းခဲ့သည့် ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးဥပဒေနှင့်အတူ မြန်မာနိုင်ငံရှိ စီမံကိန်းအတည်ပြုချက်နှင့် ပတ်သက်၍ မြန်မာအစိုးရ၏ နောက်ဆုံးလိုအပ်ချက်များအရ CPIYN မှ အလုပ်အပ်နှံထားသည့် CDC သည် ၂၀၁၃ ခုနှစ် စက်တင်ဘာလတွင် ချီဖွေငယ် ရေအားလျှပ်စစ်စက်ရုံ ပတ်ဝန်းကျင်ထိခိုက်မှု အစီရင်ခံစာ (စက်ရုံတည်ဆောက်ခြင်း)၊ ၂၀၁၃ ခုနှစ် ဒီဇင်ဘာလတွင် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှုဆန်းစစ်ခြင်းနှင့် ဆက်စပ်၍ လက်ရှိရှိနေသော အချက်အလက်များ ထည့်သွင်းစဉ်းစားထားသည့် ဧရာဝတီမြစ်အထက်ပိုင်းရှိ ရေးအားလျှပ်စစ်စီမံကိန်း၊ စသည်တို့ကို ပြီးဆုံးအောင် ဆောင်ရွက်ခဲ့ပါသည်။

Changjiang Institute of Survey, Planning, Design and Research (အတိုကောက် "Changjiang Design Institute" ဟု အမည်ရပြီး အစီရင်ခံစာထဲတွင် CISPDR ဟု သုံးစွဲသွားမည်) သည် ၁၉၅၀ ခုနှစ် ဖေဖော်ဝါရီလတွင် တည်ထောင်ခဲ့ပြီး Ministry of Water Resources of China ၏ Changjiang Water Resources Commission အဖွဲ့ဝင်ဖြစ်လာခဲ့သည်။ ၎င်းသည် အစိုးရနှင့် Ministry of Commerce of China မှ အသိအမှတ်ပြု လက်မှတ်ရရှိထားသော အပြည်ပြည်ဆိုင်ရာ လုပ်ငန်းကန်ထရိုက်တာတို့မှ ခွင့်ပြုထားသည့် အဆင့်မြင့်နည်းပညာသုံး အစိုးရပိုင်လုပ်ငန်းတစ်ခုဖြစ်ပြီး အဓိကအားဖြင့် နည်းပညာ ပိုင်းဆိုင်ရာ ကွင်းဆင်းလေ့လာခြင်းများ၊ စီမံကိန်း ရေးဆွဲခြင်း၊ စီမံကိန်း ပုံစံ အကောင်အထည်ဖော်ခြင်း၊ သိပ္ပံနည်းကျ သုတေသနများ၊ အကြံဉာဏ်ပေးခြင်းများ၊ ဆောက်လုပ်ရေး ကြီးကြပ်မှုများ၊ ဆောက်လုပ်မှု စီမံခန့်ခွဲရေးတို့အပြင် တရုတ်နိုင်ငံနှင့် အခြားနိုင်ငံများရှိ စီမံကိန်းများအတွက် EPC စာချုပ်ချုပ်ဆိုခြင်းများကို

ဆောင်ရွက်ခဲ့ပါသည်။၄င်းသည် တရုတ်နိုင်ငံရှိ အရည်အသွေးပြည့်မီသော A အဆင့်ရှိ စစ်တမ်းနှင့်ဒီဇိုင်းလုပ်ငန်းဟု အသိအမှတ်ပြုထားသည့် ပထမတန်းစားထဲတွင် တစ်ခုအပါအဝင်ဖြစ်ပြီး နိုင်ငံအဆင့် စစ်တမ်းနှင့်ဒီဇိုင်းလုပ်ငန်း ၁၀၀ တွင် ခိုင်မာသော အရည်အသွေးမီ အင်အားနှင့်အတူ ထိပ်ဆုံးအဆင့်တွင် အမြဲတမ်းရှိနေပါသည်။

CISPDR တွင် သက်ဆိုင်ရာနယ်ပယ်၌ ကျွမ်းကျင်ပညာရှင်များ၊ Chinese Academy of Engineering မှ ပညာရှင် ၂ ယောက်၊ နည်းပညာပိုင်းဆိုင်ရာ ကွင်းဆင်းလေ့လာခြင်းအတွက် National Masters ၃ ယောက်၊ နည်းပညာပိုင်းဆိုင် စီမံကိန်းပုံစံရေးဆွဲခြင်းအတွက် National Master ၁ ယောက်၊ National Talent Program of New Era မှ ရွေးချယ်ခံထားရသည့် ပုဂ္ဂိုလ် ၁ ဦး၊ 5151 Talent Program of Ministry of Water Resources မှ ရွေးချယ်ခံထားရသည့် ပုဂ္ဂိုလ် ၁၈ ဦး၊ လူငယ်ထူးချွန်ပညာရှင် ၄ ယောက်၊ အစိုးရမှ အထူးခွင့်ပြုချက်ရရှိထားသည့် ကျွမ်းကျင်ပညာရှင် ၆၇ ယောက်၊ ပါမောက္ခရာထူးအဆင့်ရှိ အကြီးတန်း အင်ဂျင်နီယာ ၁၅၀ ယောက်၊ အကြီးတန်း အင်ဂျင်နီယာ ၇၄၅ ယောက်၊ အသိအမှတ်ပြု အင်ဂျင်နီယာ အယောက် ၁၀၀၀ နှင့် အသိအမှတ်ပြု လက်မှတ်ရရှိထားသော စာရင်းကိုင်များ ပါဝင်သည့် ဝန်ထမ်း ၁၉၅၉ ယောက်ရှိပါသည်။ နည်းပညာပိုင်းဆိုင်ရာ ကွင်းဆင်းလေ့လာခြင်းနှင့် နည်းပညာပိုင်းဆိုင် စီမံကိန်းပုံစံရေးဆွဲခြင်းဆိုင်ရာ အရည်အသွေးပြည့်မီသော A အဆင့် ထောက်ခံချက်များ အပြင် အခြား A အဆင့် ထောက်ခံချက် ၁၀ ကျော် နှင့်အတူ တရုတ်နိုင်ငံ၏ အဓိကမြို့တော်ဖြစ်သည့် Wuhan တွင် အခြေစိုက်ထားသည့် CISPDR သည် Hubei ၊ Hunan ၊ Henan ၊ Chongqing ၊ Shanghai ၊ Guangdong နှင့် Tibet တို့တွင်လည်း ရုံးခွဲများဖွင့်လှစ်ထားပါသည်။ CSPDR တွင် ပြည်စုံသော အရည်အသွေးစီမံခန့်ခွဲမှုစနစ် နှင်အတူ ကျန်းမားရေး၊ ဘေးအန္တရာယ်ကင်းရှင်းရေး နှင့် ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှုစနစ်များ ရှိပါသည်။ "ခေတ်မီနည်းပညာနှင့် စစ်မှန်သည့်ဝန်ဆောင်မှုများဖြင့် လုပ်ငန်းအပ်နှံသူများ၏ မျှော်မှန်းချက်များထက်သာလွန်သော သိပ္ပံနည်းကျစီမံခန့်ခွဲမှု နှင့်အတူ စဉ်ဆက်မပြတ်ဖွံ့ ဖြိုးတိုးတက်မှုများဖြင့် အရည်အသွေးပြည့် ထုတ်ကုန်များ ဖြည့်စည်းပေးခြင်း" ဟူသော အရည်အသွေးသတ်မှတ်ချက်နှင့် အမြဲကိုက်ညီလျက်ရှိပါသည်။

ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် သစ်တောရေးရာဝန်ကြီးဌာန (MOECAF) ရှိ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန (ECD) သည် ချီဗွေငယ် ရေအားလျှပ်စစ်စီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာမူကြမ်းအတွက် မှတ်ချက်များကို ၂၀၁၆ ခုနှစ် မတ်လတွင် ပထမဆုံး ထုတ်ပြန်ပေးခဲ့ပါသည်။ MOECAF သည် စီမံကိန်းနယ်မြေ၏ အခြေခံအချက်အလက်များနှင့် ပြည်သူလူထု တွေ့ဆုံဆွေးနွေးပွဲများ ထပ်မံဆောင်ရွက်ရန် CSPDR ကို အကြံပြုခဲ့ပါသည်။

၄င်းကိုအခြေခံ၍ Resource and Environment Myanmar Co., Ltd. သည် ၂၀၁၆ ဩဂုတ်လတွင် ပတ်ဝန်းကျင်ဆိုင်ရာ အခြေခံအချက်အလက်များကောက်ယူခြင်းနှင့် ပြည်သူလူထုတွေ့ဆုံဆွေးနွေးပွဲများကို ဆောင်ရွက်ခဲ့ပါသည်။ ပြန်လည်ပြင်ဆင်ထားသော ပတ်ဝန်းကျင်ဆိုင်ရာ အခြေခံအချက်အလက်များ ပါဝင်သော အစီရင်ခံစာနှင့် ထပ်မံထည့်သွင်းထားသော လူမှုရေးဆိုင်ရာ သက်ရောက်မှု အကဲဖြတ်ခြင်း အစီရင်ခံစာကို နောက်ဆက်တွဲ ၁၊ ၂ နှင့် ၃ တို့တွင် ဖော်ပြထားပါသည်။

စီမံကိန်းအဆိုပြုသူသည် ဒုတိယအကြိမ် နောက်ဆုံး EIA မူကြမ်း အစီရင်ခံစာကိုပြင်ဆင်ပြီး MOEE သို့ တင်ပြခဲ့ပါသည်။ MOEE သည် ၄င်းအစီရင်ခံစာကို MOEE အညွှန်းစာအမှတ် Electric-2 (Chipwi Nge) (5241)/2017 နှင့်အတူ ECD သို့ ၂၀၁၇ ဇွန်လ ၁ ရက်နေ့တွင် ပြန်လည်တင်ပြခဲ့ပါသည်။

ESIA အစီရင်ခံစာမူကြမ်းအပေါ် သုံသပ်စိစစ်ရေးအဖွဲ့အစည်းအဝေးကို ၂၀၁၈ မတ်လ ၈ ရက်နေ့တွင်

ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဌာန (ECD) တွင် ကျင်းပခဲ့ပါသည်။ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဌာန (ECD) သည် ချီပွေငယ်ရေအားလျှပ်စစ်စီမံကိန်း၏ ESIA အစီရင်ခံစာမူကြမ်းအတွက် မှတ်ချက်များကို ၂၀၁၈ ဖေဖော်ဝါရီလ ၂၈ ရက်နေ့တွင် စာအမှတ် EIA-1/7 (213/2018) နှင့်အတူ ထုတ်ပြန်ခဲ့ပါသည်။ စီမံကိန်းအဆိုပြုသူသည် ဇယား ၁၄.၁ တွင်ဖော်ပြထားသော စည်းမျဉ်းစည်းကမ်းလိုအပ်ချက်များအရ EIA နောက်ဆုံး အစီရင်ခံစာကို ပြင်ဆင်ခဲ့ပါသည်။

၁.၂ မြန်မာနိုင်ငံဥပဒေများ နှင့် စည်းမျဉ်းစည်းကမ်းများ

ရေ၊ မြေ၊ သစ်တော၊ တွင်းထွက်ပစ္စည်း၊ ပင်လယ်နှင့် အခြားသဘာဝ အရင်းအမြစ်များ ကြောင်းကျိုးဆီလျော်စွာ ဖွံ့ဖြိုးတိုးတက်စေရန်နှင့် သဘာဝနှင့် ဂေဟစနစ်ဆိုင်ရာ ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေးကျဆင်းခြင်းကို တားမြစ်ရန် ပြည်ထောင်စုမြန်မာနိုင်ငံတော်အစိုးရသည် ၁၉၉၄ ခုနှစ် ဒီဇင်ဘာလ ၅ ရက်နေ့တွင် *Agenda and Environmental Policies of Myanmar in the 21st Century* ကို ပြဋ္ဌာန်းခဲ့ပြီး အောက်ပါအတိုင်းညွှန်းဆိုခဲ့ပါသည်။

" လူ၊ ယဉ်ကျေးမှုအမွေအနှစ်၊ ပတ်ဝန်းကျင်နှင့် သဘာဝအရင်းအမြစ်များသည် နိုင်ငံ၏ ပထမဆုံးသော ကြွယ်ဝမှုဖြစ်သည်။ ကျွန်ုပ်တို့၏ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး နည်းဥပဒေသည် ကျွန်ုပ်တို့ပြည်သူများ၏ လူနေမှုဘဝအရည်အသွေး တိုးမြှင့်စေရန်အတွက် ဖွံ့ဖြိုးတိုးတက်မှုစဉ်ကာလာအတွင်း ဖြစ်နိုင်ခြေရှိသည့် ပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှုကို ထည့်သွင်းစဉ်းစားစေခြင်း၊ စီးပွားရေးဖွံ့ဖြိုးတိုးတက်မှုနှင့် ပတ်ဝန်းကျင်ထိန်သိမ်းရေးကြား ချိန်ကိုက်မှုနှင့် လိုက်လျောညီထွေဖြစ်မှုအား သိမြင်နားလည်စေရန် ရည်ရွယ်ထားပါသည်။ နိုင်ငံတစ်ခုစီတွင် ၎င်းနိုင်ငံ၏ ပတ်ဝန်းကျင်ဆိုင်ရာ နည်းဥပဒေနှင့်အညီ သဘာဝအရင်းအမြစ်သုံးစွဲနိုင်သည့် လွတ်လပ်သော အချုပ်အခြာအာဏာရှိသည်ဆိုသော်လည်း ခွင့်ပြုထားသော ကန့်သတ်ချက်များထက် ပိုမသုံးစွဲမိအောင် သို့မဟုတ် သဘာဝအရင်းအမြစ်များ ဖွံ့ဖြိုးတိုးတက်မှုကာလတွင် တစ်ခြားနိုင်ငံများ၏ စိတ်ဝင်စားမှုကို မထိပါးမိအောင် ဂရုစိုက်ရမည်။ နိုင်ငံတော်နှင့် နိုင်ငံသားတိုင်းတွင် လက်ရှိနှင့် အနာဂတ်ကာလရှိ သဘာဝအရင်းအမြစ်များကို ကာကွယ်စောင့်ရှောက်ရန် တာဝန်ရှိသည့်အပြင် ဖွံ့ဖြိုးတိုးတက်ရေးလုပ်ငန်းစဉ်ကာလအတွင်း ပတ်ဝန်းကျင်ထိန် သိမ်းရေးကို အဓိကရည်မှန်းချက်အဖြစ် ယူဆထားရမည်။ "

ပတ်ဝန်းကျင်ကာကွယ် ထိန်းသိမ်းရေး ဥပဒေကို ပြည်ထောင်စုလွှတ်တော်မှ အသိအမှတ်ပြုပြီး သမ္မတဦးသိန်းစိန်မှ လက်မှတ်ရေးထိုးပြီးနောက် ၂၀၁၂ ခုနှစ် မတ်လ ၃၀ ရက်နေ့တွင် ပြဋ္ဌာန်းခဲ့ပါသည်။ ပတ်ဝန်းကျင်ကာကွယ် ထိန်းသိမ်းရေး ဥပဒေကို အခန်း ၁၄ ခန်း၊ အပိုဒ် ၄၂ ခုဖြင့် ဖွဲ့စည်းထားပြီး အဓိကအားဖြင့် ပတ်ဝန်းကျင်ကာကွယ် ထိန်းသိမ်းရေး ဥပဒေ သတ်မှတ်ချက်၊ ပတ်ဝန်းကျင် ကာကွယ်ထိန်းသိမ်းရေးဦးစီးဌာန၏ တာဝန်နှင့် ဝတ္တရားများ၊ ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး သတ်မှတ်ချက်၊ ပတ်ဝန်းကျင် ကာကွယ်ထိန်းသိမ်းရေး၊ မြို့ပြပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု၊ သဘာဝ အရင်းမြစ်များနှင့် ယဉ်ကျေးမှု အမွေနှစ်များ ကာကွယ်ထိန်းသိမ်းရေး၊ စီမံကိန်း ဆောင်ရွက်ခွင့်နှင့် ပြစ်ဒဏ်များ စသည်တို့ ပါဝင်ပါသည်။

လက်ရှိ အချက်အလက်များအရ ပြည်ထောင်စု မြန်မာနိုင်ငံတော် အစိုးရသည် ပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှု ဆန်းစစ်ခြင်းနှင့် ဆက်စပ်နေသည့် ဥပဒေနှင့် စည်းမျဉ်းစည်းကမ်း တစ်စုံတစ်ရာ ထုတ်ပြန်ထားခြင်း မရှိပါ။ လက်ရှိကာလတွင် ပတ်ဝန်းကျင်ကာကွယ်ထိန်းသိမ်းရေးနှင့် ဆက်စပ်နေသည့် မြန်မာနိုင်ငံရှိ အဓိကဥပဒေများတွင် *မြန်မာ့သစ်တောဥပဒေ၊ တောရိုင်းတိရိစ္ဆာန်နှင့် သဘာဝနယ်မြေများ ထိန်းသိမ်းရေးဥပဒေ (၁၉၉၄)၊ ရေအရင်းအမြစ်နှင့် မြစ်ချောင်းများ ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၆)၊*

သတ္တုတွင်းဥပဒေ (၁၉၉၄)၊ ရေချိုငါးလုပ်ငန်း ဥပဒေ (၁၉၉၁) နှင့် မြန်မာ့ပင်လယ်ငါးလုပ်ငန်း ဥပဒေ (၁၉၉၀) တို့ပါဝင်ပါသည်။

၁.၃ စီမံကိန်းအကြောင်းအရာ ခြုံငုံဖော်ပြချက်

၁.၃.၁ မြန်မာ့သစ်တောဥပဒေ

ဧရာဝတီမြစ်ဝှမ်းဒေသသည် မြောက်လတ္တီကျူ. ၁၅ ဒီဂရီ ၃၀ မိနစ်-၂၈ ဒီဂရီ ၅၀ မိနစ်နှင့် အရှေ့လောင်ဂျီကျူ. ၉၃ ဒီဂရီ ၁၆ မိနစ်-၉၈ ဒီဂရီ ၄၀ မိနစ်တွင် တည်ရှိပြီး တရုတ်နိုင်ငံ တိဘက်ရှိ ဇာယူ ကောင်တီ (Zayu County) တွင်ရှိသော ဘိုရှလာတောင် (Boshula Mountains) ခြေ အနောက်တောင်ဘက်မှ မြစ်ဖျားခံလာပါသည်။ တိဘက်တွင် ဂျီတိုင်ကျူ (Jitaiqu) ဟု အမည်ရပြီး ယူနန်တွင် ဒူလောင်မြစ် (Dulong) ဟု ခေါ်ဆိုပါသည်။ ယူနန်စီရင်စု ဂေါင်ရှန် ကောင်တီ (Gongshan County)၊ မာကု(Maku) မှ မြန်မာနိုင်သို့ စီးဆင်းပြီးနောက် အင်မိုင်ခမြစ်ဟု ခေါ်တွင်ခဲ့ပါသည်။ မြစ်ကြီးနား အထက် ၄၅ ကီလိုမီတာ အကွာရှိ မြစ်ဆုံမြို့၌ရှိသော မလိခမြစ်နှင့် ပေါင်းဆုံပြီးနောက် ဧရာဝတီမြစ်ဟု ခေါ်တွင်ခဲ့ပါသည်။ ဧရာဝတီမြစ်၏ စုစုပေါင်း အရှည်မှာ ၂၇၁၄ ကီလိုမီတာ ရှိပါသည်။ ရေဝင်ရေလဲ ဇရိယာမှာ ခန့်မှန်းခြေ စတုန်းရန်းကီလိုမီတာ ၄၁၀,၀၀၀ ရှိပြီး မြန်မာနိုင်ငံတွင်ရှိသော စုစုပေါင်း ရေအရင်းမြစ်၏ ၆၀ ရာခိုင်နှုန်းခန့် ရှိပါသည်။

စုစုပေါင်းအရှည် ၃၅၃ ကီလိုမီတာ ရှိသော အင်မိုင်ခမြစ်သည် ဧရာဝတီမြစ်၏ အဓိကအရင်းအမြစ်ဖြစ်ပြီး ရေဝင်ရေလွဲ ဇရိယာမှာ ၂၄,၂၀၀ စတုရန်းကီလိုမီတာ (တရုတ်နိုင်ငံရှိ ၄,၂၀၀ စတုရန်းကီလိုမီတာ အပါအဝင်) ရှိသည့်အပြင် သဘာဝရေစီးဆင်းသည့် အမြင့်မှာ ၁,၀၁၀ မီတာရှိသည်။ မြန်မာနိုင်ငံမြောက်ပိုင်း တွင်ရှိသော ဟိမဝန္တာတောင်ခြေရှိ တောင်ဘက်မှ မြစ်ဖျားခံလာသော မလိခံမြစ်တွင် ဘယ်၊ ညာ၊ အလယ် ဟူ၍ အရင်းအမြစ်သုံးခုရှိပြီး မြစ်၏ စုစုပေါင်းအရှည်မှာ ၃၇၅ ကီလိုမီတာ ရှိပါသည်။ ရေဝင်ရေလွဲ ဇရိယာမှာ ၂၃,၀၀၀ စတုရန်းကီလိုမီတာ ရှိပြီး သဘာဝရေစီးဆင်းသည့် အမြင့်မှာ ၄,၄၇၀ မီတာရှိသည်။ ဧရာဝတီမြစ်အထက်ပိုင်း၏ ရေဝင်ရေလဲ ဇရိယာမှာ ခန့်မှန်းခြေ စတုန်းရန်းကီလိုမီတာ ၄၇,၃၀၀ (တရုတ်နိုင်ငံရှိ ၄,၂၀၀ စတုရန်းကီလိုမီတာအပါအဝင်) ရှိပါသည်။

ချီဗွေငယ်မြစ်သည် အင်မိုင်ခမြစ်၏ ညာဘက်အခြမ်းတွင်ရှိသော ပင်မမြစ်လက်တက်တစ်ခုဖြစ်ပြီး အရှေ့လောင်ဂျီကျူ. ၉၈ ဒီဂရီ ၈ မိနစ် - ၉၈ ဒီဂရီ ၂၈ မိနစ်နှင့် မြောက်လတ္တီကျူ. ၂၅ ဒီဂရီ ၃၀ မိနစ် - ၂၅ ဒီဂရီ ၅၂ မိနစ် တွင် တည်ရှိပါသည်။ တရုတ်မြန်မာ နယ်စပ်ဒေသရှိ ကောင်းလီဂေါင်းတောင် (Gaoligong Mountain) မှ မြစ်ဖျားခံလာပြီး အရှေ့တောင်မှ အနောက်မြောက်သို့ စီဆင်းလာပြီးနောက် ချီဗွေမြို့ အနီးရှိ အမ်မိုင်ခမြစ် အတွင်းသို့ စီးဝင်ပါသည်။ ချီဗွေမြစ်၏ ရေဝင်ရေလွဲ ဇရိယာမှာ ၇၄၃.၆ စတုရန်းကီလိုမီတာ၊ အရှည် ၅၈ ကီလိုမီတာ၊ စီးဆင်းသည့် အမြင့် ၃၀၀၀မီတာ၊ ပြောင်းလဲနှုန်း ၅၂ ရာခိုင်နှုန်းနှင့် နှစ်စဉ် ပျမ်းမျှ စီးဆင်းနှုန်း တစ်စက္ကန့်လျှင် ၅၄ ကုဗမီတာခန့် ရှိပါသည်။

၁.၃.၂ မြစ်ဝှမ်းဒသတွင်း ရေအားလျှပ်စစ် စီမံကိန်းရေးဆွဲခြင်း

မြန်မာနိုင်ငံရှိ ဧရာဝတီမြစ်၏ မေခမြစ်၊ မလိခမြစ်နှင့် ချီဗွေငယ်မြစ်များတွင် ရှိသော ရေအားလျှပ်စစ် စီမံကိန်းများ အတွက် MOEP1 နှင့် CPI သည် ၂၀၀၆ ခုနှစ် ဒီဇင်ဘာလတွင် နားလည်မှု စာချွန်လွှာ ရေးထိုးခဲ့ပါသည်။ CPI မှ ခန့်အပ်ထားသည့် CDC သည် မြန်မာနိုင်ငံရှိ ဧရာဝတီမြစ်၏ မေခမြစ်၊ မလိခမြစ်နှင့် ချီဗွေငယ်မြစ်ရှိ ရေအားလျှပ်စစ် ဖွံ့ဖြိုးတိုးတက်မှု စီမံကိန်းရေးဆွဲခြင်း အစီရင်ခံစာကို ၂၀၀၇ ခုနှစ် ဒီဇင်ဘာလတွင် ဆောင်ရွက်ပြီးစီးခဲ့ပြီး ဧရာဝတီမြစ် အထက်ပိုင်းရှိ ရေအားလျှပ်စစ် စီမံကိန်းဖြစ်သည့်

ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံ (မာတ်အားပေးစက်ရုံ တည်ဆောက်မှု)၏ ဖြစ်နိုင်ခြေ လေ့လာဆန်းစစ်မှု အစီရင်ခံစာ (Feasibility Study Report of Chipwi Nge Hydropower Station) ကို ၂၀၁၉ ခုနှစ် အောက်တိုဘာလတွင် ဆောင်ရွက် ပြီးစီးခဲ့ပါသည်။

မြစ်ကြီးနား အထက်ပိုင်းရှိ ဇရာဝတီမြစ်ဝှမ်း၏ လက္ခဏာရပ်များ နှင့်အတူ မြစ်ကြောင်း ဖွံ့ဖြိုးရေးပေါ်တွင် မြန်မာနိုင်ငံ၏ အမျိုးသား စီးပွားရေး ဖွံ့ဖြိုးတိုးတက်မှု လိုအပ်ချက်များအရ လျှပ်စစ်မာတ်အား ထုတ်လုပ်ရန် ရည်မှန်း၍ မြစ်အထက်ပိုင်းရှိ ရေအားလျှပ်စစ် တိုးတက်ဖွံ့ဖြိုးရေးကို ဆောင်ရွက်ခဲ့ပါသည်။ ထို့နည်းတူ ရေကြီးရေလျှံမှု ထိန်းချုပ်ရေးနှင့် မြစ်အောက်ပိုင်းရှိ ရေကြောင်းသွားလာရေးနှင့် ရေသွယ်ယူရရှိရေး အခြေအနေများ တိုးတက်စေရေး စသည်တို့ကိုလည်း လုပ်ဆောင်ခဲ့ပါသည်။ စုပေါင်းထုတ်ယူ သုံးစွဲနိုင်အား၊ နည်းပညာအခြေအနေ၊ စီးပွားရေးဆိုင်ရာ ညွှန်းကိန်းများ စသည်တို့နှင့် ဆက်စပ်သော သုံးသပ်ချက်များနှင့် နှိုင်းယှဉ်ချက်များကို အခြေခံ၍ မြစ်ကြီးနား အထက်တွင်ရှိသော ဇရာဝတီ မြစ်ဝှမ်းဒေသရှိ ရေစီးဆင်းမှု ဖွံ့ဖြိုးတိုးတက်ရေးအတွက် အကြံပြု ထောက်ခံထားသည့် စီမံချက်ကို အောက်ပါအတိုင်း အဆိုပြုထားပါသည်။

အင်မိုင်ခမြစ်နှင့် ဇရာဝတီမြစ် - ရေနံ (Yenan) ၁၀၁၀ မီတာ - ကောင်းလန်ပေါ (Kaunglanhpur) ၈၇၅ မီတာ - ပီဆာ (Pisa) ၆၆၅ မီတာ - ဝက်စွတ် (Wutsok) ၅၂၅ မီတာ - ချီဗွေ (Chipwi) ၄၀၀ မီတာ - မြစ်စုံ (Myitsone) ၂၄၅ မီတာ။

မလိခမြစ် - လိုင်ဇာ (Laza) ၃၇၀ မီတာ

ဇရာဝတီမြစ်ဝှမ်းဒေသ၏ ရေအားလျှပ်စစ်စီမံကိန်းရေးဆွဲခြင်းနှင့် ချီဗွေငယ်ရေအားလျှပ်စစ် မာတ်အားပေးစက်ရုံ၏ ကနဦး လုပ်ငန်းအခြေအနေများအရ မြစ်ကြီးနား အထက်တွင်ရှိသော ဇရာဝတီ မြစ်ဝှမ်းဒေသရှိ ရေစီးဆင်းမှု ဖွံ့ဖြိုးတိုးတက်ရေးအတွက် အကြံပြုထောက်ခံထားသည့် စီမံချက်၏ စုစုပေါင်း ဆောင်ရွက်မည့်ပမာဏမှာ ၂၁,၆၀၀ မဂ္ဂါဝပ်ဖြစ်ပြီး နှစ်စဉ် လျှပ်စစ်မာတ်အား ထုတ်လုပ်မှုမှာ တစ်နာရီလျှင် ၁၁၁.၀၉ ဘီလီယမ် ကီလိုဝပ် ဟု သတ်မှတ်ထားပါသည်။

သဘောတူညီမှုစာချွန်လွှာ၏ ထည်သွင်းစဉ်းစားချက်များအရ ဇရာဝတီမြစ်အထက်ပိုင်းရှိ ရေအားလျှပ်စစ် စီမံကိန်း ဖွံ့ဖြိုးတိုးတက်ရေးကို ၁၅ နှစ်အတွင်း ပြီးစီးအောင် အကောင်အထည်ဖော်ဆောင်သွားမည် ဖြစ်သည်။ ဖွံ့ဖြိုးတိုးတက်ရေး အခြေအနေများနှင့် ကနဦး လုပ်ငန်းအခြေအနေများအရ မြစ်ဆုံနှင့် ချီဗွေငယ် မာတ်အားပေးစက်ရုံများသည် မကြာမီကာလအတွင်း တိုးတက်ပြောင်းလာလိမ့်မည်။ မာတ်အားပေးစက်ရုံ (Yenan Station) သည် တတိယအသုတ်တွင် ရှိနေစဉ် (Wutsok)၊ (Pisa)၊ (Kaunglanhpur) နှင့် (Laza) မာတ်အားပေးစက်ရုံများသည် ဖွံ့ဖြိုးတိုးတက်ရမည့် စီမံကိန်း ဒုတိယအသုတ်တွင် ပါဝင်ပါသည်။

၁.၃.၃ ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံ ဆောက်လုပ်ရေးဆိုင်ရာ လိုအပ်ချက်

စီမံကိန်းဇရိယာသည် နိုင်ငံတော် မဟာမာတ်အားလိုင်း၏ နယ်ပယ်အတိုင်းတာကို ကျော်လွန်၍ တည်ရှိနေသောကြောင့် လျှပ်စစ်မာတ်အား ပြတ်တောက်မှု အခက်အခဲနှင့် ကြုံတွေ့ရပါသည်။ ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံ တည်ဆောက်ခြင်းသည် မြစ်ဆုံနှင့် ချီဗွေမာတ်အားပေးစက်ရုံများ တည်ဆောက်ခြင်း အတွက် စွမ်းအင်လိုအပ်ချက်ကို ဖြည့်ဆည်းပေးနိုင်ပြီး မြစ်ဝှမ်းဒေသအတွင်း ရေအားလျှပ်စစ် ဖွံ့ဖြိုးတိုးတက်မှုကို လွယ်ချောမွေ့စွာ အကောင်ထည်ဖော် ဆောင်ရွက်ရန်အတွက် အာမခံချက်

ရှိလာမည်ဖြစ်ပါသည်။ ဖြည့်စွက်ပြောဆိုရလျှင် စီမံကိန်း ဇရိယာမှာ သဘာဝ အရင်းမြစ်များ ကြွယ်ဝသော်လည်း ဖွံ့ဖြိုးတိုးတက်မှုနှင့် အသုံးချမှုမှာ နည်းပါးပါသည်။ ထို့ကြောင့် ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံတွင် ဒေသအရင်းမြစ်များ ဖွံ့ဖြိုးတိုးတက်ခြင်း၊ ဒေသတွင်း စီးပွားရေး တိုးတက်မှုနှင့် ဒေသခံနေထိုင်သူများ၏ လူနေမှုအရည်အသွေး ကောင်းမွန်လာခြင်း စသည်တို့တွင် အဓိက အခန်းကဏ္ဍမှ ပါဝင်နေပါသည်။ တစ်ချိန်တည်းမှာပင် ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံ တည်ဆောက်မှုမှာ မြန်မာနိုင်ငံရှိ မြစ်ကြီးနား အပေါ်ဘက် ဇရာဝတီ မြစ်ဝှမ်းရှိ ရေအားလျှပ်စစ် ဖွံ့ဖြိုးတိုးတက်မှု စီမံကိန်းများ တရားဝင် စတင်ဆောင်ရွက်သည့် အဓိပ္ပာယ်လည်း ဖြစ်ပါသည်။ ယင်းမှာ တရုတ်နိုင်ငံနှင့် မြန်မာနိုင်ငံ၏ နှစ်ဦးနှစ်ဘက် အကျိုးရှိမည့် မဟာဗျူဟာမြောက် စီမံကိန်း တစ်ခုဖြစ်ပြီး အပြန်အလှန် အကျိုးခံစားခွင့်နှင့်တူ ပူးတွဲဖွံ့ဖြိုးမှုအတွက် လိုအပ်ချက်လည်းဖြစ်ပါသည်။ နှစ်နိုင်ငံကြား ရေရှည် ဗျူဟာမြောက် ပူပေါင်းဆောင်ရွက်မှု တိုးမြှင့်စေခြင်း အတွက် သီးခြား ဆောင်ရွက်ချက်လည်း ဖြစ်ပါသည်။

မြစ်ဆုံ ရေအားလျှပ်စစ်စက်ရုံ ဆိုင်းငံ့မှုနှင့် ချီဗွေ ရေအားလျှပ်စစ်စက်ရုံ နောင့်နေးမှုကြောင့် ချီဗွေငယ် ရေအားလျှပ်စစ် စက်ရုံသာ ကျန်ရှိခဲ့ပါသည်။ တစ်ချိန်တည်းမှာပင် ကချင်ပြည်နယ်အတွင်း လျှပ်စစ်ဓာတ် အား ထောက်ပံ့မှု မလုံလောက်ခြင်းနှင့် လူနေမှုအဆင့်အတန်းနှင့် စီးပွားရေး ဖွံ့ဖြိုးမှု နှစ်ခုလုံး အပေါ်တွင် သက်ရောက်မှု ရှိသည့် အတွက် ကချင်ပြည်နယ်သို့ လျှပ်စစ်ဓာတ်အား ထောက်ပံ့ရန် သက်ဆိုင်ရာ မြန်မာ အစိုးရမှ ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံ တည်ဆောက်ခြင်းကို အရှိန်မြှင့်တင်ရန် လိုအပ်ခဲ့ပါသည်။ ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံမှ ယခုအခါတွင် ဒေသအား စီးပွားဖြစ် အသုံးပြုရန်အတွက် လျှပ်စစ်ဓာတ်အား ထောက်ပံ့ပေးနေခြင်း၊ မြန်မာနိုင်ငံ မြောက်ပိုင်းတွင် လက်ရှိ လျှပ်စစ်ဓာတ်အား ပြတ်လတ်မှုကို လျော့ချပေးနိုင်ခြင်း၊ ဒေသတွင်းနေထိုင်သူများဆီသို့ အကျိုးကျေးဇူးများ ယူဆောင် လာခြင်း၊ ဒေသတွင်း လူမှုစီးပွားရေး ဖွံ့ဖြိုးတိုးတက်မှုကို မြှင့်တင်ပေးခြင်းနှင့် တစ်ဆက်တည်းမှာပင် ချီဗွေငယ် လျှပ်စစ်ဓာတ်အားပေးစက်ရုံကို အသုံးမပြုခြင်းကြောင့် ဆုံးရှုံးမှုကိုလည်း လျော့ကျစေပါသည်။

၁၃.၃.၄ ပထဝီဝင်တည်နေရာအနေအထား

ချီဗွေငယ် ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံ ဆည်သည် ချီဗွေမြို့မှ ၁၅ ကီလိုမီတာခန့်အကွာရှိ လာဘမ်းတံတား (Labang Bridge) မှ မြစ်အထက်ပိုင်း ၁.၅ ကီလိုမီတာမှ ၂.၀ ကီလိုမီတာထိ မြစ်ဝှမ်းတစ်လျောက်အတွင်းတွင်ရှိသော အင်မိုင်ခမြစ်၏ လက်ယာဘက်အခြမ်းရှိ မြစ်လက်တက် တစ်ခုဖြစ်သည့် ချီဗွေမြစ်၌ တည်ရှိပါသည်။ လျှပ်စစ်ဓာတ်အားရုံသည် အင်မိုင်ခမြစ်၏ လက်ယာဘက် အခြမ်းတွင် ရှိနေပြီး ချီဗွေမြို့၏ မြစ်အထက်ပိုင်းမှ ၉ ကီလိုမီတာ အကွာ၊ မြစ်အောက်ပိုင်းရှိ မြစ်ဆုံရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံမှ ၆၂ ကီလိုမီတာ အကွာ၊ မြစ်အထက်ပိုင်းရှိ ချီဗွေရေအားလျှပ်စစ်ဓာတ်အားပေးမှ ၂၀ ကီလိုမီတာ အကွာခန့်တို့တွင် တည်ရှိပါသည်။

၁.၃.၅ ဖွံ့ဖြိုးမှုလုပ်ငန်းတာဝန်၊ ပမာဏနှင့် လုပ်ငန်းလည်ပတ်မှု နည်းလမ်း

ယခုစီမံကိန်းမှာ လျှပ်စစ်ဓာတ်အား ထုတ်လုပ်ရန် ရည်ရွယ်ကာ အကောင်ထည်ဖော် ဆောင်ရွက်ခဲ့ခြင်း ဖြစ်သည်။ ထို့အပြင် မြစ်ကြီးနား အထက်ဘက် ဇရာဝတီမြစ်ဝှမ်း ရေအားလျှပ်စစ်အရင်းမြစ် ဖွံ့ဖြိုးတိုး တက်မှုအတွက် မကြာသေးမီ ကာလက အကောင်ထည်ဖော် ဆောင်ရွက်ခဲ့သည့် မြစ်ဆုံ လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ နှင့် ချီဗွေ ဓာတ်အားပေးစက်ရုံ ကဲ့သို့ပင် စီမံကိန်းကို အကောင်ထည် ဖော်ဆောင်သွားမည် ဖြစ်ပါသည်။ တစ်ချိန်တည်းမှာပင် ယခု စီမံကိန်းမှာ ဓာတ်အားပေးစက်ရုံ

ဆောက်လုပ်ရေး လိုအပ်ချက်များ ပြည့်မှီရန်နှင့် ကချင်ပြည်နယ်အား စီးပွားဖြစ် အသုံးပြုရန်အတွက် လိုအပ်သည့် လျှပ်စစ်မာတ်အား ထောက်ပံ့ပေးနိုင်မည် ဖြစ်ပါသည်။ မြန်မာနိုင်ငံ မြောက်ပိုင်းတွင် လက်ရှိ လျှပ်စစ်မာတ်အား ပြတ်လတ်မှုကိုလည်း လျော့ချပေးနိုင်ပြီး ဒေသတွင်းနေထိုင်သူများဆီသို့ အကျိုးကျေးဇူးများ ယူဆောင်လာခြင်းနှင့် ဒေသတွင်း လူမှုစီးပွားရေး ဖွံ့ဖြိုးတိုးတက်မှုကို မြှင့်တင်ပေး နိုင်မည် ဖြစ်ပါသည်။ ချီဗွေငယ် ရေအားလျှပ်စစ်စီမံကိန်းသည် နေ့စဉ် ပုံမှန်လည်ပတ်ဆောင်ရွက် ရမည့် အမျိုးအစား တွင် ပါဝင်ပါသည်။

ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံမှာ ပုံမှန် ရေအမှတ် ၇၄၀ မီတာ၊ စိုးရိမ်ရေ အမှတ် ၇၄၅.၉၉ မီတာ၊ ရေလှောင်တမံ ဆန့်ဝင်နိုင်မှု ၇၈၉၀၀၀ ကုဗမီတာနှင့် ၁၂၃၄၀၀၀ ကုဗမီတာ အသီးသီးရှိပြီး တပ်ဆင်မှု ပမာဏ ၉၉ မဂ္ဂါဝပ်နှင့် နှစ်စဉ် ပျမ်းမျှ လျှပ်စစ်မာတ်အား ထုတ်လုပ်မှုမှာ တစ်နာရီလျှင် ၅၉၉ မီလီယမ် ကီလိုဝပ် ရှိပါသည်။ ချီဗွေငယ် ရေအားလျှပ်စစ် စက်ရုံမှာ နေ့စဉ်ပုံမှန် လည်ပတ်ရသည့် အမျိုးအစားတွင် ပါဝင်ပါသည်။ ရေလွှမ်းမိုးမှု ထိန်းချုပ်သည့် စံသတ်မှတ်ချက် (GB50201-94) နှင့် အမျိုးအစားခွဲခြားခြင်းနှင့် ရေအားလျှပ်စစ် စီမံကိန်း၏ ဘေးအန္တရာယ် ကင်းရှင်းမှု ဒီဇိုင်း အတွက် စံသတ်မှတ်ချက် (DL5180-2003) အရ စီမံကိန်းမှာ အဆင့်-၃၊ အလတ်စား စီမံကိန်းဖြစ်ပါသည်။ ဆည်၊ ရေပိုလွှဲနှင့် မာတ်အားထုတ်လုပ်မှု စနစ် စသည့် အဓိက ဖွဲ့စည်းတည်ဆောက်ပုံများမှာ သတ်မှတ်ချက် အဆင့် ၃ ရှိခဲ့ပြီး အရန် တည်ဆောက်ပုံများမှာ အဆင့် ၄ နှင့် ယာယီတည်ဆောက်ပုံများမှာ အဆင့် ၅ ရှိပါသည်။ ဟိုက်ဒရောလစ် ဖွဲ့စည်းတည်ဆောက်ပုံများ၏ ဖွဲ့စည်းတည်ဆောက်ပုံဆိုင်ရာ ဘေးအန္တရာယ် ကင်းရှင်းမှု အဆင့်အတန်းမှာ အဆင့် ၃ ဖြစ်ပါသည်။

1၁.၃.၆ စီမံကိန်း ဖွဲ့စည်းမှုပုံစံနှင့် အဓိကဖွဲ့စည်းတည်ဆောက်ပုံများ

ချီဗွေငယ် ရေအားလျှပ်စစ်မာတ်အားပေး စက်ရုံသည် ရေလွှဲအမျိုးအစားဖြစ်ပြီး အဓိက ဖွဲ့စည်းတည် ဆောက်ပုံများတွင် ဆည်၊ ရေလွှဲ နှင် လျှပ်စစ်မာတ်အား ထုတ်လုပ်ခြင်းစနစ်၊ ရေလွှဲတည်ဆောက်ပုံနှင့် လျှပ်စစ်မာတ်အားစက်ရုံ စသည်တို့ ပါဝင်ပါသည်။

ချီဗွေငယ် ရေအားလျှပ်စစ်မာတ်အားပေး စက်ရုံ၏ အဆိုပြုထားသည့် ဖွဲ့စည်းမှုပုံစံကို အောက်ပါအတိုင်း ဖော်ပြထားပါသည်။ ဆည်နှင့် ရေဝင်နေရာသည် ချီဗွေမြစ်တွင်တည်ရှိသည်။ ကွန်ကရစ်ဆည်၊ ရေအဝင်ထိန်းသည့် ဆည်၊ polygonal scheme အလိုက် ရေလွှဲရာလမ်းကြောင်း၊ ၄ မီတာအချင်းရှိ မြောင်း၊ လျှပ်စစ်မာတ်အားစက်ရုံ နှင့် အင်မိုင်ခမြစ်ညာဘက်အခြမ်းရှိ မြောင်း (tailrace tunnel) လျှပ်စစ်မာတ်အားစက်ရုံ နှင့် မာတ်အားပေးစက်ရုံ၏ ဝင်ရိုးမှာ ရေသယ်ပိုက်ဝင်ရိုးဆီသို့ ၃၀ ဒီဂရီဆောင်းထားပါသည်။

၁.၃.၇ အထွေထွေဖွဲ့စည်းပုံနှင့် လုပ်ငန်းအဆင့်ဆင့်

(၁) အထွေထွေဖွဲ့စည်းပုံ

စီမံကိန်းဇရိယာကို အပိုင်းအခြားအမျိုးမျိုးဖြင့် ဖွဲ့စည်းထားပြီး ဆည်၊ ရေလွှဲမြောင်း နှင့် လျှပ်စစ်မာတ်အားရုံ နယ်မြေများ အစရှိသည်ဖြင့် စီမံကိန်းအကောင်အထည်ဖော် ဆောင်ရွက်မည့်နယ်မြေ ၃ ခု အဖြစ် ပိုင်းခြားထားပါသည်။ အရန်ဆောက်လုပ်ရေး အခြေခံအဆောက်အအုံများတွင် နေထိုင်ရာအဆောက် အအုံများနှင့် ထုတ်လုပ်ရေး အခြေခံအဆောက်အအုံများ ပါဝင်ပါသည်။ နေထိုင်ရာအခြေခံ အဆောက်အအုံများတွင် ယာယီအလုပ်သမားတန်းလျားများ၊ ရုံခန်းများပါဝင်ပြီး ထုတ်လုပ်ရေး

အခြေခံအဆောက်အအုံများတွင် ကွန်ကရစ်ရောစပ်ခြင်း၊ စီမံကိန်းသုံး ပစ္စည်းများကိုင်တွယ် ဆောင်ရွက်သည့် စက်ရုံ၊ ပစ္စည်းသိုလှောင်ရုံနှင် ကုန်ပစ္စည်းများထားရာ ခြံဝန်းများ၊ စက်ယန္တရားများ ရပ်နားရာနေရာ နှင့် ပြုပြင်ထိန်းသိမ်းရမည့် ပစ္စည်းပုံများ စသည်တို့ ပါဝင်သည်။

သဲကျောက်နှင့်ပတ်သက်သည့် လုပ်ငန်းစဉ်နှင့် ကွန်ကရစ်ရောစပ်သည့်စနစ်၊ ဆည်နေရာ၏ ကမ်းပါးနှစ်ဘက်လုံးတွင် တည်ရှိနေသော ဆောက်လုပ်ရေးလုပ်ငန်းနေရာ၊ ရုံးနှင့် လူနေထိုင်သည့်နေရာ စသည်တို့ကို ဆည်၏ကပ်လျက်တွင်ရှိသော မြစ်အောက်ဘက်အပိုင်းတွင် စီစဉ်ထားပါသည်။ စက်ယန္တရားများ ပြုပြင်ထိန်းသိမ်း သည့်နေရာ၊ အမျိုးမျိုးသော လုပ်ငန်းသုံး ပစ္စည်းများထားရာ ခြံဝန်းများ၊ ပစ္စည်းသိုလှောင်ရုံများသည် မြစ်ညာဘက်အခြမ်းအပေါ် ကုန်းပြင်မြင့်၌ နေရာလွတ်များရှိရာ မြစ်အထက်ပိုင်းတွင် တည်ရှိပါသည်။ အပျက်အစီးများသိုလှောင်ရာနေရာသည် ဆည်၏ မြစ်အောက်ပိုင်း တစ်ဘက်တစ်ချက်တွင် တည်ရှိပါသည်။

ယာယီအလုပ်သမားတန်းလျားများနှင့် ရုံးများသည် ကုန်းမြေအမြင့် ၂၆၇ မီတာတွင်ရှိ စီမံကိန်းသုံး လမ်းအနီးတွင် ရှိပါသည်။ အခြားဆောက်လုပ်ရေး အခြေခံအဆောက်အဦးများကို ကုန်းမြေအမြင့် ၂၃၅ မီတာရှိ စီမံကိန်းနေရာ၏ အောက်ပိုင်းတွင် ပြင်ဆင်ထားပါသည်။ ယင်းကုန်းမြင့်သည် အစပိုင်းတွင် မြေညှိရန်အတွက် စီမံကိန်းနေရာ၏ စွန့်ပစ်မြေစာများ ပစ်ထားပြီး နောက်ပိုင်းတွင် မြစ်ဘေးတစ်လျှောက် စွန့်ပစ်မြေစာများဖို့ထားသည့် နေရာဖြစ်သည်။

စီမံကိန်းဆောက်လုပ်ရေးဝင်ပေါက်ကို ဦးတည်ထားသော ယာယီလမ်းဖောက်လုပ်ခြင်းမှာ ၂၈.၀၈ ကီလိုမီတာရှည်လား၍ ၄ မီတာအကျယ်အဝန်းရှိပါသည်။ စီမံကိန်းဆောက်လုပ်ရေးဝင်ပေါက် $2^{\#}$ နှင့် $3^{\#}$ တွင် စီမံကိန်းနေရာအတွက် မြေညှိထားပြီးဖြစ်သည်။ တစ်ဆက်တည်းမှာပင် စီမံကိန်းဆောက် လုပ်ရေးဝင်ပေါက် နှင့် ပင်မမြောင်း ဖောက်လုပ်ခြင်းမှ ထွက်ရှိလာသော စွန့်ပစ်မြေစာများကို အနီးအနားတွင် ဖို့ထားပါသည်။ $1^{\#}$ ရှိ စီမံကိန်းဆောက်လုပ်ရေးဝင်ပေါက်မှ စွန့်ပစ်မြေစာများ နှင့် နှင့် ပင်မ မြောင်းမှ စွန့်ပစ်မြေစာများကို ဆည်၏ စွန့်ပစ္စည်းများထားရာ ဝန်းအတွင်းသို့ သယ်ယူပါသည်။ $4^{\#}$၊ $5^{\#}$ နှင့် $6^{\#}$ ရှိ စီမံကိန်းဆောက်လုပ်ရေးဝင်ပေါက်များမှ ထွက်ရှိလာသော စွန့်ပစ်မြေစာများနှင့် ပင်မ မြောင်းမှ စွန့်ပစ်မြေစာတစ်ချို့ကို စက်ရုံဇရိယာ၏ စွန့်ပစ္စည်းများထားရာ ဝန်းအတွင်းသို့ သယ်ယူပါသည်။

(၂) ရေလွှဲ တည်ဆောက်ခြင်း

ချီဗွေငယ် ရေအားလျှပ်စစ် ဓါတ်အားပေးစက်ရုံရှိ ပင်မရေထိန်းဆည်သည် မြစ်အောက်ပိုင်းရှိ ပျက်စီးနေသော ကျောက်ဖြည့်တမံမှ ၁၁၀ မီတာ ဝန်းကျင်တွင် တည်ရှိပါသည်။ ၄င်းနေရာ၌ မိုးရာသီတွင် ရေထုတ်လွှတ်မှုများပြီး နွေရာသီတွင် နည်းပါသည်။ ၇၀၅ မီတာ မှ ၇၁၃ မီတာထိ ရေလွှမ်းမိုးသောလွင်ပြင်သည် ဆည်၏ လက်ရာဘက်ခြမ်း တွင်တည်ရှိပါသည်။ မိုးနည်းသောရာသီတွင် မြစ်ကြောင်းသည် မြစ်၏လက်ယာဘက်ခြမ်းမှ သွယ်တန်းစီးဆင်း ပါသည်။ ဆည်ပမာဏနှင့် အလုပ်လုပ်မည့်ပမာဏအပေါ် လေ့လာဆန်းစစ်မှုများအရ ကွန်ကရစ် ရေလွှဲဆည် တည်ဆောက်ခြင်းသည် ရေအနည်းငယ် ရှိသောအချိန်တွင်း ပြီးစီးနိုင်ပါသည်။ ထို့ကြောင့် ရေလွှဲအတွက် မြောင်း သို့မဟုတ် ရေထွက်ပေါက် များအသုံးပြု၍ မြစ်ကြောင်းပိတ်ခြင်းအားကောင်းမွန်စွာ ဆောင်ရွက်နိုင်ပါသည်။

ချီဗွေငယ် ရေအားလျှပ်စစ် ဓါတ်အားပေးစက်ရုံရှိ ရေထိန်းဆည်အား permanent hydraulic structure အဆင့် ၃ ဟု ပိုင်းခြားသတ်မှတ်နိုင်ပါသည်။ ရေအရင်းအမြစ် နှင့် ရေအားလျှပ်စစ် စီမံကိန်း အကောင်အထည်ဖော်တည်ဆောက်ခြင်းဆိုင်ရာ သတ်မှတ်ချက်များ (*Specifications for Construction Planning of Water Resources and Hydropower Projects* (SDJ338-89)) အရ permanent structures

ကို ကာကွယ်ပေးသည့် ရေလွှဲတည်ဆောက်ခြင်းကို အဆင့် ၅ အဖြစ် ခွဲခြား သတ်မှတ်နိုင်ပါသည်။ ရေထိန်းဆည်အတွက် မြစ်အောက်ပိုင်းနှင့် အထက်ပိုင်းရှိ မြေသားတမံနှင့် ရေလွှဲမြောင်းအား တည်ဆောက်ပုံ အဆင့် ၅ ဟု သက်မှတ်ထားပါသည်။

ဤစီမံချက်တွင် အမြဲတမ်းရေပိုလွှဲနှင့် အနည်အနှစ်ထိန်းချုပ်ရေးများအား ရေလွှဲအောက်ခြေ ရေထွက်ပေါက်တွင် အသုံးပြုထားပြီး ဆည်၏ overflow ဖြစ်နိုင်သောနေရာ၏ လက်ဝဲဘက်ခြမ်းရှိ overflow မဖြစ်နိုင်သောနေရာတွင် တည်ရှိပါသည်။ ရေလွှဲအောက်ခြေ ရေထွက်ပေါက်၏ အပေါ်ပိုင်းအတွက် တောင်အောက်ခြေကိုတူး၍ ရေတွန်းမြောင်းတစ်ခု တည်ဆောက်ပြီး ရေလွှဲလုပ်ငန်းအား အဆင်ပြေစေရန်ထားရှိပါမည်။ အောက်ပိုင်းအတွက်မူ အမြဲတမ်းရေပိုလွှဲနှင့် အနည်အနှစ်ထိန်းချုပ်ရေး လိုင်းများ၏ စွန့်ထုတ်ပေါက်ကို ရေထုတ်ရန်အတွက် အသုံးပြုသွားမည်။

(၃) တည်ဆောက်ရေးလုပ်ငန်း အဆင့်ဆင့်

စီမံကိန်းလုပ်ငန်းတစ်ခုလုံးအတွက် ၃၂ လ ကြာမြင့်မည်ဖြစ်ပြီး တည်ဆောက်ရေးလုပ်ငန်းအတွက် ပြင်ဆင်ချိန် ၃ လ နှင့် အဓိက တည်ဆောက်ရေးလုပ်ငန်းများအတွက် ၂၆ လ ကြာမြင့်မည်ဖြစ်ပါသည်။ ကျန်ရှိနေသော ဒုတိယနှင့် တတိယအပိုင်းများကို တစ်ဆက်တည်း ၄ လ ဆက်တိုက် ဆောင်ရွက်သွားပါမည်။

(၄) အရင်းအမြစ်များ

မြေများ၊ ကျောက်များ၊ သဲများ၊ ကျောက်စရစ်များ နှင့် သစ်ကို အနီးအနားမှ အသုံးပြုသွားမည်ဖြစ်ပြီး အခြားလိုအပ်သော ပစ္စည်းများကို ကီလိုမီတာ ၁၀၀ ဝေးသော တရုတ်ပြည် ယူနမ် (Yunnan China) မှ မှာယူအသုံးပြုသွားမည်ဖြစ်သည်။

ဆောက်လုပ်ရေးလုပ်ငန်းအတွက် လေရရှိနိုင်ရန် အခြားလေရယူသည်စနစ်ကို အသုံးမပြုပဲ ရွှေ့လျားတပ်ဆင်နိုင်သော လေဖိအားပေးစက်အမျိုးအစားများကို အသုံးပြုသွားပါမည်။ ဆောက်လုပ်ရေးအတွက်လိုအပ်သောရေကို submersible pumps ဖြင့်မြစ်အတွင်းမှ တိုက်ရိုက် ယူဆောင်အသုံးပြုသွားပါမည်။ သုံးရေကို ဒေသအတွင်း အသုံးပြုနေသောရေကို သုံးစွဲသွားမည်ဖြစ်ပြီး အနီးအနားမှ ယူဆောင်အသုံးပြုခြင်း သို့မဟုတ် ဘောစ်အသေးများတည်ဆောက် အသုံးပြုသွားမည်။ တည်ဆောက်ရေးလုပ်ငန်းနှင့် နေထိုင်ရေးတို့အတွက်လိုအပ်သော လျှပ်စစ်မီးကို ဆောက်လုပ်ရေးဝန်းရှိ ကိုယ်ပိုင်မီးဖြင့် အသုံးပြုပါမည်။

တည်ဆောက်ရေးလုပ်ငန်း အတွက်စက်ယန္တရားအရေအတွက်မှာ အစုံ ၂၉၀ ဖြစ်ပါသည်။ အဓိက ဆောက်လုပ်ရေးလုပ်ငန်းများချိန်တွင် အသုံးပြုသော အလုပ်သမား စုစုပေါင်းမှာ ၈၃၀ ယောက်ဖြစ်ပါသည်။

၁.၃.၈ ရေလွှမ်းခြင်း၊ မြေယာလိုအပ်ချက်နှင့် ပြည်လည်နေရာချထားခြင်း

ရေလှောင်တမံရှိ ရေသိုလှောင်နိုင်သော ဇရိယာမှာ ၉.၇ hm^2 ဖြစ်ပြီး ရေလွှမ်းဇရိယာမှာ ၈.၁ hm^2 ဖြစ်ပါသည်။ ဆည်တည် ဆောက်ခြင်းလုပ်ငန်းအတွက် လိုအပ်သော ၄.၈ hm^2 နှင့် ခါတ်အားပေးစက်ရုံအတွက်လိုအပ်သော ၂.၈ hm^2 အပါအဝင် မြေနေရာလိုအပ်ချုပ်မှာ ၇.၆ hm^2 ဖြစ်ပါသည်။ ယာယီမြေနေရာလိုအပ်ချက်စုစုပေါင်းမှာ ၅၆.၃၉ hm^2 ဖြစ်ပါသည်။

အဆိုပါနေရာများတွင် ဥယျာဉ်ခြံနှင့် သစ်တောမြေ အနည်းငယ်မှအပ အိုးအိမ်များမရှိသောကြောင့် ပြည်လည်နေရာချထားရန်မလိုအပ်၍ ဒေသခံပြည်သူများအပေါ် စီမံကိန်းကြောင့်ထိခိုက်မှု အနည်းငယ်သာ ရှိနိုင်ပါသည်။

၁.၃.၉ ရင်းနှီးမြှုပ်နှံမှုပမာဏ

စီမံကိန်းတစ်ခုလုံးအတွက် ကုန်ကျစရိတ်စုစုပေါင်းတွက်ချက်ထားမှုမှာ ယွမ် ၁.၁၁၉ ဘီလီယံ ဖြစ်ပါသည်။

၁.၄ ပတ်ဝန်းကျင် အခြေအနေ

၁.၄.၁ ယေဘုယျ ပတ်ဝန်းကျင် အခြေအနေ စစ်တမ်းကောက်ယူခြင်း

မြစ်ကြီးနား အထက်ပိုင်း ဇရာဝတီမြစ်ဝှမ်းရှိ ရေအားလျှပ်စစ်ဖွံ့ဖြိုးတိုးတက်ရေးအပေါ် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း လုပ်ငန်းလမ်းညွှန်နှင့် မြန်မာအစိုးရ၏ လုပ်ငန်းလိုအပ်ချက်လမ်းညွှန်များအရ CPIYN, CDC နှင့် BANCA အဖွဲ့အစည်းများ၏ လက်အောက်တွင်ရှိပြီး SCBG၊ SCIEA၊ IHE နှင့် BANCA ဖြင့်ဖွဲ့စည်းထားသော ပူးတွဲလေ့လာရေးအသင်းအား မြစ်ဝှမ်းဝန်းကျင်ရှိ ဂေဟဗေဒ စနစ်များအား လေ့လာဆန်းစစ်ရန် တည်ထောင်ထားပါသည်။ ထို့ပြင် ရည်ရွယ်ထားသော ရေအားလျှပ်စစ်ဓာတ်အားပေးရုံ ဂုခု အနီးဝန်းကျင်ရှိ အပင်များ၊ ကုန်းနေ နှင့် ရေနေ သတ္တဝါများ၊ ပတ်ဝန်းကျင် အရည်အသွေးနှင့် လူမှုစီးပွားရေး အခြေအနေ စသည်တို့၏ အခြေခံအချက်အလက်ကောက်ယူခြင်းများကို ထိထိ ရောက်ရောက်ဆောင်ရွက်ပါသည်။ သက်ရောက်ခံရသည့် လူများ၏ သဘောထားအမြင်များ၊ ပတ်ဝန်းကျင်ဆိုင်ရာ စိုးရိမ်ပူပန်မှုဆိုင်ရာ အချက်အလက်များကို မေးခွန်းပုံစံများနှင့်လည်းကောင်း၊ လူတွေ့မေးခွန်းများ မေးခြင်းဖြင့်လည်းကောင်း ကောက်ယူဆောင်ရွက်မည်။ ထိုသို့ပူးပေါင်းလေ့လာ ခြင်းများကို ၂၀၁၉ ခုနှစ် ဇန်နဝါရီလမှ စတင်ပြီး မေလအထိ ၅လ တိုင်အောင်ဆောင်ရွက်ထားပါသည်။ ကျန်ရှိနေသော လုပ်ငန်းများကို BANCA နှင့်ဆက်လက်ဆောင်ရွက်၍ ဇူလိုင်လတွင် ပြီးဆုံးခဲ့ပါသည်။ ထိုသို့လေ့လာ ဆောင်ရွက်ခြင်းတွင် လူပေါင်း ၂၆၀ ပါဝင်ပြီး လူပေါင်း ၁၀၀ ကျော်မှာ မြန်မာနှင့် တရုတ်နိုင်ငံတို့မှ ကျွမ်းကျင်ပညာရှင်များဖြစ်ပါသည်။

၁.၄.၂ သဘာဝ ဝန်းကျင်

(၁) မြေမျက်နှာသွင်ပြင်နှင့် ပထဝီဝင်အနေအထား

ရေသိုလှောင်ဇရိယာသည် မနိမ့်မမြင့်မြေအနေအထားတွင် တည်ရှိပြီး မြစ်ကြောင်း၏ ဝဲယာတစ်ဘက်တစ်ခက်တွင် မတ်ဆောက်သော တောင်တန်းများ သွယ်တန်းတည်ရှိသည့်အပြင် မြေမျက်နှာပြင် ပထမဆင့်၊ ဒုတိယဆင့် အဆင့်ဆင့် ကာရံတည်ရှိနေပါသည်။ ရေသိုလှောင်ရေးထိပ်ပိုင်း၏ လက်ယာဘက်ခြမ်းတွင် အရှည် ၁၀၀၀ မီတာရှိသော လျှိုမြောင်တစ်ခုတည်ရှိပါသည်။ မြစ်ဝှမ်းသည် ၅မီတာမှ ၃၀ မီတာထိကျယ်ပြီး ၅မီတာမှ ၂၀မီတာထိနက်၍ ၁.၅ m^3/s နှုန်းဖြင့် စီးဆင်းပါသည်။ လျှိုမြောင်အောက်ခြေတွင် ပြေပြစ်သော လျှောစောက်များနှင့် နံးအနည်အနစ် ပို့ချမှုများကြောင့်ဖြစ်နေသော platform များတွေ့ရပါသည်။

ဆည်တစ်ဖက်တစ်ချက်တွင် ကျယ်ပြန့်ထူထပ်သော တောင်များတည်ရှိပါသည်။ ကောင်းစွာထိန်းသိမ်းထားသော တောတောင်များလည်းတည်ရှိပါသည်။ ပထမဆင့်၊ ဒုတိယဆင့် အဆင့်ဆင့် အကာအရံများသည် လက်ယာဘက်အခြမ်းတွင်ရှိသော အမြင့်ပိုင်းရှိဆည် axis မှ မြစ်အထက်ပိုင်းနေရာတွင် တည်ဆောက်ထားသည်။ မြစ်အောက်ပိုင်းသို့ နိမ့်ဆင်းသွားရာမှ တစ်ဆင့် မြစ်အောက်ပိုင်းသို့ ကွေ့ဆင်းသွားပြီးနောက် မြစ်အောင်ဘက်ခြမ်းတိုင်အောင် အခြေခံအားဖြင့် အဆင့်ဆင့်ဖြစ်တည်နေပါသည်။ မူလအကာအရံအဆင့်သည် ချီဗွေမြစ်တစ်လျှောက် လက်ဝဲဘက်အခြမ်းရှိ အောက်ပိုင်းရှိဆည် axis မှ မြစ်အောက်ပိုင်းနေရာတွင် တည်ဆောက်ထားသည်။ မြစ်အောက်ပိုင်းသို့ နိမ့်ဆင်းသွားရာမှ တစ်ဆင့် မြစ်အောက်ပိုင်းသို့ ကွေ့ဆင်းသွားသည်။ ဆည်၏ တစ်ဖက်တစ်ချက်စီတွင် ပုံစံမျိုးစုံရှိသော လျှိုမြောင်များရှိပြီး နှစ်ရှည်လများ ရေစီးဆင်းမှုရှိနေခဲ့သည်ကိုတွေ့ရပါသည်။

ဓါတ်အားပေးစက်ရုံတည်ရှိရာနေရာသည် ကချင်တောင်၏ တောင်ဘက်ဖျားဘက်ရှိ မနိမ့်မမြင့်မြေအနေအထားတွင် တည်ရှိပြီး မလိခမြစ်ကမ်း၏ လက်ဝဲဘက်ခြမ်း တွင်ရှိသည့်အပြင် ချီဗွေမြို့အောက်ဖက် ၉ ကီလိုမီတာအကွာတွင် တည်ရှိပါသည်။

(၂) ဇလဘူမိဗေဒ

ချီဖွေငယ် ရေအားလျှပ်စစ်ဓါတ်အားပေးစက်ရုံသည် ကချင်တောင်ဇရိယာတွင်တည်ရှိပြီး တရုတ် - မြန်မာတောင်များ၏ မြောက်ဘက်တွင်တည်ရှိပါသည်။ ဘူမိဗေဒဆိုင်ရာ ကျောက်လွှာရွေ့ရှားမှု (Geotectonic unit) သည် Qinghai – Tibet rejuvenated orogeny တွင်ပါဝင်ပါသည်။ ချီဖွေပြတ်ရွေ့သည် မလိခမြစ်တစ်လျှောက်တည်ရှိပြီး ချီဖွေ - Tengchong ပြတ်ရွေ့သည် ချီဖွေမြစ်တစ်လျှောက် အရှေ့မှ အနောက်သို့ သွယ်တန်းတည်ရှိသည်။ ချီဖွေပြတ်ရွေ့သည် လွန်ခဲ့သော နှစ် ၁,၁၈၀,၀၀၀ ခန့်မှစ၍ လှုပ်ရှားမှုမရှိတော့ပေ။ စီမံကိန်း အနီး ၅ ကီလိုမီတာအတွင်း လှုပ်ရှားမှုရှိသော ပြတ်ရွေ့များမရှိပါ။ မြစ်ဝှမ်းသည် လှုပ်ရှားမှု မရှိသော ကျောက်လွှာများနေရာတွင် တည်ရှိပါသည်။ ငလျင်အားအခြေခံအဆင့် VIIIရှိသော လျောင်ကြောင့် လွန်ခဲ့သော နှစ် ၅၀ အတွင်း ထိုဇရိယာအတွင်း ၁၀% ထက်ကျော်သော အပြင်းဆုံး Seismic Acceleration မှာ ၀.၂၀ g ဖြစ်သည်။

(၃) ရာသီဥတု

စီမံကိန်းတည်နေရာသည် အနောက်တောင် အာရှမုတ်သုန်ဇုန် အတွင်းတွင်ရှိပြီး အနောက်တောင် မတ်သုန်လေ တိုက်ခတ်မှုရရှိပါသည်။ တစ်နှစ်တွင် ရာသီဥတုသုံးမျိုးရှိပါသည်။ မတ်လမှ မေလအထိနွေရာသီဖြစ်ပြီး ဇွန်လမှ အောက်တိုဘာလအထိ မိုးရာသီဖြစ်ကာ နိုဝင်ဘာလမှ ဖေဖော်ဝါရီလအထိ ဆောင်းရာသီ ဖြစ်ပါသည်။ အအေးဆုံးလဖြစ်သည့် ဇန်နဝါရီလ၏ အပူချိန်မှာ ၂၀°C ၂၅ °C ထိဖြစ်စ၍ အပူဆုံးလဖြစ်သော ပေရယ်လ၏ ပျမ်းမျှအပူချိန်မှာ ၂၅°C မှ ၃၀°C ထိဖြစ်ပါသည်။ လားရှိုး မိုးလေဝသဌာနမှ ထုတ်ပြန်ချက်အရ လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ ဆောက်လုပ်ရာ အနီးအနားရှိမြစ်ဝှမ်းဒေသတွင် နှစ်များစွာအတွင်း မိုးကြိုးမုန်တိုင်းတိုက်ခတ်မှုမှာ ၅၂.၁ရက် ဖြစ်ပါသည်။ မြစ်ဆုံ မိုးလေဝသဌာနမှ ၂၀၀၃ - ၂၀၀၄ ထုတ်ပြန်ချက်အရ နှစ်စဉ်ပျမ်းမျှ ရေအပူချိန်မှာ ၂၃.၀°C ဖြစ်ပါသည်။

မြစ်ဝှမ်းဒေသသည် မိုးရေရရှိမှုများပြားသော ဒေသဖြစ်ပြီး မြောက်ဘက်ပိုင်းနှင့် မြစ်ဝကျွန်းပေါ်ဒေသတွင် နှစ်စဉ်မိုးရေချိန် ၂၀၀၀ မီလီမီတာ မှ ၄၀၀၀ မီလီမီတာ ထိရရှိပါသည်။ မြေပြန့်ဒေသနှင့် မြစ်ကြောင်းအလယ်ပိုင်းများတွင် နှစ်စဉ်မိုးရေချိန် ၆၀၀ မီလီမီတာ မှ ၁၀၀၀ မီလီမီတာအထိရရှိပါသည်။ မိုးအများဆုံးကာလမှာ ဇူလိုင်လဖြစ်ပြီး မတ်လနှင့် မေလများတွင်မိုးနည်းပါသည်။ ဥပမာ ဧရာဝတီမြစ်အထက်ပိုင်း ဗန်မော်ဒေသတွင် ဖေဖော်ဝါရီလရောက်လျှင် မြစ်အကျယ်မှာ ၅၀၀ မီတာအောက် သာရှိပြီး ဩဂုတ်လတွင် ၃ ကီလိုမီတာသို့ရောက်ရှိပါသည်။ တစ်နှစ်ပတ်လုံး ရေ level မှာ ၁၀ မီတာရှိပါသည်။

(၄) ဇလဗေဒနှင့် အနည်အနှစ်ပို့ချမှု

ဧရာဝတီမြစ်မှ ရေရှိမှုမှာ မိုးရာသီတွင်ရရှိသော မိုးရေပမာဏ၊ မြေအောက်ရေပမာဏနှင့် နွေရာသီတွင်ရရှိသော ဆီနှင်း အရည်ပျော်မှုတို့အပေါ်မူတည်သည်။ ချီဖွေမြစ်ဝှမ်းဒေသတွင် မုန်တိုင်းတိုက်ခိုက်မှုများမှာ ဇွန်လမှ စက်တင်ဘာလအတွင်း အဓိကဖြစ်သည့်အပြင် ဇွန်လတွင် အများဆုံးဖြစ်ပွား၍ စုစုပေါင်းတွက်ချက်ထားသော နှစ်အတိုင်း၏ ၂၇% ရှိပါသည်။ နှစ် ၅၀၀ ရာအတွင်း ရေကြီးမှုမှာ ၂၅၄၀ m^3/s၊ နှစ် ၁၀၀ ရာအတွင်း ရေကြီးမှုမှာ ၁၉၈၀ m^3/s၊ နှစ် ၂၀ ရာအတွင်း ရေကြီးမှုမှာ ၁၃၂၀ m^3/s တို့ဖြစ်သည်။

ချီဖွေငယ် ရေအားလျှပ်စစ်ဓါတ်အားပေးစက်ရုံ၏ နှစ်စဉ် ပျမ်းမျှရေစီးဆင်းမှုနှုန်းမှာ ၄၀.၁ m^3/s ဖြစ်ပြီး ပမာဏမှာ ၁,၂၆၀,၀၀၀,၀၀၀ ကုဗမီတာဖြစ်၍ နှစ်စဉ်ပျမ်းမျှ စီးဆင်းသောရေအနက်မှာ ၂,၂၈၈ မီလီမီတာဖြစ်ပါသည်။ ချီဖွေငယ် ရေအားလျှပ်စစ်ဓါတ်အားပေးစက်ရုံ၏ ဆည်တည်ရှိရာ အထက်ပိုင်းရှိ ရေထိန်းသိမ်းနိုင်သောဧရိယာမှာ ၅၅၂.၃ စတုရန်း ကီလိုမီတာ ဖြစ်သည်။ နှစ်စဉ် ပျမ်းမျှရေစီးဆင်းမှုနှုန်းမှာ ၄၀.၁ m^3/s ဖြစ်ပြီး ပမာဏမှာ ၁,၂၆၀,၀၀၀,၀၀၀ ကုဗမီတာဖြစ်ပါသည်။ ချီဖွေငယ်

ရေအားလျှပ်စစ်ဓါတ်အားပေးစက်ရုံမှ နှစ်စဉ်ပျမ်းမျှ နှုန်းပို့ချမှုမှာ ၇၂၄,၀၀၀ တန်နှင့် နှစ်စဉ် bed-load နှုန်းပို့ချမှုမှာ ၁၄၅၀၀၀ တန်ဖြစ်ပြီး စုစုပေါင်းနှုန်းပို့ချမှုမှာ နှစ်စဉ် ၈၆၉,၀၀၀ တန်ဖြစ်ပါသည်။

(၅) မြေဆီလွှာ၊ ရေနှင့် မြေဆီလွှာ တိုက်စားခြင်း

ဆောက်လုပ်ရေးဇရိယာအတွင်းရှိ အဓိကမြေအမျိုးအစားများမှာ နီညိုရောင်မြေသား၊ နီဝါရောင်မြေသား၊ ဝါညိုရောင်မြေသား၊ အညိုရောင်မြေသားနှင့် မဲညိုရောင်မြေသားများ အစရှိသည်တို့ဖြစ်ပါသည်။ မြစ်ကြောင်းတစ်လျှောက်တွင် မြေသြဇာကောင်းသော မြေဆီမြေသားများတွေ့ရှိရပါသည်။ ဆောက်လုပ် ရေးလုပ်ငန်းနေရာ၏ အောက်ခြေ လျောစောက်မှာ ၃၅° နှင့်အကျော်ဖြစ်၍ သစ်ပင်နှင့် ပေါင်းပင်များ ဖုံးလွှမ်းမှုမှာ ၆၀% ရှိပါသည်။ မြေဆီလွှာတိုက်စားမှုအဆင့်မှာ အလယ်လတ်တန်းစား အဆင့်တွင်ရှိသည်။

၁.၄.၃ ဂေဟဗေဒ ဝန်းကျင်

၁.၄.၃.၁ မြေပြင်ပေါ်တွင်ပေါက်ရောက်ရာ အပင်များ

ချီဗွေငယ် ရေအားလျှပ်စစ်ဓါတ်အားပေးစက်ရုံ အနီးဝန်းကျင်ရှိအပင်များ တည်ရှိမှုသည် အပူပိုင်း အာရှ (အိန္ဒိယ -မလေးရှား) ဒေသနှင့် ဆက်နွယ်နေပါသည်။ ယင်းသည် ၎င်းဒေသ၏ မြောက်ဘက်ပိုင်းတွင်တာ်ရှိနေသော ဟိမဝန္တာဒေသ၏ အရှေ့ဘက်နှင့် ထိစပ်နေပြီး အရှေ့ဘက်ရှိ တရုတ်ပြည်နယ်၊ Salween မြစ်ချိုင့်ဝှမ်းနှင့် ထိစပ်နေပါသည်။ အပင်မျိုးစိတ်များမှာ အရှေ့ဘက်နှင့် အနောက်ဘက်ကြားတွင် အများအပြားတွေ့ရပြီး မြောက်နှင့်တောင်ကြားတွင် နည်းပါးပါသည်။

လေ့လာဆန်းစစ်မှုများအရ အပင် မျိုးစိတ်ပေါင်း ၅၅၆ မျိုး၊ မျိုးစိတ်တူပေါင်း ၃၅၇ မျိုးနှင့် မျိုးရင်းပေါင်း ၁၂၇မျိုးအား ချီဗွေနယ်အပိုင်း အင်မိုင်ခ မြစ်ကြောင်းတစ်လျှောက်တွေ့ရပါသည်။ ၎င်းမျိုးရင်းများတွင် Pteridophyta မျိုးရင်း ၂၁မျိုး၊ Gymnospermae မျိုးရင်း ၃မျိုးနှင့် Angiosperm မျိုးစိတ်ပေါင်း ၁၀၃ မျိုးတို့ပါဝင်ပါသည်။ အပူပိုင်းဒေသ မျိုးစိတ်များ ကိုအများအပြားတွေ့ရှိရပါသည်။

လေ့လာဆန်းစစ်မှုရလဒ်များအရ စီမံကိန်းနေရာတွင် အပင်ပေါက်ရောက်မှုပုံစံ ၇ မျိုး၊ အခွဲ ၉မျိုးနှင့် မျိုစိတ်အစုအဝေး ၁၃မျိုး တွေ့ရှိရပါသည်။ Bombax ceiba နှင့် Dendrocalamus မျိုးစိတ်ကဲ့သိုသော ဝါးတောများအား အများအပြားတွေ့ရှိရပါသည်။ လူတို့၏ သုံးစွဲမှုများကြောင့် ပျက်စီးလာပြီးနောက်တွင် အပင်အစုအဝေးများမှာ အပူပိုင်းမိုးသစ်တောများမှ ဒုတိယတန်းစား ပေါက်ရောက်မှုပုံစံများသာရှိသည်။ ၎င်းပုံစံများမှာ ကျဲပါးစွာပေါက်ရောက်သော မုတ်သုန်အစုအဝေးနှင့် တူပါသည်။

စီမံကိန်းဇရိယာ အတွင်းပိုင်းတွင်ပေါက်ရောက်သော ပေါက်ရောက်မှုပုံစံများမှာ စိုစွတ်သော မိုးသစ်တောတွင် ပါဝင်ပြီး လူတို့၏သုံစွဲမှုများကြောင့် တောအဆင့်အတန်းနိမ့်သော ကျဲပါးသည့် ဝါးနှင့် ၄က်ပျောတောများသာ ကျန်ရှိတော့သည်။ စိုက်ပျိုးမြေအနည်းငယ်သာတွေ့ရပြီး ဆူးချံုတော့သို့ ပြောင်းလဲနေသော မြေအနည်းငယ်ကိုလည်းတွေ့ရသည်။ မြစ်ဘေးတစ်လျှောက်ရှိ ဆူးချံုတောများမှာ disclimax community အမျိုးအစားနှင့် ရေလွှမ်းမှုကြောင့်တည်မြဲသော ဆူးချံုတောအမျိုးအစားများ ကိုတွေ့ရသည်။ အပင်ပေါက်ရောက်မှုပုံစံပြောင်းလဲခြင်းကို အောက်တွင်ဖော်ပြထားပါသည်။

ပြန်လည်ထူထောင်ခြင်း ပြန်လည်ထူထောင်ခြင်း

ကျဲပါးသည့် ဝါးနှင့် ၄က်ပျောတော ဒုတိယတန်းစား စိုစွတ်သော မိုးသစ်တော စိုစွတ်သော မိုးသစ်တော

ဖျက်စီးခြင်း ဖျက်စီးခြင်း

လေ့ဓာဆန်းစစ်မှုများအရ Tetrameles nudiflora၊ Aquilaria malaccensis Lam.၊ Bhesa sinensis ၊ Dipterocarpus retusus၊ Craibiodendron stellatum၊ Cephalotaxus griffithii Hook. f.၊ Dipterocarpus turbinatus Gaertn. f.၊ Taiwania cryptomerioides Hayata နှင့်Bretschneidera sinensis Hemsl ကဲ့သို့သော IUCN Red List စရင်းဝင် ရှားပါးမျိုးစိတ်များနှင့် မျိုးသုန်းရန်အန္တ ရာယ်ရှိသော မျိုးစိတ်များ ကို မလိခမြစ်ကြောင်းရှိ ချီဗွေဒေသ အပိုင်းတွင်တွေ့ရှိရပါသည်။ ထို့ပြင် Cyathea spp. and Orchidaceous species ကဲ့သို့သော CITES Appendices စရင်းဝင် အပင်များအား ဖျက်စီးသုံးစွဲထားသည်ကိုတွေ့ရပါသည်။

၁.၄.၃.၂ ကုန်းနေ သတ္တဝါများ

စီမံကိန်းတည်ရှိရာ အင်မိုင်ခ မြစ်ကြောင်းရှိ ချီဗွေဒေသ အပိုင်းတွင် တောရိုင်းတိရစ္ဆာန်များ ပေါများစွာတွေ့ရသည်။ တွေ့ရှိရသော မျိုးစိတ်စုစုပေါင်းမှာ- order ၆ခု ပါဝင်နေသော နို့တိုက်သတ္တဝါမျိုးစိတ် ၄၁ မျိုး၊ မျိုးရင်း ၁၈မျိုး၊ genera ၃၂ မျိုးနှင့် order ၁၈ခုပါသော ငှက်မျိုးစိတ်များ ၃၁၈ မျိုး၊ မျိုးရင်း ၅၆မျိုး နှင့် genera ၁၃၆မျိုး၊ order ၂ ခုပါသော မျိုးစိတ် တွားသွားသတ္တဝါ မျိုးစိတ် ၁၃ မျိုး၊ မျိုးရင်း ၅ မျိုး နှင့် genera ၁၃ မျိုး၊ order ၁ ခုပါသော ကုန်းနေရေနေသွားသတ္တဝါ မျိုးစိတ် ၁၄ မျိုး၊ မျိုးရင်း ၄ မျိုး နှင့် genera ၁၁ မျိုးနှင့်အတူ မျိုးရင်း ၁၁ မျိုး နှင့် genera ၁၂၅ မျိုး ပါဝင်သော လိပ်ပြာမျိုးစိတ် ၂၁၆ မျိုး စသည်တို့ကို မှတ်တမ်းတင်ခဲ့ရပါသည်။

လေ့လာဆန်းစစ်မှုရလဒ်များအရ ခြေလေးချောင်း သတ္တဝါ ၁၈မျိုး၊ ငှက် ၁၆မျိုး၊ တွားသွား သတ္တဝါနှင့် ကုန်းနေရေနေ သတ္တဝါ ၃ မျိုး နှင့် လိပ်ပြာ ၂မျိုး အပါအဝင် ရှားပါးနှင့် မျိုးတုန်းရန် အနေအထားရှိ မျိုးစိတ် ၃၉ မျိုးတွေ့ရှိပါသည်။ IUCN Red List စရင်းဝင် ခြေလေးချောင်း သတ္တဝါ ၁၈မျိုး၊ ငှက် ၁၀ မျိုး အပါအဝင် မျိုးစိတ်စုစုပေါင်း ၂၈မျိုး တွေ့ရှိရပြီး CITES Appendices စရင်းဝင် ခြေလေးချောင်း သတ္တဝါ ၁၇မျိုး၊ ငှက် ၈မျိုး၊ တွားသွား သတ္တဝါနှင့် ကုန်းနေရေနေ သတ္တဝါ ၃ မျိုး နှင့် လိပ်ပြာ ၂မျိုးအပါအဝင် မျိုးစိတ် ၃၀ မျိုး အားတွေ့ရှိရပါသည်။

၁.၄.၃.၃ ရေနေ သတ္တဝါများ

အင်မိုင်ခ မြစ်အတွင်းတွင် order ၂ခုရှိ cypriniformes မျိုးစိတ် ၁၈ မျိုး၊ order ၁ခုရှိ siluriformes မျိုးစိတ် ၇ မျိုး၊ order ၁ခုရှိ anguilliformes မျိုးစိတ် ၁ ခု အပါအဝင် order 3 ခုနှင့် မျိုးရင်း ၄ မျိုး ပါရှိနေသော စုစုပေါင်းမျိုးစိတ် ၂၆ မျိုးကို တွေ့ရှိရပါသည်။

ချီဗွေမြစ်ဒေသတွင် ရေလုပ်ငန်းလုပ်ကိုင်မှုမှာ နည်းပါးပြီး ငါးဖမ်းခြင်းအတွက်အသုံးပြုသော နည်းလမ်းများမှာနှင့် ငါးဖမ်းကိရိယာများမှာလည်းရိုးရှင်းပါသည်။ ငါးဖမ်းလုပ်ငန်းဖြင့် အသက်မွေးဝမ်းကြောင်းပြုနေသော တံငါသည်များ ရှိမနေပါ။ အဓိကထားဖမ်းသော ငါးများမှာ Schizothorax meridionalis, Tor putitora နှင့် Garra qiaojiensis စသည်တို့ဖြစ်ပါသည်။ ချီဗွေမြစ်သည် အင်မိုင်ခမြစ်၏ လက်ဝဲဘက်ခြမ်းမှ ခွဲထွက်လာသည့် အဓိကမြစ်တစ်ခုဖြစ်သည်။ လေ့လာချက်များအရ ချီဗွေမြစ်အတွင်း Scaphiodonichthys, Sisoridae, Glyptothorax နှင့် Pseudecheneis စသော ငါးမျိုးစိတ်များ ပျံနှံ့နေပါသည်။

ထပ်မံ၍ ရုပ်ပိုင်းဆိုင်ရာ အခြေခံအချက်အလက်များကောက်ယူခြင်း အစီရင်ခံစာနှင့် ဂေဟဗေဒဆိုင်ရာ အစီရင်ခံစာကို နောက်ဆက်တွဲ ၁ နှင့် ၂ တို့တွင် ဖော်ပြထားပါသည်။

၁.၄.၄ လူမှုဝန်းကျင်

ကချင်ပြည်နယ်သည် မြန်မာနိုင်ငံ၏ မြောက်ဘက်အစွန်းပိုင်းတွင်တည်ရှိပြီး တရုတ်နိုင်ငံ ယူနန်နှင့် ထိစပ်

လျက်ရှိပါသည်။ ကချင်ပြည်နယ်၏ ဧရိယာစုစုပေါင်းမှာ ၈၉,၀၀၀ စတုရန်းကီလိုမီတာဖြစ်ပြီး မြန်မာနိုင်ငံတစ်နိုင်ငံလုံး၏ ၁၃%ရှိပါသည်။ ကချင်ပြည်နယ်သည် မြစ်ကြီးနား၊ ပူတာအို၊ ဗန်မော် ခရိုင် (၃) ခုဖြင့် ဖွဲ့စည်းထားပြီး မြို့ပေါင်း (၁၈) မြို့တွင် လူဦးရေ ၁,၄၂၀,၀၀၀ ခန့်နေထိုင်လျက်ရှိပါသည်။ ကချင်ပြည်နယ်၏အဓိက လူမျိုးမှာ ကချင်လူမျိုးဖြစ်ပြီး အခြားအနေဖြင့် ဗမာ၊ ရှမ်း၊ လီဆူး၊ အဇီး၊ လဇီး၊ ရဝမ်၊ Xianu, Xiadu and Ganan အစရှိသည့် လူမျိုးများပျံနှံ့နေထိုင်လျက်ရှိပါသည်။

ကချင်ပြည်နယ်အတွင်းစိုက်ပျိုးရေးကိုအဓိကလုပ်ကိုင်ကြပြီး စပါး၊ နှံစားပြောင်၊ ပြောင်းဖူး၊ ကြံ၊ မုန်ညှင်းတို့ကို စိုက်ပျိုးလျက်ရှိပါသည်။ စိုက်ပျိုးဧရိယာ ၁၂၀,၀၀၀ စတုရန်းဟက်တာရှိသည့်အနက် ၅၆,၇၀၀ စတုရန်းဟက်တာကို ရေသွင်းစိုက်ပျိုးလျက်ရှိပြီး ကျန် ၂၀,၂၀၀ စတုရန်းဟက်တာသည် သီးနှံရောနှောစိုက်ခင်း ဧရိယာဖြစ်ပါသည်။ စိုက်ပျိုးမြေ၏ ၇၀% သည် ကောက်ပဲ သီးနှံစိုက်ပျိုးပြီး ကျန်ဒေသများမှာ ခြောက်သွေ့မြေများ၊ ဥယျာဉ်ခြံမြေနှင့် တောအုပ်ငယ်လေးများဖြစ်ကြပါသည်။ ကောက်ပဲသီးနှံစိုက်ပျိုးခြင်းသည်စိုက်ပျိုးရေးအတွက် အလွန်အရေးပါပြီး စိုက်ပျိုးမြေ၏ ၇၅%ခန့်စိုက်ပျိုးကြသည်။ ကောက်ပဲသီးနှံများကို မြေပြန့်နှင့်တောင်ပေါ်ဒေသနှစ်မျိုးလုံး တွင်စိုက်ပျိုးကြသည်။ ကြိုးပြင်ကာကွယ်တော ၅၆၇၀ စတုရန်းကီလိုမှတ်ရှိပြီး မိုးညှင်း၊ မြစ်ကြီးနား၊ ဗန်မော်နှင့် ရွှေဂူအစရှိသောနေရာတို့တွင်ရှိပါသည်။ တခြားဝင်ငွေရနိုင်သော အရင်းအမြစ်များအဖြစ် ကျွန်း၊ သစ်မာ နှင့်အခြားသော သစ်တောထွက်ပစ္စည်းများမှ ရရှိပါသည်။

မြစ်ကြီးနားသည်ကချင်ပြည်နယ်၏ မြို့တော်ဖြစ်ပြီး မြန်မာနိုင်ငံမြောက်ဘက်ဆုံး မီးရထားလမ်းဆုံးနှင့် မြစ်ဆိပ်ကမ်းလမ်းဆုံးမြို့ဖြစ်သည်။ ရန်ကုန်မြို့နှင့် ၁,၄၈၀ ကီလိုမီတာကွာဝေးပြီး မန္တလေးမြို့နှင့် ၇၈၀ ကီလိုမီတာကွာဝေးပါသည်။ မေခနှင့် မလိခဆုံစည်းရာ ဧရာဝတီမြစ်ဆုံမှ အောက်ဘက်သို့ ၄၅ ကီလိုမီတာကွာဝေးပါသည်။ မြစ်ကြီးနားမြို့ပေါ်တွင် အမြဲတမ်းနေထိုင်သောလူဦးရေမှာ ၂၀၀,၀၀၀ ကျော်ရှိပြီး ကချင်၊ ရှမ်းနှင့် ဗမာလူမျိုးများနေထိုင်ကြပါသည်။

ကနဦးလေ့လာဆန်းစစ်ချက်များအရ တန်ဖိုးရှိသောတွင်းထွက်ပစ္စည်းများ စိမ်ကိန်းနေရာတွင် မတွေ့ရပါ။ ရွှေတူးဖော်ခြင်းလုပ်ငန်းသည် ဒေသခံပြည်သူများအတွက် အရေးပါသော စီးပွားရေးလုပ်ငန်းဖြစ်ပြီး ရွှေမှုန့်များကို မလိခမြစ်နှင့် ဧရာဝတီမြစ်များထဲတွင်သာတွေ့ရပါသည်။

ဒေသတွင်းဖြစ်ပွားတတ်သော ရောဂါများမှာ ငှက်ဖျားရောဂါ၊ သွေးလွန်တုတ်ကွေးရောဂါ နှင့်ဝမ်းရောဂါများ ဖြစ်ပါသည်။

၁.၄.၅ လက်ရှိ ပတ်ဝန်းကျင် အရည်အသွေးအခြေအနေများ

လေ့လာဆန်းစစ်ခြင်းများအရ စိမ်ကိန်းဧရိယာအတွင်း ကြီးမားသော စက်ရုံနှင့် တူးဖော်ရေးလုပ်ငန်းများ မရှိသောကြောင့် စက်ရုံထွက်ညစ်ညမ်းမှု အရင်းအမြစ်များမရှိပါ။ မိလ္လာအညစ်အကြေးအနည်းငယ်ကို ရေသိုလှောင်ဧရိယာအနီးတွင်ရှိနေပြီး စိုက်ပျိုးရေးလုပ်ငန်းများကိုသာ ရေသိုလှောင်ဧရိယာအနီးရှိ ကျေးရွာများတွင်လုပ်ကိုင်နေကြပါသည်။ အဓိကသီးနှံများမှာ ဆန်စပါး၊ တရုတ်ကြံ၊ ပြောင်း၊ ကြံများစသည်တို့ဖြစ်ကြပြီး မြေဩဇာများနှင့် စိုက်ပျိုးရေးဆိုင်ရာ ဓာတုပစ္စည်းများလည်း အသုံးပြုသည်ကို တွေ့ရသည်။

ဆည်နှင့် ဓါတ်အားပေးစက်ရုံတည်ဆောက်မည့် အင်မိုင်ခမြစ်ရေအရည်အသွေးအား ၂၀၁၄ ခုနှစ် အောက်တိုဘာတွင်တရုတ်နိုင်ငံ ယူနန်စီရင်စု Tengchong County ရှိ ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြည်ရေးဌာန CPIYN မှ စောင့်ကြည့်လေ့လာခဲ့ပါသည်။ လေ့လာဆန်းစစ်ခြင်းရလဒ်များအရ နှစ်ဖက်စလုံး ရေအရည်အသွေးမှာ ကောင်းမွန်ပြီး တရုတ်နိုင်ငံရှိ မြေပေါ်ရေ အရည်အသွေးအတွက်

ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး စံချိန်စံညွှန်း (China, GB3838-2002) အဆင့်မှီပါသည်။

၁.၅ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း

၁.၅.၁ ရေအရင်းအမြစ်ဆိုင်ရာ စီမံခြင်း

ချီဗွေငယ် ခါတ်အားပေးစက်ရုံရှိ ပုံမှန်ရေအမှတ်သည် ၇၄၀ မီတာရှိပြီး ယင်းပုံမှန်ရေအမှတ်အောက် သိုလှောင်နိုင်သော ပမာဏမှာ ၇၈၉၀၀၀ ကုဗမီတာဖြစ်ပါသည်။ အဆိုပါ ရေလှောင်တမံမှာ နေ့စဉ် ပုံမှန်လုပ်ဆောင်နိုင်သော river-channel အမျိုးအစား ဖြစ်သည်။ ရေသိုလှောင်နိုင်သောဇရိယာမှာ ၀.၁ စတုရန်း ကီလိုမီတာဖြစ်ပြီး ရေသေပိုင်းမှာ ၀.၇၅ ကီလိုမီတာခန့်ဖြစ်ပါသည်။

စီမံကိန်းတည်ဆောက်ပြီးစီးသွားပါက အဆိုပါနေရာသည် ဆည်နှင့် မြစ်ဝကြား ရေစီးဆင်းမှု လျော့နည်းသောအပိုင်း ဖြစ်လာမည်ဖြစ်ပြီး ၁၅.၉ ကီလိုမီတာခန့် ရှိပါသည်။ နိဝင်ဘာမှ ဇူလိုင်အထိ ရေလွှဲမှုထုတ်လွှတ်မှုသည် ရေစီးဆင်းမှုကို သိသာစွာ လျော့နည်းစေမည်ဖြစ်ပြီး ယင်းကာလအတွင်း ဆည်အောက်ခြေပိုင်းတွင် စီးဆင်းမှုသည် ဂေဟဗေဒကျစွာ စီးဆင်းနိုင်ရန် ၀.၅၃ m^3/s ကိုစီမံကိန်းမှ ထုတ်လွှတ်ပေးမည်ဖြစ်သည်။ တစ်ချိန်တည်းမှာပင် ဆည်အောက်ပိုင်းတွင် ရေစီဆင်းမှုအား လျော့နည်းသွားမည် ဖြစ်သော်လည်း များစွာသော ချောင်းများစုပေါင်း စီဆင်းမှုဖြင့် ယင်းရေစီဆင်းမှု လျော့နည်းသောအပိုင်း အတွင်း စီးဆင်းမှုကို အနည်းငယ် မြင့်တက်လာစေနိုင်မည် ဖြစ်ပြီး ရေစုန်ထုတ်လွှတ်မှု၊ ရေအမှတ်နှင့် သဘာဝအခြေအနေများ အကြား ကွာဟချက်များကို အနည်းငယ် လျော့ကျစေမည် ဖြစ်ပါသည်။

ခါတ်အားပေးစက်ရုံသည် အင်မိုင်ခမြစ်၏ အဓိကရေစီးကြောင်းပေါ်တွင်တည်ရှိသည်။ ချီဗွေငယ် ရေအားလျှပ်စစ်ခါတ်အားပေးစက်ရုံသည် အင်မိုင်ခမြစ်မှခွဲထွက်လာသော ချီဗွေမြစ်မှ ရေများရယူပြီး အင်မိုင်ခမြစ်ရစီးကြောင်းထဲသို့ပြန်လည် စီဆင်းစေသည်။ လျှပ်စစ်ဓာတ်အား ထုတ်လုပ်မှုအတွက် ထုတ်လွှတ်မည့် ဒီဇိုင်းမှာ ၂၆.၄၆ m^3/s ဖြစ်ပြီး ခါတ်အားပေးစက်ရုံ တည်နေရာရှိ အင်မိုင်ခမြစ်၏ နှစ်စဉ် ပျမ်းမျှ စီးဆင်းနှုန်းမှ ၁.၂ ရာခိုင်နှုန်းမျှသာ ရယူမည်ပါသည်။ ထို့ကြောင့် ခါတ်အားပေးစက်ရုံ အထက်ပိုင်း အင်မိုင်ခမြစ်၏ ရေအရင်းအမြစ်အား အခြေခံအားဖြင့် ထိခိုက်မှုမရှိနိုင်ပါ။

၁.၅.၂ ရေဝန်းကျင်

တည်ဆောက်ရေးကာလအတွင် ချီဗွေမြစ်၏ ရေအရည်အသွေးအပေါ် သက်ရောက်မှုများတွင် ကွန်ကရစ်အတွက် ရောစပ်ခြင်း၊ ဆေးကြောခြင်းနှင့် တာရှည်ခံအောင် ထိန်းသိမ်းခြင်းမှ ထွက်ရှိလာသည့် စွန့်ပစ်အယ်ကာလိုင်း၊ တည်ဆောက်ရေးစက်ကိရိယာများ ထိန်းသိမ်းခြင်းမှ ထွက်ရှိလာသည့် အဆီပါဝင်သည့် စွန့်ပစ်ရေ၊ မြေအောက်မြောင်းနှင့် တည်ဆောက်ရေလုပ်သားများအသုံးပြုပြီးထွက်ရှိလာသော အိမ်သုံးစွန့်ပစ်ရေတို့ အဓိကအားဖြင့် ပါဝင်ပါသည်။

တည်ဆောက်ရေးလုပ်ငန်း၏ပမာဏမှ အတော်အတန်သေးငယ်သည့်အပြင် ရေဆိုးအနည်းငယ်သာ ထွက်ရှိပြီး ညစ်ညမ်းမှုများ၏ ပေါင်းစပ်ပါဝင်မှုမှာလည်း ရိုးစင်းပါသည်။ သက်ဆိုင်ရာ သန့်စင်သည့် နည်းလမ်းများအားဆောင်ရွက်ပြီးနောက် ချီဗွေမြစ်၏ ရေအရည်အသွေးအပေါ် သိသာထင်ရှားသည့် ထိခိုက်စေနိုင်သောသက်ရောက်မှု ရှိလိမ့်မည်မဟုတ်သည့်အပြင် သက်ရောက်မှုမှာလည်း ယာယီသာဖြစ်ပါသည်။ တည်ဆောက်ရေးပြီးစီးပြီးနောက် သက်ရောက်မှုမှာ ပျောက်ကွယ်သွားမည် ဖြစ်ပါသည်။

စီမံကိန်းအား အကောင်အထည်ဖော်ဆောင်ပြီးနောက် ပုံမှန်ရေကန်အမြင့်သည် ၇၄၀မီတာဖြစ်ပြီး

အရံရေသိုလှောင်ကန်၏အရှည်မှာ ၀.၇၅ ကီလိုမီတာခန့်ရှိမည် ဖြစ်ပါသည်။ ရေလှောင်ကန်ဧရိယာ၏ ရေအမြင့်သည် ရေလှောင်တမံမတည်ဆောက်မီအမြင့် ထက်ပို၍ မြင့်မားမည်ဖြစ်ပါသည်။ ရေမျက်နှာပြင်သည် အတော်အတန်ကျယ်ပြန့်လာမည်ဖြစ်ပြီး ယခုစီမံကိန်းတွင် ရေထုထည်နှင့် ၎င်း၏အရံသိုလှောင်ကန်ဧရိယာသည် တိုးလာမည်ဖြစ်ပါသည်။ ရေတွင်ပျော်ဝင်ခြင်းနှင့် သက်ဆိုင်သည့် သက်ရောက်မှုသည် ပိုမိုအားကောင်းလာမည်ဖြစ်ပြီး ရေလှောင်ကန်၏ ရေအရည်အသွေး တစ်ကန်လုံးအနေဖြင့် တိုးတက်လာမည်ဖြစ်ပါသည်။

ချီဗွေငယ်ရေအားလျှပ်စစ် ဓာတ်အားပေး စက်ရုံသည် မြေပေါ်ရေသိုလှောင်သည့် နည်းလမ်း a>20 ဖြင့်တွက်ချက်ထားသော လည်ပတ်စွမ်းအင်အား နေ့စဉ်ပုံမှန်ထောက်ပံ့ပေးပါသည်။ ဤနေရာတွင် ရေလှောင်ကန်သည် အရောအနှောအမျိုးအစားအဖြစ်သတ်မှတ်ထားပြီး ရေလှောင်ကန်၏ ရေအပူချိန်တွင် အလွှာအထပ်ထပ် ဖြစ်ပေါ်ခြင်း ရှိလိမ့်မည်မဟုတ်ပေ။ ရေလှောင်ကန်၏ ရေအပူချိန်အပေါ်တွင် စီမံကိန်း၏တည်ဆောက်ရေးနှင့် လည်ပတ်ရေးမှ သက်ရောက်မှုများဖြစ်စေမည်မဟုတ်ပါ။

၁.၅.၃ ရေနေသက်ရှိများ

အင်မိုင်ခမြစ်၏ ရေစနစ်တွင် ငါးများသည် အထူးသဖြင့် ပြင်းထန်လှသည့် ရေစီးကို နေသားကျနေသည့် ငါးများဖြစ်ပါသည်။ စီမံကိန်းပြီးစီးပြီးနောက် ရေလှောင်ကန်ဧရိယာအတွင်းရှိ ငါးများသည် အထက်ဘက်ရှိပြင်းထန်သည့်ရေစီးသို့ ပြောင်းရွှေ့ကျင်လည်ကျက်စားမည်ဖြစ်ပါသည်။ ချီဗွေငယ်ရေအားလျှပ်စစ်စခန်းသည် ရေအားနိမ့်ဆည်လွှဲ၏ အကောင်အထည်ဖော်အမျိုးအစားဖြစ်ပါသည်။ ရေလှောင်ကန်ဧရိယာအတွက် အရံရေလှောင်ကန်အရှည်မှာ ၀.၇၅ ကီလိုမီတာခန့်ဖြစ်ပြီး ပြင်းထန်လှသည့် Scaphiodonichthys, Sisoridae, Glyptothorax နှင့် Pseudecheneis အပါအဝင် ရေစီးကို နေသားကျနေသည့် ငါးများအပေါ် တည်ဆောက်ရေးမှ သက်ရောက်မှု ပမာဏမှာ အတော်သေးငယ်လှပါသည်။ တမံအပိတ်သည် ချီဗွေမြစ်နှင့် အင်မိုင်ခမြစ်အကြားရေစီးတွက် ကျင်လည်ကျက်စားသည့် ငါးများကို သက်ရောက်စေနိုင်ပါသည်။

စီမံကိန်းအား အကောင်အထည်ဖော်ဆောင်ပြီးနောက် မြစ်အပိုင်း ၁၅.၇ ကီလိုမီတာအတွင်း ရေအားလျှပ်စစ်စီမံကိန်းနှင့် ရေလှောင်ကန်အောက်ပိုင်းမှ ရေပမာဏအား ထိုမြစ်အပိုင်းတွင် အပင်မှားနှင့် မြစ်အောက်အကောင်မှားအတွက် အကောင်အရေအတွက် လျော့နည်းစေသည့် ခြောက်သွေ့ရာသီတွင် ရုတ်တရက်လျော့ချမည်ဖြစ်သည့်အတွက် ထိုမြစ်အပိုင်းတွင်းရှိ ငါးသယံဇာတများ၏ပမာဏမှာ ထိုနည်းတူစွာ လျော့နည်းမည်ဖြစ်ပါသည်။ သို့သော်လည်း မြစ်အပိုင်းရှိ ငါးများသည် အင်မိုင်ခမြစ်ဝှမ်းတွင်း ကျယ်ပြန့်စွာ ပြန့်နှံကျက်စားသောကြောင့် လျှပ်စစ်စီမံကိန်းတည်ဆောက်ရေးသည် လိုက်လျောညီထွေပြောင်းလဲသည့် စားကျင်နေရာအပိုင်းအခြားကိုသာ လျော့နည်းစေမည်ဖြစ်ပြီး လျော့နည်းသွားသည့် အပိုင်းအခြားမှာ အတော်သေးငယ်ပါသည်။ ထို့ကြောင့် ရေစီးလျော့ချသည့်အပိုင်းတွင် ရေပမာဏလျော့ချခြင်းဖြင့် ငါးများအပေါ် သက်ရောက်မှုပမာဏအား ကန့်သတ်ထားမည်ဖြစ်ပါသည်။

၁.၅.၄ ကုန်းနေသက်ရှိများ

ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံ၏ ရေလှောင်ကန်ရေလှောင်မှု၊ ဆည်နှင့် ဓာတ်အားပေးစက်ရုံ တည်ဆောက်ခြင်း၊ ဆောက်လုပ်ရေးသွားလမ်း၊ ဖိအားမြင့်ရေသွင်းပိုက်လိုက်ခေါင်း၊ ဝင်ပေါက်လမ်းကြောင်းများ စသည့် တည်ဆောက်ရေးလုပ်ငန်းများသည် ပျက်ဆီးနေသည့် အပင်ပေါက်ရောက်မှု ၁၂.၂ စတုရန်းဟက်တာမီတာအား ပံ့ပိုးပေးမည်ဖြစ်ပါသည်။ စီမံကိန်း အကောင်အထည်ဖော်ဆောင်ရေးသည် မျိုးစိတ်များပျောက်ကွယ်မှု (သို့) မျိုးစိတ်တစ်ခုခြင်းစီ၏

အရေအတွက် သိသာထင်ရှားစွာ ကျဆင်းမှုတို့အား ဦးတည်သွားမည်မဟုတ်ပါ။ စီမံကိန်းနေရာတွင် အပင်ပေါက်ရောက်မှုအရ တည်ဆောက်ရေးကြောင့် ပျက်ဆီးသွားသော အပင်ပေါက်ရောက်သည့်ဇရိယာမှာ အတော်သေးငယ်ပြီး သက်ရောက်မှုနည်းပါးပါသည်။

အမြဲတည်ရှိနေမည့် အဆောက်အဦးများမှတစ်ပါး စီမံကိန်းတည်ဆောက်ရေးကြောင့် အပင်ဆုံးရှုံးမှုအား လုံးအား အလုပ်များပြီးစီးသည်နှင့် တဖြည်းဖြည်း ပြန်လည်စိုက်ပျိုးသွားမည်ဖြစ်ပါသည်။ ရေနှင့် မြေဆီလွှာထိန်သိမ်းသည့် နည်းလမ်းများ၊ သစ်တောများပျိုးထောင်ခြင်းနှင့် အမြင်ပသာဒတင့်တယ် အောင်ပြင်ဆင်ခြင်းတို့အား တဖြည်းဖြည်း ပြုလုပ်မည်ဖြစ်ပြီး တည်ဆောက်ရေးဇရိယာတွင် လေအပူချိန်မြင့်ခြင်း၊ မိုးများခြင်း၊ လျှင်မြန်စွာ အပင်ပေါက်ရောက်ခြင်းနှင့် သန်စွမ်းသောအပင်ရှင်သန်နိုင်မှု၊ ကုန်းတွင်းအပင်များ၏ သီးနှံထွက်နှုန်းများသည် လူတို့ပြန်လည် ဆောင်ရွက်ခြင်းဖြင့် ၄င်းတို့၏နဂိုမူလ အခြေအနေသို့ပြန်လည်ရောက်ရှိအောင် ပြန်လည်ဆောင်ရွက်မည် ဖြစ်ပါသည်။

ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံ၏ ရေလှောင်ကန်အရွယ်အစားမှာ အတော်သေးငယ်ပြီး ရေလှောင်တမံ ဖျက်သိမ်းပြီးနောက် ရေလှောင်ကန်ဇရိယာသည် ၀.၀၈ စတုရန်းကီလိုမီတာသာ တိုးလာမည်ဖြစ်ပါသည်။ ရေလှောင်ကန် ဇရိယာအနီးတွင် ကျက်စားနေထိုင်သည့် တွားသွားသတ္တဝါများနှင့် နို့တိုက်သတ္တဝါများ အပေါ် တွင် အရေးကြီးသည့် သက်ရောက်မှုရှိလိမ့်မည်မဟုတ်ပေ။

တည်ဆောက်ရေးနှင့် စီမံခန့်ခွဲသည့် အလုပ်သမားများမှ တောရိုင်းတိရိစ္ဆာန် ဝယ်ယူမှုသည် တောရိုင်းတိရိစ္ဆာန် ရောင်းဝယ်ရေး လှုပ်ရှားမှုများကို အားပေးကူညီမည်ဖြစ်ပါသည်။ ထိုဝယ်ယူမှုများသည် မုဆိုးများအား အမဲလိုက်ခြင်း အင်အားနှင့် အကြိမ်အရေအတွက် ကိုတိုးစေမည်ဖြစ်ပြီး တောရိုင်းတိရိစ္ဆာန်အရေအတွက် ကျဆင်းစေမည်ဖြစ်ပါသည်။ ထို့ကြောင့် ဆောက်လုပ်ရေးနှင့် စီမံခန့်ခွဲသည့် အလုပ်သမားများအား ပိုမိုထိန်းချုပ်မှု လုပ်ဆောင်သွားမည်ဖြစ်ပါသည်။

၁.၅.၅ မြေဆီလွှာတိုက်စားခြင်း

ချီဗွေငယ် ရေအားလျှပ်စစ်စက်ရုံ၏ တည်ဆောက်ရေးလုပ်ငန်းများကြောင့် ဖြစ်ပေါ်လာသော တိုးမြင့်လာသည့် မြေဆီလွှာတိုက်စားခြင်းသည် တည်ဆောက်ရေးလုပ်ငန်းများဖြစ်သော တမံနှင့် လျှပ်စစ်မောတ်အားပေးရုံတို့၏ အုတ်မြစ်တူးဖော်ခြင်း၊ ရေလွှဲတူးမြောင်းတူးဖော်ခြင်း၊ ဖို့မြေတူးဖော်ခြင်း၊ ဆောက်လုပ်ရေးသွားလမ်း၊ အရန် လုပ်ငန်းရုံးခွဲနှင့် လူနေဇရိယာများ၊ စွန့်ပစ်မြေစာပုံတို့မှ အဓိကအားဖြင့် ဖြစ်ပေါ်စေပါသည်။

စီမံကိန်းဇရိယာတွင် မြေဆီလွှာတိုက်စားမှုလက်ရှိအခြေအနေအရ စီမံကိန်းတည်ဆောက်ခြင်းကြောင့် ဖြစ်ပေါ်လာသည့် မြေဆီလွှာတိုက်စားမှုစုစုပေါင်းသည် ဆန်းစစ်ခြင်းနှင့် ခန့်မှန်းခြင်းအရ အသစ်တိုးမြင့်လာသည့် မြေဆီလွှာတိုက်စားမှု 9,241t အပါအဝင် 16,262t ခန့်ရှိပါသည်။ သို့သော်လည်း အသစ်တိုးမြင့်လာသည့် မြေဆီလွှာတိုက်စားမှုအား သင့်တော်သည့်နည်းလမ်းဆောင်ရွက်ပြီးနောက် ထိရောက်စွာ သက်သာလျော့နည်းစေနိုင်မည့်အပြင် ထိန်းချုပ်နိုင်မည်ဖြစ်ပါသည်။

၁.၅.၆ အခြား

တည်ဆောက်ရေးဇရိယာတွင် အတိုင်းအတာအချို့အထိ လေ၊အသံ၊ စွန့်ပစ်အမှိုက်အပေါ် လွှမ်းမိုးမှုများအပါအဝင် အခြား ထိခိုက်စေသောသက်ရောက်မှုအားလုံးသည် ယာယီသာဖြစ်ပြီး ပမာဏနည်းပါးကာ လွှမ်းမိုးမှုအဆင့်နိမ့်ပါးပါသည်။ အဆိုပါအရာအားလုံးကို သက်ဆိုင်ရာ ကာကွယ်သည့် နည်းလမ်းများဆောင်ရွက်ခြင်းဖြင့် ထိရောက်စွာ သက်သာလျော့နည်းစေနိုင်မည့်အပြင် ထိန်းချုပ်နိုင်မည်ဖြစ်ပါသည်။

၁.၆ လူမှုဝန်းကျင်သက်ရောက်မှုဆန်းစစ်ခြင်း

၁.၆.၁ လူမှုဝန်းကျင်စီးပွားရေး

ဓာတ်အားထုတ်လုပ်နိုင်စွမ်း ၉၉ မဂ္ဂါဝပ်နှင့် နှစ်စဉ်ပျှမ်းမျှ တစ်နာရီလျှင် ၅၉၉၉,၀၀၀,၀၀၀ ကီလိုဝပ် လျှပ်စစ်ထုတ်လုပ်မှုရှိသော ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံအား အဓိကအားဖြင့် ဧရာဝတီမြစ်တွင် တည်ဆောက်ထားသည့် မြစ်ဆုံရေအားလျှပ်စစ်စီမံကိန်းနှင့် ချီဗွေရေအားလျှပ်စစ်စီမံကိန်း၏ အကောင်အထည်ဖော်ဆောင်ရေးအတွက် လျှပ်စစ်မီးထောက်ပံ့ပေးရန် ရည်ရွယ်၍ တည်ဆောက်ပါသည်။ ထို့အပြင် တည်ဆောက်ရေးစွမ်းအားအရင်းအမြစ်အတွက်လိုအပ်ချက်နှင့်ကိုက်ညီစေရန်နှင့် လိုအပ်ပါက ကချင်ပြည်နယ်အား အိမ်သုံးလျှပ်စစ်စွမ်းအင်ပံ့ပိုးပေးမည်ဖြစ်ပါသည်။ ထို့ကြောင့် မြန်မာနိုင်ငံ မြောက်ပိုင်းတွင် လျှပ်စစ်စွမ်းအင်ထောက်ပံ့မှုမလုံလောက်ခြင်းအား လျော့နည်းစေမည်ဖြစ်ပြီး ဒေသနေပြည်သူများအား အကျိုးကျေးဇူးဖြစ်ထွန်းစေကာ ဒေသတွင်း လူမှုစီးပွားကဏ္ဍတိုးတက်မှုကို အားပေးမည်ဖြစ်ပါသည်။

ဧရာဝတီမြစ်အထက်ပိုင်းတွင် ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံနှင့် အခြားနောက်ဆက်တွဲစက်ရုံများ တည်ဆောက်ရေးသည် ပြင်ပယာဉ်သွားလာမှုအား တိုးတက်စေရန်အထောက်အပံ့ဖြစ်စေမည်ဖြစ်ပါသည်။ ထိုစဉ် စီမံကိန်းဖွံ့ဖြိုးမှုနှင့်တည်ဆောက်ရေး အတွက် အရင်းအနှီးထည့်ဝင်မှုသည် ဒေသနေပြည်သူတို့အတွက် အလုပ်အကိုင်အခွင့်အလမ်းများစွာကို သယ်ဆောင်လာမည်ဖြစ်ပြီး အခြားဆက်စပ်နေသည့် စက်မှုလုပ်ငန်းများ၏ တိုးတက်မှုကို အားပေးမည်ဖြစ်ပါသည်။ ထို့ကြောင့် ၄င်းစီမံကိန်းသည် ဒေသနေပြည်သူတို့၏ ဘဝအရည်အသွေးအား တိုးမြှင့်ရာတွင် တက်ကြွသော ကဏ္ဍအဖြစ် ပါဝင်မည်ဖြစ်ပြီး စီးပွားရေးတိုးတက်မှုကို အားပေးမည်ဖြစ်ပါသည်။

ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံအကောင်အထည်ဖော်ဆောင်ရေးသည် မြစ်ဝှမ်းဒေသနှင့် ကချင်ပြည်နယ်တွင် လူမှုစီးပွားဖွံ့ဖြိုး တိုးမြှင့်ရာတွင် အရေးပါသော ကဏ္ဍအနေဖြင့် ပါဝင်မည်ဖြစ်ပါသည်။

၁.၆.၂ ဘာသာရေးနှင့် တိုင်းရင်းသားယဉ်ကျေးမှု

ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံတည်ဆောက်ရေးသည် ပြန်လည်နေရာချထားရေးနှင့် ဒေသတွင်း ဘာသာရေးအဆောက်အအုံများ ပါဝင်မည်မဟုတ်ပါ။ ထို့ကြောင့် ၄င်းသည် လူနည်းစုယဉ်ကျေးမှု၏ ဒေသတွင်းနေရာပေါင်းစပ်ပါဝင်မှုပုံစံအား သက်ရောက်စေမည်မဟုတ်ပါ။ သို့သော် တိုင်းတပါးယဉ်ကျေးမှုသည် ဒေသခံလူနည်းစုယဉ်ကျေးမှုအား အတိုင်းအတာတစ်ခုထိ သက်ရောက်လိမ့်မည်ဖြစ်ပါသည်။ ရှည်လျားသည့် ယဉ်ကျေးမှုနှင့် သမိုင်းတို့ဖြင့် မြန်မာနိုင်ငံတွင် အတော်အတန် ထင်ရှားစွာ ပါဝင်သည့် ကချင်၊ ရှမ်းနှင့် မြန်မာလူမျိုးများမှာ စီမံကိန်းတည်ဆောက်ရေးတွင် အဓိကအားဖြင့် ပါဝင်ပါသည်။ ထို့ကြောင့် တိုင်းတပါး ယဉ်ကျေးမှုသည် ၄င်းတို့အပေါ်တွင် အကန့်အသတ်ရှိသော လွှမ်းမိုးမှုသာ ရှိမည်ဖြစ်ပါသည်။

စီမံကိန်းတည်ဆောက်ရေးသည် ဒေသတွင်းစီးပွားရေးနှင့် လူမှုရေး တိုးတက်မှုကို တိုးမြှင့်ရန်၊ ဒေသတွင်းနေထိုင်သူများ၏ ဘဝအရည်အသွေးကို တိုးတက်စေရန်၊ အနာဂတ်တွင် ပူးပေါင်းပါဝင်မှုနှင့်အမျိုးမျိုးသော လူမျိုးများ၏ စည်းလုံးမှုကို တိုးမြှင့်စေရန်နှင့် ဒေသတွင်း လူမျိုးများအကြား ဆက်ဆံရေးတိုးတက်နေစဉ်အတွင်း တွေ့ကြုံရမည့် ပြဿနာနှင့် အခက်အခဲများအား ဖြေရှင်းရန် အကူအညီဖြစ်လိမ့်မည်ဖြစ်ပါသည်။

၁.၆.၃ ဌာနေတိုင်းရင်းသားများ

လူမှုအဖွဲ့အစည်းတစ်ခုတွင် အများစုတိုင်းရင်းသားအုပ်စုနှင့် သိသိသာသာ မတူကွဲပြားသော လူအုပ်စုအဖြစ်

ဌာနေတိုင်းရင်းသားများ (လူနည်းစုတိုင်းရင်းသားများ)သည် ဒေသတွင်းလူဦးရေတွင် အရေးမကြီးသော အင်အားနည်းအုပ်စုအဖြစ် အမြဲတမ်း တည်ရှိနေကြသည်။ ၄င်းတို့၏ စီးပွားရေး၊ လူမှုရေးနှင့် တရားစီရင်ရေးအခြေအနေတို့သည် အမြဲတစေ ၄င်းတို့၏ အကျိုးစီးပွားနှင့် ၄င်းတို့ပိုင်ဆိုင်သော မြေယာများ၊ ပိုင်နက်များနှင့် အခြားသော အရင်းအမြစ်ထွက်ကုန်များကို ကာကွယ်နိုင်စွမ်းကို ကန့်သတ်ထားသည် (သို့) ၄င်းတို့ပူးပေါင်းပါဝင်သည့် ဖွံ့ဖြိုးရေးစီမံကိန်းတို့မှ အကျိုးအမြတ်များကို ရရှိနိုင်စွမ်းကို ကန့်သတ်ထားပါသည်။ ထို့ကြောင့် ကျွန်ုပ်တို့သည့် ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံတည်ဆောက်နေစဉ် ရေလှောင်ကန် ရေလှောင်မှုကြောင့် ဌာနေတိုင်းရင်းသားများအပေါ် သက်ရောက်နိုင်သည့် ဆိုးကျိုးများအပေါ် တွင် အထူးအာရုံစိုက်အလေးထားမှု ပေးအပ်သင့်ပြီး ဌာနေတိုင်းရင်းသားများ၏အကျိုးစီးပွားကိုကာကွယ်ရန် ဖြစ်နိုင်သော နည်းလမ်းများကို ဆောင်ရွက်သင့်ပါသည်။

၁.၆.၄ ထိခိုက်လွယ်သောအုပ်စု(အမျိုးသမီးစသည်)

ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံတည်ဆောက်ရေးသည် ဒေသအတွက် အလုပ်အကိုင်အခွင့်အလမ်းများ စွာကို ယူဆောင်လာမည်ဖြစ်ပြီး ထိုသို့တည်ဆောက်နေစဉ် ဆောက်လုပ်ရေးအလုပ်သမားများ နှင့် နည်းပညာရှင်တို့အတွက် အစားအစာနှင့် နေ့စဉ်လိုအပ်ချက်များ တောင်းဆိုမှုသည် အခြေခံအလုပ်အကိုင်ဖြစ်သည့် ပန်းရံအလုပ်ကဲ့သို့သောအလုပ်များ ဖွံ့ဖြိုးမှုအား တိုးမြှင့်ရန် အကူအညီဖြစ်စေပါသည်။ ထိခိုက်လွယ်သောအုပ်စု(အမျိုးသမီးစသည်)၏ ဘဝအခက်အခဲကို သက်သာလျော့နည်းစေမည့်အပြင် ဤစီမံကိန်းသည် အမျိုးသမီးများ၏ ဘဝအရည်အသွေးကို မြှင့်တင်ရန်အတွက် ၄င်းတို့အား အလုပ်အကိုင်အခွင့်အလမ်းပေးအပ်မည် ဖြစ်ပါသည်။ ထိခိုက်လွယ်သောအုပ်စုများ၏ ပညာရေးအဆင့်အတန်းနှင့် ကာယကျန်းမာရေး အလွန်တရာ တိုးတက်စေရန်အတွက် အစိုးရ၏ ဘဏ္ဍာနှစ်ဝင်ငွေ တိုးမြှင့်လျှင် ကျန်းမာရေးနှင့် ပညာရေးအခြေခံ အဆောက်အဦအတွက် ရင်းနှီးမတည်ငွေ ပိုမိုပေးအပ်မည်ဖြစ်ပါသည်။

၁.၆.၅ မြေအသုံးချမှုများ

ရေလှောင်ကန်သည် ရေပြင်ဧရိယာ ၉.၇ စတုရန်းဟက်တာမီတာ ကျယ်ဝန်းပြီး ရေလွှမ်းမည့် ကုန်းမြေမှာ ၈.၁ စတုရန်းဟက်တာမီတာ ကျယ်ဝန်းပါသည်။ ဆည်နေရာ၏ တည်ဆောက်ရေးဧရိယာတွင် အမြဲတမ်းမြေအသုံးပြုမှုမှာ ၄.၈ စတုရန်းဟက်တာမီတာရှိပါသည်။ ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံသည် အတော်သေးငယ်သောအရွယ်အစားရှိပြီး၊ ရေလွှမ်းဧရိယာ နှင့် မြေအသုံးချမှု အနည်းငယ်သာ ရှိပါသည်။ ထို့ကြောင့် ၄င်းစီမံကိန်းသည် စီမံကိန်းဧရိယာရှိ မြေအသုံးချများအပေါ်တွင် အနည်းငယ်သာ လွှမ်းမိုးမှု ရှိမည်ဖြစ်ပါသည်။

၁.၆.၆ ရေအရင်းအမြစ်အသုံးချမှု

မြစ်ကြီးနားအထက်ပိုင်းရှိ ဧရာဝတီမြစ်ဝှမ်းသည် မြန်မာနိုင်ငံ၏မဟာဓာတ်အားလိုင်းမရောက်ရှိနိုင်သည့် မြန်မာနိုင်ငံမြောက်ပိုင်း ကချင်ပြည်နယ်၏ မြောက်ဖျားပိုင်းတွင် တည်ရှိပါသည်။ လျှပ်စစ်မီးရှားပါးပါသည်။ အစိုးရဌာနနှင့် စီးပွားရေးအခြေအနေကောင်းမွန်သည့် နေထိုင်သူများ (ဈေးဆိုင်နှင့် ဟော်တယ်ပိုင်ရှင်များ) သည် လျှပ်စစ်မီးရရှိရန် ဒီဇယ်မီးစက်အသေးစားများကို ကိုယ်ပိုင်တပ်ဆင်ထားရပါသည်။ ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံသည် ရေအားလျှပ်စစ်အသုံးချမှုအချိုးအစားကို တိုးမြှင့်ပြီး ဒေသစီးပွားရေးနှင့် လူမှုရေးဖွံ့ဖြိုးမှုအတွက် လျှပ်စစ်ဓာတ်အားအာမခံပေးမည်ဖြစ်ပြီး ဒေသတွင်းနေထိုင်သူများ၏ ရေရှည်လျှပ်စစ်မီးရှားပါးမှုကို လျော့နည်းသက်သာစေမည်ဖြစ်သည့်အပြင် ဧရာဝတီမြစ်တွင် ရေအရင်းအမြစ်တိုးတက်မှုကို တိုးမြှင့်ရာတွင် အရေးကြီးသော အခန်းကဏ္ဍမှ ပါဝင်မည်ဖြစ်ပါသည်။

၁.၆.၇ မြစ်အောက်ပိုင်းရှိ ရေအသုံးပြုမှုအပေါ် လွှမ်းမိုးမှု

ချီဗွေရေအားလျှပ်စစ်စက်ရုံပြီးစီးပါက မြစ်ဝနှင့် ဆည်နေရာအကြားအတွက် ရေစီးအားလျော့ချသည့်အပိုင်းမှာ ၁၅.၇ ကီလိုမီတာခန့်ရှိမည်ဖြစ်ပါသည်။ စီမံကိန်းပုံစံအစီအစဉ်အရ တစ်စက္ကန့်လျှင် ၀.၅၃ ကုဗမီတာဖြင့် ဂေဟဗေဒကျ စီးဆင်းနိုင်ရန် တမံမှ ထုတ်လွှတ်မည်ဖြစ်ပါသည်။ ထို့အပြင် တမံအောက်ပိုင်းရှိ ချောင်းငယ်နှစ်ခုမှာ ၁၀ စတုရန်းကီလိုမီတာနှင့် ၅.၄၅ စတုရန်းကီလိုမီတာ ရေဆင်းဧရိယာအသီးသီးရှိကြသည်။ ခန့်မှန်းချက်များအရ နှစ်စဉ်ပျှမ်းမျှ ထုတ်လွှတ်မှုမှာ တစ်စက္ကန့်လျှင် ၀.၇၃ ကုဗမီတာ နှင့် တစ်စက္ကန့်လျှင် ၀.၄ ကုဗမီတာ အသီးသီးဖြစ်ပြီး တည်နေရာ၏နှစ်စဉ် ထုတ်လွှတ်မှုတွင် တမံမှ ထုတ်လွှတ်မှု တစ်စက္ကန့်လျှင် ၀.၅၃ ကုဗမီတာ ပေါင်းစပ်ပါဝင်ပြီး ဆည်၏အောက်ဘက် ၁.၆ကီလိုမီတာ တည်နေရာတွင် နှစ်စဉ်ထုတ်လွှတ်မှုမှာ တစ်စက္ကန့်လျှင် ၁.၆ ကုဗမီတာအထိ ရှိပါသည်။

ကွင်းဆင်းလေ့လာမှုအရ လူနေဧရိယာများသည် မြစ်ဝနှင့် ဆည်နေရာအကြား မြစ်အပိုင်းအခြားရှိ ကမ်းပါးနစ်ဘက်လုံးတွင် အခြေတည်၍ပြန့်နှံ့တည်ရှိနေပါသည်။ အဆိုပါ လူနေဧရိယာများသည် ချီဗွေမြစ်နှင့် အလွန်ကွဲပြားသော အမြင့်ဖြင့် ရှည်လျားစွာတည်ရှိနေပါသည်။ ဒေသနေပြည်သူများအတွက် အိမ်သုံးရေကို ချီဗွေမြစ်မှရေကို တိုက်ရိုက်ယူဆောင်ခြင်းမရှိဘဲ စမ်းချောင်းနှင့် စိမ့်စမ်းများမှ အဓိကရယူပါသည်။ ရေစီးလျော့ချသည့်အပိုင်းတွင် ရေသွင်းခြင်းနှင့် ရေဖြန့်ဖြူးခြင်းတို့အတွက် လိုအပ်ချက်မရှိပါ။ ထို့ကြောင့် ချီဗွေရေအားလျှပ်စစ်စက်ရုံသည် ထုတ်လုပ်ရေးအပေါ်တွင် ကြီးမားသည့်သက်ရောက်မှုမရှိသည့်အပြင် ၎င်းစီမံကိန်းပြီးမြောက်ပါက မြစ်အောက်ပိုင်းတွင် သုံးရေအသုံးပြုမှုအတွက် ကြီးမားသည့်သက်ရောက်မှု မရှိပါ။

၁.၆.၈ အခြေခံအဆောက်အဦး

ရင်းနှီးမြှုပ်နှံသူသည် ပစ္စည်းများသယ်ယူပို့ဆောင်ရေး အဆင်ပြေချောမွေ့စေရန်၊ စီမံကိန်းဧရိယာတွင် ယာဉ်အသွားအလာအခြေအနေ သိသာစွာ တိုးတက်စေရန်၊ ဒေသခံတို့၏ခရီးသွားလာရေးလွယ်ကူစေရန်နှင့် ရင်းနှီးမြှုပ်နှံမှုတိုးမြှင့်ခြင်းနှင့် စီးပွားရေးတိုးတက်မှုအတွက် လွယ်ကူစေရန် အတွက် မြန်မာပြည်မြောက်ပိုင်းရှိလမ်းများ၏ အရည်အသွေးကို အဆင့်မြှင့်တင်မည်ဖြစ်ပါသည်။

ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံတည်ဆောက်ရေး အခြေခံအဆောက်အဦးများသည် အကောက်အထည် ဖော်ဆောင်နေဆဲဖြစ်ပြီး အဆင့်အတန်းနိမ့်ပါးဆဲဖြစ်ပါသည်။ ချီဗွေငယ်ရေအားလျှပ်စစ်စက်ရုံ တည်ဆောက်ရေးသည် ချီဗွေဒေသတွင် စီးပွားရေးနှင့် လူမှုရေးဖွံ့ဖြိုးမှုအဆင့်ကို တိုးမြှင့်စေမည်ဖြစ်ပြီး စီမံကိန်းဧရိယာတွင် ကျန်းမာရေးနှင့် ပညာရေးဆိုင်ရာ အဆောက်အဦးများကို တိုးတက်စေမည်ဖြစ်ပါသည်။

၁.၆.၉ လူထုကျန်းမာရေး

ဆောက်လုပ်ရေးလုပ်သားများသည် ဆောက်လုပ်နေစဉ်အတွင်း လုပ်ငန်းနေရာတွင် စုဝေးနေထိုင်မည် ဖြစ်သောကြောင့် အဆိုပါဒေသတွင် လူဦးရေထူထပ်မည်ဖြစ်ပါသည်။ ပတ်ဝန်းကျင်၊ သောက်သုံးရေနှင့် အစားအစာတို့တွင် သန့်ရှင်းရေးစီမံခန့်ခွဲမှု မခိုင်မာပါက ဝမ်းလျှောရောဂါ၊ အသည်းရောင်ရောဂါနှင့် အခြားသောအူလမ်းကြောင်းကူးစက်ရောဂါများ သည်ပြန့်နှံ့မည်ဖြစ်ပါသည်။ အခြားဒေသမှ လာရောက်လုပ်ကိုင်သည့် တည်ဆောက်ရေးအလုပ်သမားများနှင့် နည်းပညာရှင်များသည် ဒေသနေပြည်သူများနှင့် နှိုင်းစာလျှင် ကူးစက်ရောဂါများကူးစက်နိုင်ခြေပိုမိုများပြားပါသည်။ ကွဲပြားသော ဒေသများမှ လာရောက်သော တည်ဆောက်ရေးအလုပ်သမားသည် ၎င်းတို့၏မူလဒေသများမှ ရောဂါပိုးမွှားများကို သယ်ဆောင်လာနိုင်ပါသည်။ ထို့ကြောင့် ရောဂါကာကွယ်ရေးနှင့် ကူးစက်ရောဂါကာကွယ်ရေးအတွက် သက်ဆိုင်ရာကာကွယ်သည့်နည်းလမ်းများကို ဆောင်ရွက်ရပါမည်။

ပြန်လည်ပြင်ဆင်ထားသော SIA နှင့် ပြည်သူလူထု တွေ့ဆုံဆွေးနွေးခြင်း အစီရင်ခံစာကို နောက်ဆက်တွဲ ၃ တွင် ဖော်ပြထားပါသည်။

၁.၇ ပတ်ဝန်းကျင်ဆိုင်ရာဘေးအန္တရယ်ဆန်းစစ်ခြင်း

၁.၇.၁ ပတ်ဝန်းကျင်ဆိုင်ရာဘေးအန္တရယ်ခွဲခြမ်းလေ့လာခြင်း

ချီပွေငယ် ရေအားလျှပ်စစ်စက်ရုံ၏ တည်ဆောက်ရေးအစီအစဉ်အရ စီမံကိန်းတည်ဆောက်နေစဉ်အတွင်း ဆီသိုလှောင်ရုံနှစ်ခုနှင့် ပေါက်ကွဲတတ်သောပစ္စည်းသိုလှောင်ရုံတစ်ခုအား တည်ဆောက်ပါမည်။ သို့သော်လည်း ဆီသိုလှောင်ရုံနှင့် ပေါက်ကွဲတတ်သောပစ္စည်းသိုလှောင်ရုံတို့သည် အရေးပေါ်အခြေအနေများနှင့်ကြုံတွေ့နိုင်ပြီး တည်ဆောက်နေစဉ်တွင် မတော်တဆပေါက်ကွဲမှု ဖြစ်နိုင်ခြေရှိသောကြောင့် လေနှင့်ရေထုပတ်ဝန်းကျင်ကို ညစ်ညမ်းစေနိုင်ပြီး ပတ်ဝန်းကျင်ဘေးအန္တရယ်ကို ဖြစ်ပွားစေနိုင်ကာ တည်ဆောက်ရေးဇရိယာအောက်ပိုင်းတွင် ရေဖြန့်ဖြူးမှုကို ဘေးအန္တရာယ် ဖြစ်စေနိုင်ပါသည်။ ထို့ကြောင့် ၄င်းကို ဘေးအန္တရာယ်အဖြစ် သတ်မှတ်ထားပါသည်။ ရေလှောင်ကန်သည် ရေလှောင်ပြီးနောက် ဘူမိဗေဒဆိုင်ရာ ဘေးအန္တရာယ်ဖြစ်နိုင်ခြေရှိပါသည်။ ရေလှောင်ကန်ဇရိယာ၏ရုတ်ချည်းညစ်ညမ်းမှုသည် ရေညစ်ညမ်းမှုကို ဖြစ်စေနိုင်ပြီး နေထိုင်မှုအခြေအနေပြောင်းလဲခြင်းသည် ရေနေသတ္တဝါများ၏ကျက်စားမှု ပြောင်းလဲခြင်းကို ဖြစ်စေနိုင်ပါသည်။ အဆိုပါ ဘေးအန္တရာယ်များ၏ ဖြစ်ပွားနိုင်မှုသည် ရေလှောင်ကန်ရေသိုလှောင်မှုကြောင့် တိုးမြှင့်လာနိုင်ပါသည်။

၁.၇.၂ ပတ်ဝန်းကျင်ဆိုင်ရာဘေးအန္တရာယ်ကာကွယ်ရေး နည်းလမ်းများ

(၁) ဆီသိုလှောင်ရုံအတွက် ပတ်ဝန်းကျင်ဆိုင်ရာဘေးအန္တရာယ်ကာကွယ်ရေး နည်းလမ်းများ

၁) ဆီသိုလှောင်ရုံ တင်းကျပ်သည့် ဘေးအန္တရယ်ကင်းရှင်းရေးစီမံခန့်ခွဲမှု တည်ထောင်ပြီး ဆီသယ်ဆောင်ခြင်း၊ သိုလှောင်ခြင်းနှင့် အသုံးပြုခြင်းအတွက် လိုအပ်ချက်များကို သတ်မှတ်ထားပါသည်။

၂) မတော်တဆဖြစ်ပွားမှု အချက်ပြစနစ် ပြည့်စုံစွာ တပ်ဆင်ထားပြီး အချိန်မီ မတော်တဆဖြစ်ပွားမှုကို တုန့်ပြန်ဆောင်ရွက်ခြင်းကို တိကျသေချာစွာ ဆောင်ရွက်စေပါမည်။ ဆီသိုလှောင်ရုံတွင် အကြမ်းခံ၊ မီးခိုးငွေ့ကာကွယ်ရေးနှင့် အလင်းကာကွယ်ရေး ကိရိယာများ၏ ပုံမှန်လည်ပတ်ရေးအားသေချာစေပါမည်။

၃) ဆီသိုလှောင်ရုံတွင် မီးသတ်ပိုက်နှင့် မီးသတ်ပိုက်ရုံတွင် အသေတပ်ဆင်ထားသည့် လေမျှပ်မီးသတ်စနစ် တပ်ဆင်ထားပါမည်။ ဆီပါသည့်မီးသတ်ရေကြောင့် အနီးအနားရှိရေနှင့် မြေဆီလွှာများ ပျက်ဆီးမှု လျော့နည်းစေရန် မီးသတ်ရန်လိုအပ်သည့်ရေပမာဏနှင့် ကိုက်ညီသည့် အလတ်စားမြေပေါ် မီးသတ်ကန်ထားရှိမည်ဖြစ်ပြီး မီးသတ်ရေစုဆောင်းသည့်ကန်နှင့်အတူ တည်ဆောက်မည်ဖြစ်ပါသည်။

၄) ဆီသိုလှောင်ရုံတွင် အရေးပေါ်ကိရိယာနှင့် ပစ္စည်းအချို့အား အရေးပေါ်ဆီယိုစိမ့်မှုအား ထိန်းချုပ်ရန်၊ ပေါက်ကွဲစေသော ဆီတိုင်ကီစုပ်စက်နှင့် ဆီကန်များ၊ မြောင်းတူးဖော်မှုအတွက် အသုံးပြုသော ဘလောက်တုံးများနှင့် အထူးကိရိယာတန်ဆာပလာများအားအရေးပေါ်ပြင်ဆင်ရန်အတွက် တပ်ဆင်ထားရပါမည်။

(၂) ပေါက်ကွဲစေတတ်သော ပစ္စည်းသိုလှောင်ရုံအတွက် ပတ်ဝန်းကျင်ဆိုင်ရာ ဘေးအန္တရာယ်ကာကွယ်ရေး နည်းလမ်းများ

၁) သိုလှောင်ရုံတစ်ခုစီတွင် ပေါက်ကွဲပစ္စည်းများ၏အရေအတွက်သည် သတ်မှတ်ချက်နှင့် ကိုက်ညီရပါမည်။

၂) သိုလှောင်ရုံသည် သက်ဆိုင်ရာ ကာကွယ်သည့် မြေသားမြေထိန်းနံရံဖြင့် အဆောက်အဦးနှစ်ခုတိုင်းတွင်

ကာကွယ်သည့် အရံအတားတစ်ခုပါဝင်သည့် နမူနာပုံစံအတိုင်း တည်ဆောက်ရပါမည်။ ဇရိယာအား ဝင်ပေါက်နှင့် နံရံတို့ဖြင့် ထားရှိမည်ဖြစ်ပြီး နံရံနှင့် သိုလှောင်ရုံတို့အကြားအကွာအဝေးသည် ၁၅မီတာထက်ပိုမိုဖြစ်ပါသည်။ စောင့်ကြပ်ကြည့်ရှုသူအား သိုလှောင်ရုံတွင် ထားရှိမည်ဖြစ်ပြီး တာဝန်ခံရုံးခန်းကို သိုလှောင်ရုံအပြင်ဘက် ၂၅၀မီတာအကွာ သင့်တော်သည့်နေရာတွင် ထားရှိရမည်ဖြစ်ပါသည်။

၃) အပြင်ဘက် မီးသတ်ပိုက်များအား ပေါက်ကွဲနိုင်သည့်ပစ္စည်းသိုလှောင်ရုံနှင့် အရက်သိုလှောင်ရုံ အပြင်ဘက်တွင် တပ်ဆင်ရမည်ဖြစ်ပါသည်။ မီးသတ်ကန်အား ပေါက်ကွဲနိုင်သည့်ပစ္စည်း သိုလှောင်ရုံအပြင်ဘက် တောင်စောင်းတွင် တည်ရှိရမည်ဖြစ်ပြီး ရေပြင်းအားနှင့် ပမာဏမှာ သတ်မှတ်ချက်များနှင့် ကိုက်ညီရပါမည်။

၄) သတ်မှတ်ချက်များအတိုင်း ပေါက်ကွဲနိုင်သည့်ပစ္စည်းသိုလှောင်ရုံတွင် မည်သည့်လျှပ်စစ်ပစ္စည်းများမှ ထားရှိစေမည်မဟုတ်ပါ။ မီးကြိုးများသည် အတွင်းတွင် ကေလ်ဘယ်အလုံပိတ်ကြိုးအသုံးပြုရမည်ဖြစ်ပြီး သိုလှောင်ရုံအပြင်ဘက် အမြင့်ပိုင်းတွင် ထားရှိမည်ဖြစ်ပါသည်။

၅) ပေါက်ကွဲနိုင်သည့်ပစ္စည်းသိုလှောင်ရုံတွင် မိုးကြိုးလွှဲတိုင်တစ်ခုကိုမိုးကြိုးလွှဲရန်နှင့် ၎င်းအား တိုက်ရိုက်မိုးကြိုးပစ်ခြင်းမှကာကွယ်ရန် တပ်ဆင်မည်ဖြစ်ပါသည်။ ပေါက်ကွဲနိုင်သည့်ပစ္စည်းသိုလှောင်ရုံ၏ သတ္တုအစိတ်အပိုင်းအားလုံးကို လျှပ်စီးမှမှကာကွယ်ရန်အတွက် ဓာတ်ပြယ်သည့် မြေသားဖြင့် ထိတွေ့စေမည်ဖြစ်ပါသည်။

၁.၇.၃ ဘေးအန္တရယ်နှင့် မတော်တဆမှုများအတွက် အရေးပေါ်အစီအစဉ်

ဘေးအန္တရယ်ကာကွယ်သည့်နည်းလမ်းများအရ အကောင်အထည်ဖော်ဆောင်သည့်အဖွဲ့သည် ဒေသခံအစိုးရဆိုင်ရာဌာန၊ သိပ္ပံသုတေသနအဖွဲ့အစည်းများ၊ ဆောက်လုပ်ရေးအဖွဲ့နှင့် အခြားသော ဘေးအန္တရယ်နှင့် မတော်တဆမှုများ၊ အရေးပေါ် ပတ်ဝန်းကျင်ဘေးများ (အထူးသဖြင့် ညစ်ညမ်းမှု) နှင့် သက်ဆိုင်သည့် အရေးပေါ်ဘေးအန္တရာယ်တုန့်ပြန်သည့်အစီအစဉ် အကောင်အထည်ဖော်ဆောင်ရေး အတွက် ဘေးအန္တရယ်နှင့် မတော်တဆမှုများဖြစ်ပွားပြီးနောက် ပတ်ဝန်းကျင်ဆုံးရှုံးမှုများနှင့် ထိရောက်သည့် ဘေးအန္တရယ် လျော့ချရေးရည်ရွယ်ချက်ဖြင့် အရေးပေါ်ဌာနချုပ်များနှင့် ပူးပေါင်း၍ ညှိနှိုင်းဆောင်ရွက်ဖွဲ့စည်းရမည်ဖြစ်ပါသည်။

အရေးပေါ်အစီအစဉ်နယ်မြေရေးဆွဲရမည်ဖြစ်ပြီး အရေးပေါ်အဖွဲ့အစည်းနှင့် သက်ဆိုင်ရာတာဝန်ရှိသူများနှင့် စီမံကိန်းဘေးကင်းရေးဆောင်ရွက်သူများအား ခန့်အပ်ရမည်ဖြစ်ပါသည်။ အသိပေးရေးနှင့် ဆက်သွယ်ရေးအတွက် အထူးဆက်သွယ်ရမည့်လိပ်စာ သတင်းအချက်အလက်များကို ထားရှိရပါမည်ဖြစ်သည့်အပြင် အရေးပေါ်ကာကွယ်ရေးနည်းလမ်းများကို သိရှိနေစေရမည်ဖြစ်ပြီး ဝန်ထမ်းများဘေးကင်းရာရွှေ့ပြောင်းရေးအစီအစဉ်ကို ထားရှိရပါမည်။

၁.၈ စီမံခန့်ခွဲမှုအစီအစဉ်

၁.၈.၁ ပတ်ဝန်းကျင်သက်ရောက်မှုအတွက် သက်ရောက်မှုလျော့ချသည့်နည်းလမ်းများ

(၁) ရေဝန်းကျင်ဆိုင်ရာ ကာကွယ်ရေးနည်းလမ်းများ

ဘိလပ်မြေရောနှောသည့်စနစ်၏ ရေသုံးစွဲမှုပမာဏ နည်းမှုနှင့် အမြဲတမ်းစီဆင်းမှု မရှိသောကြောင့် သာမာန်အနည်စစ်ကန်အား သန့်စင်မှုအတွက် တူညီသည့် ပုံစံနှင့် ပမာဏကို အသုံးပြုမည်ဖြစ်ပါသည်။ မိလ္လာအတွက် သန့်စင်သည့်စနစ်တပ်ဆင်မည်ဖြစ်ပါသည်။ ပြုပြင်ထိန်းသိမ်းသည့် စနစ်၏ ဆီပါဝင်သည့် စွန့်ပစ်ရေကို သန့်စင်ရန်အတွက် ဆီဖယ်ရှားသည့် ကန်အသေးစားကို အသုံးပြုမည်ဖြစ်ပါသည်။

အောက်ခြေတွင်း စွန့်ပစ်ရေအတွက် copperas နှင့် polyacrylamide တို့ပါဝင်သည့် flocculant ထည့်၍ နှစ်နာရီမျှထားပြီး ရေများကို စုပ်ထုတ်ကာ ကြွင်းကျန်နေသည့် အနှစ်များကို ချက်ချင်း လူအင်အားဖြင့် ဖယ်ရှားရမည်ဖြစ်ပါသည်။

(၂) ကုန်းနေသတ္တဝါများအတွက် ကာကွယ်ရေးနည်းလမ်းများ

မီဒီယာများမှ သတင်းထုတ်ပြန်ခြင်း၊ ပညာပေးခြင်း နှင့် သက်ဆိုင်ရာသင်တန်းများကို အလေးထား၍ ဆောင်ရွက်သင့်ပါသည်။ ထိုနည်းလမ်းများသည် ကုန်းနေ သတ္တဝါများကို ကာကွယ်ရာတွင် လူထုအသိပညာတိုးပွားလာစေနိုင်ပါသည်။ ကောင်းမွန်သော ကာကွယ်ရေးအခြေအနေ ပေါ်ပေါက်ရန်အတွက် ၄င်းနည်းလမ်းများသည် အထူးသင့်တော်ပါသည်။

လယ်မြေတွင် အပင်များအား မီးရှို့ခြင်းကို လျော့ချရန် စိုက်ပျိုးမြေများသည် သီးနှံပြောင်းလဲစိုက်ပျိုးခြင်း အလေ့အထ နှင့် အမျိုးမျိုးသောသီးနှံစိုက်ပျိုးခြင်းများကို လုပ်ဆောင်သင့်ပါသည်။ သစ်တောအသုံးပြုမှုကို လျော့ချနိုင်ရန်အတွက်လည်း ဒေသနေပြည်သူများသည် အသုံးများလာသည့် စွမ်းအင်သက်သာသော မီးဖိုများ၊ မီသိန်း နှင့် လျှပ်စစ်စွမ်းအားကို အားပေးသုံးစွဲသင့်ပါသည်။

အထူးသဖြင့် သစ်တောအသစ် ကဲ့သို့ သစ်တောအရင်းအမြစ်များ ပြုန်းတီးမှုကိုလျော့ချရန် ခုတ်-ရှို့ နည်းလမ်းများမှ ခေတ်မီသော စိုက်ပျိုးရေးနည်းလမ်းအဆင့်ဆင့်ကို ဒေသနေပြည်သူများကို အစိုးရမှလမ်းညွှန်ရာတွင် ကူညီရပါမည်။

တည်ဆောက်ရေးလုပ်သားများအား ကာကွယ်ရေးနည်းလမ်းများအသိပညာပေးမှုကို တိုးမြှင့်စေပြီး ယင်းဇရိယာအတွင်း တောရိုင်းတိရစ္ဆာန်များ အမဲလိုက်ခြင်းကို တင်းကျပ်စွာ တားမြစ်ပြီး တောတွင်းတိရစ္ဆာန် များရောင်းဝယ်ဖောက်ကားမှုမရှိစေရန် တားမြစ်ထားပါသည်။

သဘာဝဂေဟဗေဒစနစ်နှင့် သစ်တောများ ပျက်စီးမှုကို တတ်နိုင်သလောက် လျော့ချပြီး မျက်နှာပြင်ပျက်စီးမှုကို လျော့ချရန် ပြင်းထန်သော မြေတူးဖော်ခြင်းနှင့် ဖို့ခြင်းများကို ရှောင်ရှားပြီး လမ်းခင်းလုပ်ငန်းများကို ဆောင်ရွက်သင့်ပါသည်။

ယျေဘုယ ရေနှင့်မြေဆီလွှာထိန်းသိမ်းစောင့်ရှောက်မည့်နည်းလမ်းများအရ ယာယီမြေစွန့်ပုံ၊ မြေစာပုံ၊ ယာယီတည်ဆောက်ရေးဇရိယာနှင့် လမ်းဆောက်လုပ်ရေးလုပ်ငန်းများ၏ မြေမျက်နှာပြင်များကို ပြင်ဆင်ထိန်းသိမ်းသင့်ပါသည်။ တည်ဆောက်ရေးလုပ်ငန်းများ ပြီးဆုံးချိန်တွင် ဆင်ခြေလျှောများ ထိန်းညှိခြင်းနှင့် မြေပြုပြင်ခြင်းကို ရေအား လျှပ်စစ်စီမံကိန်းနေရာ၊ မြေစာပုံနှင့် စွန့်ပစ်ပုံများတွင် လုပ်ဆောင်ပြီး သင့်တော့်သော အခြား စက်ရုံများအတွက် သစ်တောများ ပြန်လည်ထိန်းသိမ်းရန် ဆောင်ရွက်ပါမည်။

(၃) ရေနှင့်မြေဆီလွှာထိန်းသိမ်းကာကွယ်ရေးနည်းလမ်းများ

ယခု စီမံကိန်းတွင် ရေနှင့် မြေဆီလွှာထိန်းသိမ်းရေးအတွက် သတ်မှတ်ဇုန်များဖြစ်သည့် ပင်မအလုပ်လုပ်သည့်နေရာ၊ လမ်းဆောက်လုပ်ရေးနေရာ၊ ဆောက်လုပ်ရေးနှင့် နေထိုင်သည့်ဇရိယာ၊ မြေစာဖို့သည့်နေရာနှင့် စွန့်ပစ်သည့်နေရာ အစရှိသည်တို့ ပါဝင်ပါသည်။

(၁) ပင်မအလုပ်လုပ်သည့်နေရာ

ကောင်းမွန်သော ရေ၊မြေဆီလွှာ ရလဒ်များ နှင့် ဘေးကင်းသောဆောက်လုပ်ရေး စီမံကိန်းဖြစ်စေရန် ဆင်ခြေလျှောများ တူးဖော်ခြင်းအတွက် ကာကွယ်ရေးနည်းလမ်းများကို သေချာစွာ ချိန်ဆထားပါသည်။ စီမံကိန်းပြီးဆုံးပြီးနောက် လျှပ်စစ်ထုတ်လုပ်ရုံရှိ တူးဖော်ထားသော ဒေါင်လိုက် ဆင်ခြေလျှောများပေါ်တွင်

ရေနှင့်မြေဆီလွှာထိန်းသိမ်းရေးနည်းလမ်းများအရ သစ်ပင်များ ပြန်လည်စိုက်ပျိုးရန် အဓိက ရည်ရွယ်ထားပါသည်။

(၂) လမ်းဆောက်လုပ်ရေးနေရာ

စီမံကိန်းတည်ဆောက်ရေးနှင့် လည်ပတ်ရေးလုပ်ငန်းစဉ်များအတွက် လမ်းများကို ရေနှင့်မြေဆီလွှာထိန်းသိမ်းရေး နည်းလမ်းများအရ ပေါင်းစပ်တည်ဆောက်ရန် စီစဉ်ထားရှိပါသည်။

(၃) ဆောက်လုပ်ရေးနှင့် နေထိုင်သည့်ဇရိယာ

ဆောက်လုပ်နေစဉ်တွင်း သင့်တော်သော ယာယီရေမြောင်းစနစ်များကို ဆောက်လုပ်ရေးနှင့် နေထိုင်သည့်ဇရိယာများတွင် စီစဉ်ထားရှိပြီး စီမံကိန်းပြီးဆုံးချိန်တွင် မြေနေရာများညီ၍ အပင်စိုက်ပျိုးခြင်းများ လုပ်ဆောင်ရန် ရည်ရွယ်ထားပါသည်။

(၄) မြေစာဖို့သည့်နေရာ

မိုင်းခွဲနေစဉ် မြေစာနေရာတွင် သင့်တော်သော ရေမြောင်းများကို စီမံကိန်းဇရိယာအနီးတွင် စီစဉ်ထားရှိပြီး စီမံကိန်းပြီးဆုံးချိန်တွင် မြေနေရာများညီ၍ အပင်စိုက်ပျိုးခြင်းများ လုပ်ဆောင်ရန် လိုအပ်ပါသည်။

(၅) မြေစာဖို့သည့်နေရာနှင့် စွန့်ပစ်သည့်နေရာ

မစွန့်ပစ်ခင်ထိန်းသိမ်း ဟူသည့် နိယာမအရ ထိုမြေစာပုံ၏ အောက်ခြေတွင် ထိန်းသိမ်းမည့်နည်းလမ်းများကို စီစဉ်ထားပါသည်။ ထို့ပြင် အမှိုက်များစုပုံခြင်းမှ လျှော့ချပြီး ရေမြောင်းများ ကောင်းမွန်စွာ စီးဆင်းရန် အနီးပတ်ဝန်းကျင်တွင် အတားအဆီးများနှင့် ရေမြောင်းများကို စနစ်တကျထားရှိရပါမည်။ စွန့်ပစ်ပြီးနောက် အပေါ်ယံမြေလွှာ ပြုပြင်ညှိနှိုင်းခြင်းများနှင့် သစ်ပင်စိုက်ပျိုးခြင်းများလုပ်ဆောင်ရန် လိုအပ်ပါသည်။

(၆) ကျန်းမာရေးစောင့်ရှောက်မှု နည်းလမ်းများ

တည်ဆောက်ရေးဇရိယာတွင်းရှိ ကျန်းမာရေးအခြေအနေများကောင်းမွန်စေရန်အတွက် ဆောက်လုပ်ရေးတန်းလျားတွင် ပိုးမွှားများ မဝင်ရောက်စေရန် ဆောင်ရွက်ခြင်း၊ တည်ဆောက်ရေးဇရိယာရှိ ပိုးမွှားများ နှင့် ခန္ဓာကိုယ်တွင်းဝင်ရောက်နိုင်သည့် ရောဂါပိုးမွှားများထူထပ်မှုကို လျှော့ချခြင်း၊ တည်ဆောက်ရေးဇရိယာရှိ သဘာဝရောဂါများနှင့် ကူးစက်နိုင်သောရောဂါများနှင့် ဌက်ဖျားရောဂါကာကွယ်ခြင်းတို့ ပြုလုပ်သင့်ပါသည်။

စတင်အသုံးမပြုခင် အဆောက်အအုံတန်းလျား နှင့် တည်ဆောက်ရေးဇရိယာတွင်းတွင် သန့်ရှင်းရေးများကို လုပ်ဆောင်သင့်ပြီး အမှိုက်များကို ရှင်းလင်းသင့်ပါသည်။ တည်ဆောက်နေစဉ်တွင် သန့်ရှင်းရေး နှင့် ပိုးမွှားရှင်းလင်းခြင်းများကို တစ်နှစ်လျှင်အနည်းဆုံး နှစ်ကြိမ်ခန့် လုပ်ဆောင်သင့်ပါသည်။

Every construction unit and engineering management department should assign responsible

တည်ဆောက်ရေးလုပ်ငန်းနှင့် အင်ဂျင်နီယာလုပ်ငန်းစီမံခန့်ခွဲမှုဌာနသည် သန့်ရှင်းမှုနှင့် ကူးစက်မြန်ရောဂါများ ပြန့်ပွားခြင်းမှ ကာကွယ်ရန်တာဝန်ရှိသူများကို ခန့်အပ်သင့်ပြီး စီမံခန့်ခွဲမှုနယ်ပယ်အတွင်း သန့်ရှင်းမှုနှင့် ကူးစက်မြန်ရောဂါစောင့်ရှောက်မှုများ ဆောင်ရွက်ခြင်း နှင် တည်ဆောက်ရေးလုပ်ငန်းတွင်းရှိ ဝန်ထမ်းများ၏ တစ်ကိုယ်ရေ ကျန်းမာရေးနှင့် ကူးစက်မြန်ရောဂါများ ပြန့်ပွားခြင်းမှ ကာကွယ်ရန်အတွက် ရောဂါကာကွယ်ရေးနှင့် သက်ဆိုင်သည့် အသိပညာပေးလုပ်ငန်းများ တိုးပွားလာစေရန် အသံလွှင့်ခြင်း၊ သတင်းစာများ နှင့် လက်ကမ်းစာစောင်များမှ ဖြန့်ဝေပေးရန် တာဝန်ရှိပါသည်။

စတင်အသုံးမပြုခင်တွင် ကျန်းမာရေးနှင့်ပက်သတ်သည့် ကူးစက်တတ်သည့်ရောဂါများ မပြန့်နှံ့အောင် ကာကွယ်မှုများ ပြုလုပ်သင့်ပါသည်။ ကူးစက်ရောဂါများဝင်ရောက်ခြင်းနှင့် ရောဂါများဖြစ်ပွားလာမှုကို ကာကွယ်ရန် တည်ဆောက်ရေးလုပ်ငန်းတွင်း မည်သည့်ကူးစက်နိုင်သည့် ကပ်ရောဂါမျှ အဝင်မခံပါ။

စီမံကိန်းလုပ်ဆောင်စဉ်တစ်လျှောက်တွင် ဝန်ထမ်းများ၏ တစ်ကိုယ်ရေကျန်းမာရေးအတွက် ကျန်းမာရေးနှင့်ပက်သတ်သည့် ကူးစက်တတ်သည့်ရောဂါများ နှင့် ကာလအပိုင်းအခြားအလိုက် ရုပ်ပိုင်းဆိုင်ရာ စစ်ဆေးခြင်းများကို ဆောင်ရွက်သင့်ပါသည်။

တည်ဆောက်နေစဉ်အတွင်း သောက်သုံးရေသန့်ရှင်းမှုကိုလည်း အလေးထားဆောင်ရွက်ပါမည်။ မြစ်များမှ တိုက်ရိုက်ယူဆောင်သည့်ရေများကို ပိုးမွှားသန့်စင်ပြီး သောက်သုံးရေသန့်စင်သည့် စံချိန်စံနှုန်းများနှင့် ကိုက်ညီမှသာ အသုံးပြုသင့်ပါသည်။ ထို့ပြင် ရေမှတစ်ဆင့်ကူးစက်တတ်သော ရောဂါများမှ ကာကွယ်ရန် လိုအပ်သည့်သောက်သုံးရေ အရင်းအမြစ်နေရာများကို ကာလအပိုင်းအခြားအလိုက် စောင့်ကြပ်ကြည့်ရှုခြင်းများ ဆောင်ရွက်သင့်ပါသည်။

တည်ဆောက်နေစဉ်အတွင်း စားသောက်ကုန်များ သန့်ရှင်းမှုကိုလည်း အလေးထားဆောင်ရွက်ပါမည်။ တည်ဆောက်ရေးဇရိယာတွင်းရှိ အကျွေးအမွေး တာဂန်ယူထားသည့် နေရာများကို စောင့်ကြပ်ကြည့်ရှုခြင်းများ နှင့် အစားအသောက်သန့်ရှင်းမှု စစ်ဆေးခြင်းများကို လုပ်ဆောင်သင့်ပါသည်။ ထို့ပြင် သင့်တော်ပြီး သန့်ရှင်းသောလုပ်ရည်ကိုင်ရည် ရှိသည့်သူများကိုသာ အစားအသောက် ကျွေးမွေးသော နေရာများတွင် ဂင်ရောက်အလုပ်လုပ်ကိုင်ခွင့် ပြုရပါမည်။

တည်ဆောက်ရေးဇရိယာထဲတွင် လူထုကျန်းမာရေးစောင့်ရှောက်မှုများလည်း ခွဲဝေထားရှိသင့်ပါသည်။ ခြင်၊ ယင်၊ ကြွက် အစရှိသည့် ကူးစက်နိုင်သော အင်းဆက်များကို ပုံမှန်စစ်ဆေး ရှင်းလင်းပြီး ထိုစီမံကိန်း တည်ဆောက်ခြင်း ဇရိယာတွင် လူထု ကျန်းမာရေးစီမံခန့်ခွဲမှု၊ သန့်ရှင်းရေး နှင့် စွန့်ပစ်ခြင်းများအတွက် စောင့်ရှောက်မှုများပေးရန် ကျွမ်းကျင်ပညာရှင်များကို ခန့်အပ်ထားရန် အကြံပေးထားပါသည်။

တည်ဆောက်ရေးဇရိယာ၏ ဆေးဘက်ဆိုင်ရာဌာနသည် ဌက်ဖျားရောဂါများ ကုသရေးနှင့် ကာကွယ်ရေးအတွက် လုံလောက်သောဆေးဝါးများကို ထောက်ပံ့ပေးရပါမည်။ ထို့ပြင် ဌက်ဖျားရောဂါကာကွယ်ရေးအတွက် ဆေးဝါးများကို အချိန်အပိုင်းအခြားအလိုက် ပေးအပ်ပြီး ဌက်ဖျားရောဂါခံစားနေရသူများသည် အချိန်အတိုင်းအတာတစ်ခုထိ ကုသမှုကို ခံယူရမည်ဖြစ်ပါသည်။

ဖုန်ထူထပ်သော တည်ဆောက်ရေးနေရာတွင် အလုပ်လုပ်နေသော အလုပ်သမားများကို အမှုန်ကာကွယ်ရေးပစ္စည်းများဖြစ်သည့် အမှုန်ကာ ပစ္စည်းများကို ထောက်ပံ့သင့်ပါသည်။

ကွန်ကရစ်ဖျော်စက်တွင် လုပ်ဆောင်သူ၊ ဘူဒိုဇာ နှင့် မြေတူးစက် ယာဉ်မောင်းများ နှင့် လုပ်ငန်းလုပ်ဆောင်သည့် အလုပ်သမားများအတွက် အလုပ်ချိန်ခွဲခြားသည့်စနစ်ကို လုပ်ဆောင်သင့် ပါသည်။

(၅) လေထုကာကွယ်ရေးနည်းလမ်းများ

အမှုန်ထုတ်လွှတ်မှုလျော့ချရန် လက်တွေ့ကျသည့် ဖုန်စုပ်စက်တပ်ဆင်ထားသည့် ဆောက်လုပ်ရေး စက်ပစ္စည်းများ နှင့် မြေတူးခြင်း၊ မိုင်းခွဲခြင်းများအတွက် ရေဖျန်းစနစ်များကို အသုံးပြုသင့်ပါသည်။ အမှုန်ထုတ်လွှတ်မှုလျော့ချရန် မိုင်းခွဲနေစဉ်အတွင်း straw bag များကို မိုင်းခွဲသည့်မျက်နှာပြင်များပေါ်တွင် ဖုံးအုပ်ရန် အသုံးပြုသင့်ပါသည်။

ကောင်းမွန်သည့် ဆောက်လုပ်ရေးစက်ပစ္စည်းများနှင့် သယ်ယူပို့ဆောင်သည့်နည်းလမ်းများကို ဆောင်ရွက်သင့်သည်။ အမှုန်များကြောင့် လေထုညစ်ညမ်းမှုများမှ ကာကွယ်ရန် ဘိလပ်မြေများကို ကောင်းမွန်သည့် သိုလှောင်ကန်များတွင် ထားရှိခြင်းနှင့် ၄င်းတို့ကိုသယ်ဆောင်ရေးနှင့် ကိုင်တွယ်ရာတွင် သေချာစွာ ပိတ်ထားသင့်ပါသည်။

ကြီးမားသော ဆောက်လုပ်ရေးလုပ်ငန်သုံး စက်ပစ္စည်းများနှင့် ယန္တရားများကို စီမံခန့်ခွဲရာတွင် အလေးထားဆောင်ရွက်ရပါမည်။ မီးခိုးအထွက်နည်းပြီး အမှုန်ထွက်ရှိမှုကို ထိန်းချုပ်နိုင်သည့်

နည်းစနစ်များပါရှိသည့် စက်ပစ္စည်းကိရိယာများကို ထောက်ပံ့ပေးပြီး ယာဉ်များတွင် အိပ်ဇောသန့်စင်သည့်နည်းစနစ်ကို ထည့်သွင်းတပ်ဆင်သင့်ပါသည်။

လမ်းမကြီးများကို အချိန်အပိုင်းအခြားအလိုက် ပြုပြင်ထိန်းသိမ်းသင့်ပြီး ၄င်းလုပ်ငန်းများကို လမ်းပျက်ခြင်း၊ ဖုန်ထခြင်းမှ ကာကွယ်ရန် ယာယီလမ်းခင်းခြင်းများ အထူးဆောင်ရွက်သင့်ပါသည်။ အမှန်ထုတ်လွှတ်ခြင်းလျော့ချရန် မိုးရာသီမှအပ ကျန်ရာသီများတွင် ရေဖြန်းသင့်ပါသည်။

အမှန်ထုတ်လွှတ်ခြင်းလျော့ချရန် ရေနှင့်မြေဆီလွှာကိုထိန်းသိမ်းသည့်နည်းလမ်းများအရ လမ်းမ၏ဘေး ဘက်များတွင် အပင်စိုက်ပျိုးခြင်းများ လုပ်ဆောင်သင့်ပါသည်။

(၆) ပတ်ဝန်းကျင်ဆူညံသံ ကာကွယ်ရေးနည်းလမ်းများ

လေလံစာချုပ်များအရ ကောင်းမွန်သည့် တည်ဆောက်ရေးလုပ်ငန်းသုံးပစ္စည်းများ နှင့် ကိရိယာ ယန္တရားများကို ရွေးချယ်ခြင်း၊ အသံဆူညံမှုအနည်းဆုံးထွက်သည့် ကိရိယာများ နှင့် နည်းပညာများကို ရွေးချယ်ခြင်း၊ စက်ကိရိယာများပြုပြင်ခြင်းနှင့် စက်ဆီထည့်ခြင်း စသည်နှင့် အလုပ်လုပ်သည့်အချိန်တွင် ဆူညံသံအနည်းဆုံးဖြစ်အောင် အလေးထား ဆောင်ရွက်သင့်ပါသည်။

တုန်ခါမှုများသည့် စက်ကိရိယာများကို ဆူညံသံနည်းစေရန် တုန်ခါမှုလျော့နည်းစေသည့် အောက်ခံဖြင့် အသုံးပြုသင့်ပါသည်။

အလုပ်လုပ်ချိန်ကို သေချာစီမံခန့်ခွဲသင့်ပြီး မိုင်းခွဲခြင်းနှင့် လုပ်ငန်းစဉ်များကို မနက်(၇) နာရီမှ ည (၁၀) နာရီအတွင်း ပြုလုပ်ပြီး အနီးရှိတည်ဆောက်ရေးများကို လျော့ချရပါမည်။

လူနေရပ်ကွက်များနှင့် တည်ဆောက်ရေးတန်းလျား တစ်လျှောက် ယာဉ်ဖြတ်သန်းသွားရာ နေရာများတွင် ယာဉ်အန္တရာယ်သတိပေး ဆိုင်းဘုတ်များ တပ်ဆင်ခြင်း နှင့် တည်ဆောက်ရေးဇရိယာတွင်း ယာဉ်မောင်းနှင်နှုန်းသတ်မှတ်ထားသင့်ပါသည်။ အနီးရှိနေထိုင်သူများနှင့် တည်ဆောက်ရေး လုပ်ငန်းခွင်တွင်းရှိသူများကို သက်ရောက်မှုမရှိစေရန် နေ့အချိန်နှင့် ညအချိန်တွင် ယာဉ်များမှ ဆူညံသံများ မထွက်စေရန် လမ်းညွှန်ဆိုင်းဘုတ်များတွင် ရှင်းလင်းစွာ ရေးသားထားသင့်ပါသည်။

အလုပ်သမားအင်အား မလျော့သွားစေရန် ဆူညံသံထွက်ရှိသည့်နေရာနှင့် ဝေးသောနေရာများတွင် အလုပ်သမားများကို အလုပ်လုပ်စေပြီး ဆူညံသံအများဆုံးထွက်ရှိသည့် နေရာများအတွက် အလှိအလျောက် အဝေးစောင့်ကြပ်ကြည့်ရှုသည့် နည်းစနစ်များ ထားရှိသင့်ပါသည်။

တည်ဆောက်ချိန်အတွင်း ပြင်းထန်သောဆူညံသံထွက်သည့် အလုပ်နေရာများသို့ ဝင်ရောက်အလုပ်လုပ်မည့် အလုပ်သမားများသည် ဆူညံသံကာကွယ်သည့် တစ်ကိုယ်ရေအန္တရာယ်ကင်းရှင်းရေးပစ္စည်းများ ဝတ်ဆင်ထားသင့်ပါသည်။

(၇) အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း သန့်စင်မှု

မတူညီသောအရောင်များဖြင့် အော်ဂဲနစ် နှင့် အင်အော်ဂဲနစ်အမှိုက်များကို စုစည်းထားသည့် အမှိုက်ပုံးများအား လူနေဇရိယာများ နှင့် တန်းလျားများတွင် ခွဲခြား၍ ထားသင့်ပါသည်။ အမှိုက်များကို သန့်ရှင်း၍ သယ်ဆောင်သည့်ယာဉ်များကို ထောက်ပံ့ပေးသင့်ပြီး အမှိုက်သိမ်းသည့် ဝန်ထမ်းများကိုလည်း အမှိုက်သယ်ဆောင်ရာ လမ်းတစ်လျှောက် သန့်စင်စေရန် တာဝန်ပေးအပ်သင့်ပါသည်။ အင်အော်ဂဲနစ်အမှိုက်များ (ကျောက်မီးသွေးမှုန်များနှင့် အဆောက်အအုံဖြိုချထားသည့်အမှိုက်များ အစရှိသည်) တို့ကို ဆည်နှင့်အနီးတစ်ဝိုက်ရှိ အမှိုက်စွန့်ပစ်ပုံတွင် ထားသင့်ပြီး လျှပ်စစ်ထုတ်လုပ်ရုံကို ထိန်းသိမ်းရန်အတွက် မြေဖို့နိုင်ပါသည်။ ထို့ပြင် အမှိုက်သိုလှောင်နေရာ၏ ရေ နှင့်

မြေဆီလွှာထိန်းသိမ်းစောင့်ရှောက်ရေးနည်းလမ်းများအရ သစ်တောပျိုးထောင်မည့်နေရာအလွတ်များကို ထိန်းသိမ်းစောင့်ရှောက်သင့်သည်။ အော်ဂဲနစ်စွန့်ပစ်ပစ္စည်းများကို အင်္ဂေ့ထုတ်လုပ်မှုကင်းစင်သည့် အမှိုက်မီးရှို့စနစ်ဖြင့် ဆောင်ရွက်နိုင်ပါသည်။

တည်ဆောက်ရေးလုပ်ငန်းများပြီးဆုံးချိန်တွင် ဆောက်လုပ်ရေးတန်းလျားသည် အချိန်မှီ ဖယ်ရှားသင့်ပြီး အနီးရှိ စွန့်ပစ်ပစ္စည်းများ၊ ယာယီအိမ်သာများ နှင့် မိလ္လာကျင်းများကို သန့်ရှင်း၍ မြေနေရာညှိခြင်း၊ ပိုးမွှားများမရှိစေရန် ကာဘော်လစ်အက်စစ် နှင့် ထုံးများကို ဖြူးထားသင့်ပါသည်။

တည်ဆောက်ရေးကန်ထရိုက်တာများသည် အမှိုက်များသိမ်းဆည်းရန် အမြဲတမ်းဂန်ထမ်းများ ထားရှိသင့်ပြီး သံတိုသံစများ၊ သံချောင်းအပိုများနှင့် သစ်သားဆမျာကို စနစ်တကျ ခွဲခြားရန် တာဂန်ပေးအပ်ရပါမည်။ အမှိုက်များရှုပ်ထွေးမှုမရှိစေရန် တားမြစ်ချက်များထားရှိပါမည်။

အမှိုက်များသယ်ဆောင်စဉ်တွင်း သယ်ဆောင်သည့် လမ်းတစ်လျှောက်တွင် ဆောက်လုပ်ရေး ပစ္စည်းများကို ဖုံးအုပ်ထားသင့်ပြီး လမ်းမကြီးကို ပုံမှန်သန့်ရှင်းပေးသင့်ပါသည်။

၁.၈.၂ ပတ်ဂန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှုအစီအစဉ်

ပတ်ဂန်းကျင်ဆိုင်ရာ ထိန်းသိမ်းကာကွယ်ရေး စီမံခန့်ခွဲမှုအဖွဲ့ကို ချီဗွေရေအားလျှပ်စစ်စီမံကိန်း တည်ဆောက်ရေးဌာန၏အောက်တွင် ဖွဲ့စည်းရန်ရည်ရွယ်ထားပြီး တည်ဆောက်ချိန်တွင်း ပတ်ဂန်းကျင်ဆိုင်ရာ ထိန်းသိမ်းကာကွယ်ရေးအဖွဲ့၏ လုပ်ငန်းများနှင့် ဦးဆောင်မှုများကို နားလည်သဘောပေါက်စေရန် အမြဲတမ်းဂန်ထမ်းများ နှင့် ယာယီဂန်ထမ်းများ ခန့်အပ်ပါမည်။ ထိုအဖွဲ့အစည်း၏ အဓိကတာဂန်များမှာ- စီမံကိန်းတည်ဆောက်ချိန်တွင်း ပတ်ဂန်းကျင်ဆိုင်ရာ ကာကွယ်ရေးအတွက် နည်းလမ်းများနှင့် စီမံခန့်ခွဲမှုအစီအစဉ်များကို အကောင်အထည်ဖော်ဆောင်ရွက်ခြင်း၊ ပတ်ဂန်းကျင်ကာကွယ်ထိန်းသိမ်းရေးအတွက် ကုန်ကျငွေများ အပါအဂင် ၄င်းကာကွယ်ရေးနည်းလမ်းများ၏ နှစ်အလိုက်အစီအစဉ်များကို မှတ်တမ်းပြုစုခြင်း၊ ပတ်ဂန်းကျင်ကာကွယ်ထိန်းသိမ်းရေး၏ အထူးဆောင်ရွက်ချက်များအတွက် လေလံခေါ်ယူခြင်း၊ ကန်ထရိုက်တာ၏ ပတ်ဂန်းကျင်ဆိုင်ရာ ကာကွယ်ရေးနည်းလမ်းများ လုပ်ဆောင်ချက်အခြေအနေများအပေါ် စောင့်ကြပ်စစ်ဆေးခြင်းများ၊ စီမံကိန်းလည်ပတ်ချိန်၏ ပတ်ဂန်းကျင်ဆိုင်ရာ ကာကွယ်ရေးနည်းလမ်းများ လုပ်ဆောင်ချက်အခြေအနေများအပေါ် စောင့်ကြပ်စစ်ဆေးခြင်းများ၊ တည်ဆောက်ရေးလုပ်ငန်းများနှင့် ဆက်စပ်နေသည့် ပတ်ဂန်းကျင်ဆိုင်ရာ အငြင်းပွားမှုများကို ကူညီပေး၍ ပတ်ဂန်းကျင်ညစ်ညမ်းစေသည့် မတော်တဆမှုများကို ဖြေရှင်းပေးခြင်း၊ သက်ဆိုင်ရာ စီမံခန့်ခွဲမှုဌာနများသို့ အချိန်မှီ အစီရင်ခံခြင်း၊ ပတ်ဂန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုသည့်လုပ်ငန်းရပ်များ တည်ထောင်ခြင်း၊ တည်ဆောက်ရေးဇရိယာ၏ ပတ်ဂန်းကျင်ဆိုင်ရာအရည်အသွေးအစီရင်ခံစာကို ပြုစုရေးသား၍ ပုံမှန်တင်ပြခြင်း၊ ပတ်ဂန်းကျင်ဆိုင်ရာ ကာကွယ်ရေးအတွက် ပြည်သူကို အသိပညာပေးခြင်း နှင့် သင်တန်းများပေးခြင်း၊ စီမံကိန်းပြီးဆုံးချိန်တွင် လက်ခံနိုင်သည့် ပတ်ဝန်းကျင်ဆိုင်ရာ ထိန်းသိမ်းကာကွယ်ရေး အစီအရင်ခံစာကို ပြုစုရေးသားခြင်းတို့ဖြစ်သည်။

ချီဗွေငယ်ရေအားလျှပ်စစ်စီမံကိန်းလည်ပတ်စဉ်တွင် ကောင်းမွန်သည့် ပတ်ဂန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှုအဖွဲ့အစည်းတည်ထောင်ခြင်းအပါအဂင် ပတ်ဂန်းကျင်ဆိုင်ရာစီမံခန့်ခွဲမှု၏ အဓိကအကြောင်းအရာများ၊ ပတ်ဂန်းကျင်ဆိုင်ရာ လျော့ချသည့်နည်းလမ်းများ အကောင်အထည်ဖော်ဆောင်ရွက်ချက်များ နှင့် ပတ်ဂန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု နှင့် စောင့်ကြပ်ကြည့်ရှုခြင်းစနစ်များ တည်ထောင်ခြင်းတို့လည်း ပါဂင်ပါသည်။

လုပ်ငန်းလည်ပတ်စဉ်ကာလ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်ကို အခန်း ၁၁.၂.၇ တွင် ဖော်ပြထားပါသည်။

၁.၈.၃ ပတ်ဂန်းကျင်ဆိုင်ရာလုပ်ငန်းစဉ်များကို ကြီးကြပ်ခြင်း

ပတ်ဂန်းကျင်ဆိုင်ရာလုပ်ငန်းစဉ်များ စောင့်ကြပ်ကြည့်ရှုသူ၏ အဓိက တာဂန်များကို အောက်တွင်ဖော်ပြထားပါသည်- တည်ဆောက်မည့်အဖွဲ့အစည်း၏ အစီအစဉ်၊ စီမံချက်၊ အချိန်ဇယား၊ တည်ဆောက်ရေးလုပ်ငန်းမစခင်နှင့် ပြီးဆုံးချိန်တွင်း အသုံးချမှုအပြောင်းအလဲများကို စိစစ်သုံးသပ်ခြင်းတို့ ဖြစ်ပါသည်။

တည်ဆောက်ချိန်အတွင်း ပတ်ဂန်းကျင်ဆိုင်ရာကာကွယ်ခြင်းနည်းလမ်းအမျိုးမျိုးတို့ကို အကောင်အထည် ဖော်ဆောင်ရွက်မည့် အခြေအနေများကို စောင့်ကြပ်ကြည့်ရှုပြီး ပတ်ဂန်းကျင်အပေါ် သက်ရောက်နိုင်သည့် ဆိုးကျိုးများ သို့မဟုတ် ပတ်ဂန်းကျင်ဆိုင်ရာ ကာကွယ်ရေးနည်းလမ်းများကို ချိုးဖောက်ခြင်းများအတွက် အမှန်ပြင်ဆင်ချက်များ ထုတ်ပေးရန်ဖြစ်ပါသည်။ ပတ်ဂန်းကျင်ဆိုင်ရာ ကာကွယ်ရေးနည်းလမ်းများနှင့် တည်ဆောက်ရေးလုပ်ငန်းလုပ်ဆောင်မှုများကို ကိုယ်တိုင်ကိုယ်ကျ စစ်ဆေးနည်းများဖြင့် စောင့်ကြပ်ကြည့်ရှုရပါမည်။

စောင့်ကြပ်ကြည့်ရှုမှတ်တမ်းများကို မှတ်သားပြီး ပြုစုရေးသား၍ ၎င်းတို့ကို မှန်ကန်စွာသိမ်းဆည်းထားခြင်း၊ ပတ်ဂန်းကျင်ဆိုင်ရာစောင့်ကြပ်ကြည့်ရှုသည့် မှတ်တမ်းအစီအစဉ်များကို တည်ထောင်ခြင်း နှင့် ပတ်ဂန်းကျင်ဆိုင်ရာကာကွယ်ရေးနည်းလမ်း၏ ရလဒ်များနှင့် အချက်အလက်များကို စီမံခန့်ခွဲမှုများလည်း ဆောင်ရွက်ရပါမည်။ ပတ်ဂန်းကျင်စီမံခန့်ခွဲသည့် အဖွဲ့အစည်းများသို့ ထိုစောင့်ကြပ်ကြည့်ရှုထားသည့် လအလိုက်ဖြစ်စေ နှစ်အလိုက်ဖြစ်စေ အစီရင်ခံစာများကို လစဉ်၊ နှစ်စဉ် တင်ပြရပါမည်။

စီမံကိန်းလည်ပတ်နေစဉ်အတွင်း ပတ်ဂန်းကျင်ဆိုင်ရာကာကွယ်ရေးအစီအစဉ်နှင့် နည်းလမ်းများ အကောင်အထည်ဖော်ဆောင်ရွက်သည့် အခြေအနေများကိုလည်း စစ်ဆေးကြည့်ရှုပြီး ပတ်ဂန်းကျင်နှင့် ဂေဟဗေဒဆိုင်ရာ ကာကွယ်စောင့်ရှောက်မည့် အစီအစဉ်များ စစ်ဆေးကြည့်ရှုခြင်း၊ ရေလှောင်ကန်ဇရိယာနှင့် မြစ်အောက်ဘက်ပိုင်းကို ပတ်ဂန်းကျင်နှင့် ဂေဟဗေဒစနစ်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမည့်လုပ်ငန်းစဉ်များ နှင့် ပြဿနာတစ်စုံတစ်ရာပေါ် ပေါက်လာလျှင် လိုအပ်မည့် ပြင်ဆင်ချက်များကို အချိန်မီ ထုတ်ပြန်ချက်များ အစရှိသည်တို့ကို အလေးထားဆောင်ရွက်ရပါမည်။

၁.၈.၄ ပတ်ဂန်းကျင်ဆိုင်ရာအရည်အသွေး စောင့်ကြပ်ကြည့်ရှုခြင်း

စီမံကိန်းတည်ဆောက်ခြင်းနှင့် ဒေသ၏ပတ်ဂန်းကျင်လက္ခဏာရပ်များအရ ထိုစီမံကိန်း၏ ပတ်ဂန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုခြင်းကို ရေထု၊ လေထု၊ အသံဆူညံမှု၊ ကုန်းနေရေနေသတ္တဂါများနှင့် ရေနေဂေဟဗေဒစနစ်၊ ရေနှင့် မြေဆီလွှာထိန်းသိမ်းမှု နှင့် လူထုကျန်းမာရေးအစရှိသည်တို့အပါအဂင် ဆောက်လုပ်ရေးပတ်ဂန်းကျင်အနီးတွင်လည်း ဆောင်ရွက်သွားပါမည်။

၁.၈.၅ ပတ်ဂန်းကျင်ကာကွယ်ရေးအတွက် ရင်းနှီးမြှုပ်နှံမှု

၂၀၁၇ခုနှစ်၏ စက်တင်ဘာလတွင် ငွေအသုံးပြုမှုအခြေအနေအရ ပတ်ဂန်းကျင်ထိန်းသိမ်းကာကွယ်ရေး အတွက် အသုံးပြုငွေမှာ ပတ်ဂန်းကျင်ထိန်းသိမ်းရေးအထူးအသုံးပြုငွေ ၄၂၆၈၅၀၀ ယွမ်အပါအဂင် ၂၀၈၄၄၅၀၀ ယွမ်ဖြစ်ပြီး ရေနှင့် မြေဆီလွှာထိန်းသိမ်းရေးအတွက် အထူးအသုံးပြုငွေမှာ ၁၆၅၇၆၀၀၀ ယွမ်ဖြစ်ပါသည်။

၁.၉ နိဂုံးချုပ်

ချီဇွေရေအားလျှပ်စစ်စီမံကိန်း၏ ပတ်ဂန်းကျင်ဆိုင်ရာ ဆန်းစစ်ချက်များအားလုံးမှာ အောက်ပါအချက်များ

ဖြစ်ပါသည်။

အဓိကကောင်းကျိုးသက်ရောက်မှုများ - ချီဗွေရေအားလျှပ်စစ်စီမံကိန်းသည် လျှပ်စစ်ထုတ်လုပ်ရေးအတွက် အဓိကဖွံ့ဖြိုးတိုးတက်လာပြီး မြစ်ကြီးနားမြို့အထက်ပိုင်း ဧရာဝတီမြစ်ဝှမ်း ရေအားလျှပ်စစ်ဖွံ့ဖြိုးတိုးတက်ရေးတွင် ပါဝင်သည့် မြစ်ဆုံနှင့် ချီဗွေအနီးရှိ ရေအားလျှပ်စစ်စီမံကိန်းများအတွက် ဆောက်လုပ်ရေးစွမ်းအားကို ထောက်ပံ့ပေးသကဲ့သို့ မြန်မာနိုင်ငံမြောက်ပိုင်းဒေသ၏ လျှပ်စစ်စွမ်းအား ပြတ်လပ်မှုမရှိစေရန် ဆောက်လုပ်ရေးစွမ်းအားအပြင် ကချင်ပြည်နယ်တွင် လိုအပ်သည့် စီးပွားဖြစ်အသုံးပြုမှုများအတွက် လျှပ်စစ်စွမ်းအားကိုလည်း ထောက်ပံ့ပေးပါသည်။ ထို့ကြောင့် ဒေသနေပြည်သူများအတွက် အကျိုးကျေးဇူးများရရှိနိုင်ပြီး ဒေသတွင်းလူမှုစီးပွားဖွံ့ဖြိုးတိုးတက်မှုကိုလည်း တိုးပွားစေပါသည်။ ၄င်းရေအားလျှပ်စစ်စီမံကိန်းသည် ကချင်ပြည်နယ်၊ ချီဗွေမြို့သို့ လုံလောက်သော လျှပ်စစ်စွမ်းအားထောက်ပံ့ခြင်းပြီးမြောက်မှုပေါ်မူတည်၍ ရေရှည် လျှပ်စစ်စွမ်းအားမလုံလောက်မှု အခြေအနေကို ပြောင်းလဲခြင်း၊ ဒေသတွင်းလျှပ်စစ်စွမ်းအား ရရှိမှုအခြေအနေ နှင့် ယာဉ်အသုံးပြုမှုအခြေခံအဆောက်အအုံများ တိုးတက်လာခြင်း၊ ဒေသနေပြည်သူတို့၏ လူနေမှုဘဝနှင့် ကုန်ထုတ်လုပ်မှုများ အဆင်ပြေချောမွေ့လာခြင်း၊ ဆင်းရဲမှုလျော့ချရေးနှင့် လူနေမှုအဆင့်မြှင့်တင်ခြင်းအတွက် လိုအပ်ချက်များ ထောက်ပံ့ပေးခြင်းအပြင် ဒေသ၏ ဘဏ္ဍာငွေများတိုးမြင့်လာခြင်းနှင့် ဒေသတွင်း လူမှုစီးပွားများရေရှည်တိုးတက်ကောင်းမွန်လာခြင်းတို့ ဖြစ်ပေါ်လာနိုင်ပါသည်။ ထို့အပြင် ၄င်းစီမံကိန်းသည် ဧရာဝတီမြစ်၏ ရေအားလျှပ်စစ်ဖွံ့ဖြိုးတိုးတက်မှုတွင် အဓိကအခန်းကဏ္ဍမှ ပါဝင်ပါသည်။

အဓိကဆိုးကျိုးသက်ရောက်မှုများ - စီမံကိန်းတည်ဆောက်ခြင်း၊ ရေကြီးရေလျှံခြင်း၊ မြေယာသိမ်းဆည်းခြင်းနှင့် ဆည်ပိတ်ဆို့မှုများသည် ဒေသတွင်းဂေဟဗေဒစနစ်၊ ကုန်းနေရေနေသတ္တဝါများနှင့်အပင်များ၊ ရေနေသတ္တဝါများအစရှိသည်တို့ကို ထပ်လောင်း၍ ထိခိုက်စေနိုင်ပါသည်။ ထိုစီမံကိန်းတည်ဆောက်ချိန်တွင် အချိန်တိုအတွင်း ဆောက်လုပ်ရေးဇရိယာမြေပြိုမှုများကို ပိုမိုဖြစ်စေနိုင်ပါသည်။ ထို့ပြင် စီမံကိန်းတည်ဆောက်ချိန်တွင် ရေဆိုးနှင့် ဓါတ်ငွေ့များ၊ အသံဆူညံမှု နှင့် အညစ်အကြေးများ စွန့်ထုတ်မှုကြောင့် အနီးရှိပတ်ဝန်းကျင်နှင့် ဆောက်လုပ်ရေးအလုပ်သမားများ၏ တစ်ကိုယ်ရေကျန်းမာရေးကို ထိခိုက်စေနိုင်ပါသည်။ သို့သော် ထိုထိခိုက်မှုများသည် ဆောက်လုပ်ရေးအချိန်တွင်သာ ဖြစ်ပေါ်နိုင်ပြီး စီမံကိန်းတည်ဆောက်ပြီးချိန်နှင့် ပတ်ဝန်းကျင်ထိခိုက်မှု ကာကွယ်ရေးနည်းလမ်းများ လုပ်ဆောင်နေစဉ်တွင် တစ်ဖြည်းဖြည်းချင်း လျော့ကျသွားမည်ဖြစ်ပါသည်။

အထက်တွင်ဖော်ပြခဲ့သည့် စီမံကိန်းတည်ဆောက်ချိန်နှင့် လည်ပတ်ချိန်တွင် ဖြစ်ပေါ်နိုင်သည့် ထိခိုက်မှုများသည် အောက်ပါပတ်ဝန်းကျင်ထိခိုက်မှုကာကွယ်ရေးနည်းလမ်းများ လုပ်ဆောင်ပြီးချိန်တွင် လျော့ကျသွားနိုင်ပါသည်။ ၄င်းတို့မှာ- ရေ နှင့် မြေဆီလွှာထိန်းသိမ်းခြင်း၊ ပတ်ဝန်းကျင်ဂေဟဗေဒစနစ်များ ကာကွယ်ခြင်း၊ ဆောက်လုပ်ရေးမှ ထွက်ရှိသည့်ရေဆိုးနှင့် မိလ္လာရေးများ ပြန်လည်သန့်စင်ခြင်း၊ စွန့်ပစ်အမှိုက်များ ပြန်လည်သန့်စင်ခြင်း၊ ပတ်ဝန်းကျင်လေထုညစ်ညမ်းမှုများမှ ကာကွယ်ခြင်း နှင့် လူဦးရေအလိုက်ကျန်းမာရေး စောင့်ရှောက်ကာကွယ်ခြင်း အစရှိသည်တို့ဖြစ်ပါသည်။ ထို့ပြင် ပတ်ဝန်းကျင်ကာကွယ်ရေးနည်းလမ်းများသည်လည်း စီမံကိန်းတည်ဆောက်ခြင်းကို မထိခိုက်စေနိုင်ပါ။

1 Executive Summary

1.1 Project background

AyeyawadyRiver basin above Myitkyina owns abundant water resources and has relatively high development value. In recent years, the Government of Myanmar classifies the hydropower development as national priority as per the demand of social & economic development and meanwhile, transforms its advantage of resources to economic superiority. In 2005, Chinese investment in Myanmar ranked 11th in foreign investment and the Government of Myanmar expected to make use of Chinese capital and technology to develop its own hydropower resources. In October 2006, the Government of Myanmar invited China Power Investment Corporation (hereinafter referred to as "CPI") on the third China-ASEAN Expo (CAEXPO) to develop the hydropower resources of AyeyawadyRiver and Chindwin River etc. However, in view of market risk and such factors, CPI only decided to invest and develop the hydropower project in upper reaches of AyeyawadyRiver.

In December 2006, Ministry of Electric Power No. 1 Myanmar (hereinafter referred to as "MOEP1") signed the *Memorandum of Understanding on Hydropower Projects in Nmaihka River, MalikhaRiver and Chipwi Nge of Ayeyawady River, Myanmar*. In January 2007, Changjiang Survey, Planning, Design and Research Limited Co. (hereinafter referred to as "CDC") was entrusted by CPI to undertake the survey, planning, design and research works for the full process of Chipwi Nge Hydropower Station. According to field survey, CDC analyzed the hydropower resources and construction conditions of 12 tributaries nearby Myitsone and Chipwi hydropower stations and decided to build Chipwi Nge Hydropower Station in Chipwi River after sufficient discussion with CPI.

At the end of March 2007, CDC started the site investigation and hydrologic survey works and carried out the planning & design works based on it. In addition, CDC completed the *Feasibility Study Report of Chipwi Nge Hydropower Station in Upper Reaches of Ayeyawady River* in September 2007.

CDC, being entrusted by CPI Yunnan International Power Investment Co., Ltd. (hereinafter referred to as "CPIYN"), carried out the environmental impact assessment and survey work for hydropower development in upper reaches of Ayeyawady River together with Institute of Hydroecology of Ministry of Water Resources & Chinese Academy of Sciences (hereinafter referred to as "IHE"), South China Botanical Garden, Chinese Academy of Sciences (SCBG), South China Institute of Endangered Animals (SCIEA) and Biodiversity And Nature Conservation Association (BANCA). In 2009, a joint investigation team consisted of both Chinese and Myanmar parties aiming for finding out the ecological environment of the river basin carried out a deep investigation on the ecological environment in upper reaches of Ayeyawady River (including areas affected by 7 hydropower stations including Myitsone) and colleted the data about attitude of those people affected by the construction of the hydropower project, environmental issues concerned and requirements by means of questionnaire and interview. The team formally started works in January 2009 and completed in May, five months in total; and the rest work was completed by BANCA in July. Around 260 persons joined in the joint investigation, including more than 100 Chinese & Myanmar experts. After completing the survey works, IHE, SCBG and SCIEA separately completed the results of special study on aquatic and terrestrial ecology. BANCA also conducted, together with Chinese experts, the identification of specimens and the communication of survey results according to the survey data; completed the corresponding investigation and submitted the survey result report to CPIYN in October 2009.

In March 2010, CDC completed the *Environmental Impact Report of Hydropower Development*

in Upper Reaches of Ayeyawady River, which was submitted by CPIYN to MOEP1 in May 2010 and approved by MOEP1 in January 2011.

According to the *Environmental Protection Law* promulgated in March 2012 in Myanmar and the latest requirements of the Government of Myanmar regarding project approval in Myanmar, CDC, being entrusted by CPIYN in September 2013, completed the *Environmental Impact Report of Chipwi Nge Hydropower Station (Construction Power Plant), Hydropower Project in Upper Reaches of Ayeyawady River* in December 2013 in the light of the existing data related to environmental and social assessment.

Changjiang Institute of Survey, Planning, Design and Research (briefly called "Changjiang Design Institute" and hereinafter referred to as CISPDR), founded in Feb.1950 and affiliated to Changjiang Water Resources Commission, Ministry of Water Resources of China, is a stated-owned high-tech enterprise approved by the State and the international Contractor certified by Ministry of Commerce of China, mainly engaged in engineering survey, planning, design, scientific research, consulting, construction supervision, construction management and EPC contracting for the projects in China and abroad. It is one of the first batch certified comprehensive Grade A Survey and Design Enterprise in China and always ranks the top in the National Top 100 Survey & Design Enterprise with the strongest comprehensive strength.

CISPDR has 1959 employees with professional titles, including 2 academicians of Chinese Academy of Engineering, 3 National Masters for engineering Survey and 1 National Master for engineering design, 1 Candidate in the National Talent Program of New Era, 18 Candidates in 5151 Talent Program of Ministry of Water Resources, 4 Young Experts With Outstanding Contributions, 67 experts entitled to Government Special Allowances, 150 professorate senior engineers, 745 senior engineers and over 1000 registered engineers and Certified Public Accounts. With the comprehensive Grade-A certifications of engineering survey and engineering design and over ten other Grade-A Certifications, CISPDR, based in Wuhan, the Central City of China, has set up branches offices in 7 provinces and municipalities named as Hubei, Hunan, Henan, Chongqing, Shanghai, Guangdong and Tibet.

CSPDR has perfect Quality Management System and H.S.E Management Systems. CISPDR always sticks to the quality principle of "Contributing Quality Products by Scientific Management and Sustaining Improvement, Surpassing Customer's Expectation by Advanced Technology and Sincere Services".

The Environmental Conservation Department (ECD), Ministry of Environmental Conservation and Forestry (MOECAF) issued first notification regarding the comments for the draft EIA Report on Environmental Impact Assessment for Development of Chipwi Nge Hydropower on March 2016. MOECAF required CSPDR to investigate and monitor the baseline and public participation of the project zone again.

Based on this, Resource and Environment Myanmar Co., Ltd. was conducted environmental baseline data collection and public consultation activities on August 2016. The updated environmental baseline report and additional Social Impact Assessment Report are presented in Appendix I, II and III.

The project proponent prepared the second draft final EIA report and submitted to MOEE. MOEE forwarded this report to ECD on 1 June 2017 with reference letter MOEE Letter Electric-2 (Chipwi Nge) (5241)/2017.

The review team meeting on draft ESIA report held in Environmental Conservation Department (ECD) on 8 March 2018. Environmental Conservation Department issued notification letter EIA-1/7 (213/2018) regarding the comments for the draft ESIA Report on Environmental Impact Assessment for Development of Chipwi Nge Hydropower on 28 February 2018. The

project proponent prepared the final EIA report which corresponds to the terms and conditions as shown in Table 14.1.

1.2 Myanmar laws & regulations

To reasonably develop water, land, forest, mineral, marine and other natural resources and prevent degradation of natural & ecological environment, the federal government of Myanmar promulgated *Agenda and Environmental Policies of Myanmar in the 21st Century* on Dec. 5th 1994, stipulating that:

"People, cultural heritage, environment and natural resources are the first wealth of the country. Our environmental policy is aimed at considering the possible environmental impact during the development and realizing the harmony and balance between economic development and environmental protection, so as to improve the life quality of our people. Each country has its sovereignty to use natural resources in compliance with its environmental policy but must be careful to not exceed its jurisdictional limits or infringe the interests of other countries during the development of natural resources. The country and every citizen have the liability to protect the current and future natural resources and should always deem environmental protection as the key target during the development process."

On March 30th 2012, *Environmental Protection Law* was promulgated after being approved by the Federal Parliament and signed by President U Thein Sein. *Environmental Protection Law* of Myanmar is comprised of 42 articles in 14 chapters, mainly including tenet of environmental protection law, duties & responsibilities of the environmental protection department, environmental quality standard, environmental protection, urban environment management, natural resources and cultural heritage protection, project permit and punishment etc.

According to the existing data, the federal government of Myanmar has not issued any law or regulation related to the environmental impact assessment. Nowadays, major Myanmar laws related to environmental protection include *Forestry Law of Myanmar, Wildlife and Natural Area Protection Law* (1994), *Water Resources and River Protection Law* (2006), *Mineral Resource Law* (1994), *Fresh Water Fishery Law* (1991) and *Marine Fishery Law of Myanmar* (1990).

1.3 Project overview

1.3.1River basin

AyeyawadyRiver basin is situated at north latitude 15°30'~ 28°50' and east longitude 93°16'~ 98°42', and originates from the southwest foot of BoshulaMountains in Zayu County Tibet China. It is named Jitaiqu in Tibet and DulongRiver in Yunnan. It is called as Nmaihka River after flowing into Myanmar from Maku, Gongshan County Yunnan Province and only called as Ayeyawady River after converging with Malikha River in Myitsone Town around 45km above Myitkyina. AyeyawadyRiver has a total mainstream length 2714km and the catchment area approximately 410,000km^2, about 60% of the total water area in Myanmar.

Nmaihka River, 353km long in total, is the main source of Ayeyawady River, with the catchment area around 24,200km^2 (including 4,200km^2 in China) and the natural head about 1010m. Malikha River originates from the south foot of the Himalayas in the north of Myanmar, has three sources i.e. left, middle and right, 375km long in total, with the catchment area around 23,000km^2 and the natural head about 4470m. Catchment area of the upper reaches of AyeyawadyRiver is around 47,300km^2 (including 4,200km^2 inChina).

Chipwi River is a primary branch on the left bank of Nmaihka River, with the geographic coordinates 98°8′~98°28′EL and 25°30′~25°52′NL, originates from Gaoligong Mountain in China-Myanmar border area, from southeast to northwest and finally flows to Nmaihka River

nearby ChipwiTown. Chipwi River has the catchment area 743.6km^2, length 58.0km, fall around 3,000m, gradient 52‰ and average annual flow around 54.0m^3/s.

1.3.2 Hydropower planning in the river basin

In December 2006, MOEP1 and CPI signed the Memorandum of Understanding on Hydropower Projects in Nmaihka River, Malikha River and Chipwi Nge of Ayeyawady River, Myanmar. CDC, being entrusted by CPI, completed the Planning Report of Hydropower Development in Nmaihka River, MalihkaRiver and Chipwi Nge Hydropower Station of Ayeyawady River, Myanmar in December 2007; and completed the Feasibility Study Report of Chipwi Nge Hydropower Station (Construction Power Plant), Hydropower Project in Upper Reaches of AyeyawadyRiver in October 2009.

According to the characteristics of Ayeyawady River basin above Myitkyina and the requirements of national economic development of Myanmar on the river development, hydropower development in the upper reaches is done for purpose of power generation as well as flood control and improving the shipping and irrigation conditions in the lower reaches etc. Based on comprehensive analysis and comparison with respect to integrated utilization efficiency, technical conditions and economic indexes etc., the recommended scheme for cascade development of AyeyawadyRiver basin above Myitkyina is proposed as follows:

Nmaihka River and Ayeyawady River: Yenan (1010m) – Kaunglanhpur (875m) – Pisa (665m) – Wutsok (525m) – Chipwi (400m) – Myitsone (245m);

MalikhaRiver: Laza (370m)

According to the hydropower planning of the river basin and the preliminary work conditions of Chipwi Nge Hydropower Station, recommended scheme for cascade hydropower development of Ayeyawady River basin above Myitkyina specifies the total installed capacity 21,600MW and the annual power generation 111.09 billion kW·h.

In the light of MOA, it is planned to complete the development of hydropower project in upper reaches of AyeyawadyRiver within 15 years. According to the development conditions and the preliminary works, Myitsone and Chipwi stations will be developed in near term; Wutsok, Pisa, Kaunglanhpur and Laza stations are ranked amongst the second batch of projects to be developed while Yenan Station is the third batch.

1.3.3 Construction necessity of Chipwi Nge Hydropower Station

The project area is beyond the scope of Myanmar national grid and thus encounters with serious power shortage. The construction of Chipwi Nge Hydropower Station is capable of meeting the power demand for construction of Myitsone and Chipwi stations and guaranteeing the smooth implementation of hydropower development in the river basin. In addition, the project area has very rich natural resources but quite low level of development & utilization. Thus, Chipwi Nge Hydropower Station will play an important role in developing local resources, improving the local economy and increasing the life quality of local residents. Meanwhile, the construction of Chipwi Nge Hydropower Station means the formal commencement of hydropower development project in AyeyawadyRiver basin above Myitkyina, Myanmar. This is a strategic project for win-win results of China and Myanmar, necessary for mutual benefits and joint development, and is a specific action for enhancing long-term strategic cooperation between those two countries.

Chipwi Nge Hydropower Station has been left aside due to the suspended Myitsone Hydropower Station and the hindered Chipwi Hydropower Station. Meanwhile, related government of Myanmar required to speed up the construction of Chipwi Nge Hydropower Station repeatedly to supply electric power to KachinState since power supply is insufficient

and both life quality & economic development are affected in KachinState. Chipwi Nge Hydropower Station is now supplying electric power for commercial use to the local, in order to mitigate the existing short supply of electric power in the northern part of Myanmar, bring benefits to the local residents, promote the local socioeconomic development and meanwhile lower down the loss due to nonuse of Chipwi Nge Hydropower Station.

1.3.4 Geographical location

Chipwi Nge Hydropower Station dam is sited at Chipwi River – a tributary on left bank of Nmaihka River, in a straight river valley around 1.5km~2.0km upstream Labang Bridge, approximately 15km from ChipwiTown. The powerhouse is on the left bank of Nmaihka River, around 9km from the upstream ChipwiTown, 62km from the downstream Myitsone Hydropower Station and 20km from the upstream Chipwi Hydropower Station.

1.3.5 Development task, scale and operation mode

This project is developed for purpose of power generation and will act as the construction power plant of Myitsone and Chipwi stations developed in near-term for hydropower resource development of AyeyawadyRiver basin above Myitkyina. Meanwhile, to meet the requirement on construction power plant, this project will supply electric power for commercial use to KachinState as required, in order to mitigate the existing short supply of electric power in the northern part of Myanmar, bring benefits to the local residents and promote the local socioeconomic development. Chipwi Nge Hydropower Station belongs to the daily regulation type.

Chipwi Nge Hydropower Station has the normal pool level 740m, check flood level 745.99m, corresponding reservoir capacity 789,000m^3 and 1,234,000m^3 respectively, installed capacity 99MW and annual average power generation 599 million kW·h. Chipwi Nge Hydropower Station belongs to the daily regulation type. According to *Standard for Flood Control* (GB50201-94) and *Standard for Classification and Design Safety of Hydropower Project* (DL5180-2003), the project is a Class-III middle-sized project. The corresponding main structures such as dam, water diversion and power generation system, are ranked Grade 3; secondary structures Grade 4, and temporary structures Grade 5. The structural safety class of hydraulic structures is Class II.

1.3.6 Project layout and main structures

Chipwi Nge Hydropower Station is a diversion type and main structures include dam, water diversion and power generation system, diversion structure and power house etc.

Recommended layout of Chipwi Nge Hydropower Station is described as follows: dam and water intake are located at Chipwi River, concrete gravity dam, dam type intake; diversion line adopts the polygonal scheme, internal diameter of tunnel 4.0m; power house and tailrace tunnel on left bank of Nmaihka River; open type power house; axis of the power house inclines to axis of the penstock at an angle of 30°.

1.3.7 General layout and progress

(1) General layout

The construction area is arranged concentratedly in different zones and can be divided into three planning zones, i.e. dam, diversion tunnel and power house construction zones. Auxiliary construction facilities consist of living and production facilities. Living facilities include construction camps and offices; while production facilities include concrete mixing systems, processing plant for various materials, material warehouse and stockpile yards, machine parking and maintenance lots etc.

Sandstone material processing and concrete mixing system, construction area at both banks of

the dam site, office & living quarter are arranged downstream close to dam site. Machine parking lots, comprehensive processing yards for different materials, and stockpile yards are located upstream at the free locations with high elevation on the right bank. One spoil yard is located at each bank downstream the dam site.

Camps and offices are near the access road at elevation of 267.0m; other production facilities are arranged in the lower part of the project site at elevation of 235.0m, where the excavation wastes of the project area is dumped for leveling of the ground in the early stage and the excavation waste is piled along riverside the later stage.

The temporary construction road leading to mouth of each construction adit is around 28.0km long and 4.0m wide. At the mouths of $2^{\#}$& $3^{\#}$ construction adits, site leveling is done and meanwhile excavation waste from excavation of adit and main tunnel is piled nearby them. Excavation waste from $1^{\#}$ adit and a part of excavation waste from the main tunnel are transported to the spoil yard of the dam site; while excavation waste from $4^{\#}$, $5^{\#}$ and $6^{\#}$ adits and a part of excavation waste from the main tunnel are transported to the spoil yard of the plant area.

(2) Construction diversion

Water retaining dam of Chipwi Nge Hydropower Station is around 110m downstream the breached dam of cement-laid stone masonry, where there is large discharge in flood season and small discharge in dry season. A flood plain at el. 705m~713m is on the left bank of dam site. The river during the low-water season flows mainly from the river channel of the right bank. In addition, according to the analysis on dam scale and amount of works, concrete placement for the dam can be finished in one low-water period; therefore, it is suitable to close the river at one shot using tunnel or bottom outlets for diversion.

Water retaining dam of Chipwi Nge Hydropower Station is classified as Grade 3 permanent hydraulic structures. According to *Specifications for Construction Planning of Water Resources and Hydropower Projects* (SDJ338-89), the diversion structures, which protect the construction of permanent structures, are classified as Grade 5. The downstream and upstream earth-rock cofferdam and diversion tunnel for water-retaining dam are classified as Grade 5 structures.

In this scheme, permanent spillway and sediment sluice are used as diversion bottom outlet, which is located at the non-overflow dam section at the left of overflow dam section. For upstream of diversion bottom outlet, headrace channel formed by excavating foot of mountain is applied for diversion, while for downstream, the discharge chute of permanent spillway and sediment sluice is used for discharge.

(3) Construction progress

The total duration of the project is 32 months, in which the construction preparation period 3 months, the construction period of main works 26 months. The second and third units occupy 4 months of the straight-line period.

(4) Resources

Soils, rock block, sand & gravel and timber are all locally supplied; while other building materials need to be supplied by the border of Yunnan China with the haul distance over 100km.

Mobile and fixed type air compressors are provided to supply the air for construction with no other air supply system. Construction water can be directly pumped from the river by submersible pumps. Domestic water is as the same as potable water used by the local habitants; it is, therefore, preferably to take from local tap water or build small basins for water supply. Construction and living electricity should be supplied by self-provided power of the construction zones.

There are around 290 sets of construction machinery and vehicles. The number of labor during construction peak of main works is 830.

1.3.8 Inundation, land requisition and resettlement

The reservoir provides a water area 9.7hm^2 and an inundated land area of 8.1hm^2. The permanent land requisition is 7.6hm^2, including 4.8hm^2 for construction of the dam site (the overlap between dam site area and reservoir area is included in the reservoir area) and 2.8hm^2 for construction of power house; while the temporary land requisition is 56.39hm^2 in total.

As there is only a little garden and timberland without housing in the scope of land requisition, the impacts on production and living for the local people by land requisition of this construction is fairly small, excluding resettlement.

1.3.9 Investment estimate

Total static investment of the project is 1.119 billion Yuan.

1.4 Environment status

1.4.1 General of environment status survey

According to the *TOR of EIA on Hydropower Development of Ayeyawady River Basin Above Myitkyina* and the requirement of Myanmar government authorities, under the organization of CPIYN, CDC and BANCA, a joint investigation team comprised of SCBG, SCIEA, IHE and BANCA is established to find out the ecological environment of the river basin. It conducted a deep investigation on the baseline conditions of the aquatic lives, terrestrial plants & animals, environment quality and social environment etc in seven proposed cascade hydropower stations. It also collected data about the attitude of the affected people, the environmental issues concerned and the requirement by means of questionnaire and interview. The joint investigation started officially in January and completed in May 2009, lasting for 5 months. The rest work was completed by BANCA in July. About 260 people joined the investigation, among which there are more than 100 experts from China and Myanmar.

1.4.2 Natural environment

(1) Topography & geomorphy

The reservoir area is of low-medium mountainous landform with steep mountains on both banks and covers the Level-I & II terraces distributing along the river. There is a gully 1000m in length developed on the right bank of the reservoir head region. The river valley is 5m~30m in width and 5m~20m in cutting depth, with a flow approximately 1.5m^3/s. The gully bottom consists of gentle slopes and platforms made of mudflow deposits.

There are wide and thick mountains on both banks of the dam site. There is well-conserved vegetation. Level-I & II terraces develop on the upstream of the upper dam axis on the right bank, dipping to the riverbed and inclining downstream, basically in consistent with the riverbed gradient. Primary terrace develops on the downstream of the lower dam axis on the left bank along Chipwi River, dipping to the riverbed and inclining downstream. There are gullies of various sizes developing on both banks at the dam site, with perennial water flowing.

The power house area has low-medium mountainous landform at the southern edge of the Kachin mountain region, on the slope at the left bank of Nmaihka River, around 9km downstream ChipwiTown. In rainy season, the surface layer of the slope may be easily washed away, with the silty clay and the completely weathered layer scoured into gullies and locally into earth channels, leading to fracture of the slope surface. There are small gullies developing along the slope in the power house area, among which the gully around 800m upstream and the one at the downstream side are relatively large, where there is perennial water flowing.

(2) Hydrogeology

Chipwi Nge Hydropower Station is located in the Kachin mountain area, north of China-MyanmarMountains. Geotectonic unit belongs to Qinghai – Tibet rejuvenated orogen. There are mainly Chipwi fault stretching along Nmaihka River and Chipwi- Tengchong fault of Chipwi River stretching from east to west. Chipwi fault was inactive since 1,180,000 years ago. No active fault was observed within the range of 5km from the near-field region. The basin is located in an area with relatively stable regional tectonics.

The seismic peak acceleration over 10% in the area is 0.20g for 50 years with a basic earthquake intensity of VIII.

(3) Climate

The project site lies in Asia southwest monsoon zone, whose climate is affected by the southwest monsoon. There are three seasons in a year, i.e. hot season from March to May; wet season from June to October; and cool season from November to February. The average air temperature in January, the coolest month, ranges from 20℃ to 25℃; the average air temperature in April, the hottest month, ranges from 25℃ to 30℃. According to the statistical data of Lushui Station in the neighboring basin of the construction power station, the average days of thunderstorm for many years are 52.1d. According to the statistical data of Myitsone meteorological station from 2003 to 2004, the annual average water temperature is 23.0℃.

There is abundant rainfall in the basin with the annual rainfall of 2,000mm~4,000mm in the north and the delta, and that of 600mm~1,000mm in the plains at the middle stream of river. The maximum rainfall usually occurs in July, while rainfall is little from March to May. For instance, in Bhamo region in upper reaches of AyeyawadyRiver, the width of river is less than 500m in February, while it reaches over 3km in August. The range of water level is around 10m in a whole year.

(4) Hydrology and sediment

The runoff supply of AyeyawadyRiver basin relies on rainfall during flood season and on deep layer groundwater and some snowmelt during dry season. In Chipwi River basin, storms mainly occur from June to September and occur in June most frequently, accounting for 27% of the total statistical years. The 1-in-500 year flood is 2540 m^3/s, 1-in-100 year flood 1980m^3/s and 1-in-20 year flood 1320 m^3/s.

The average annual flow of Chipwi Nge Hydropower Station is 40.1m^3/s; the average annual runoff is 1,260,000,000m^3 and the average annual runoff depth is 2288mm. The controlled catchment area above the dam site of Chipwi Nge Hydropower Station is 552.3km^2; the average annual flow at the dam site is 40.1m^3/s and the annual runoff is 1,260,000,000m^3.

The average annual sediment transport quantity of Chipwi Nge Hydropower Station is 724,000t; the average annual bed-load sediment transport quantity is 145,000t and the average annual total sediment transport quantity is 869,000t.

(5) Soil and water & soil erosion

Main earth in the construction area includes brownish-red earth, red yellow earth, yellow earth, yellow brown earth, brown earth and dark brown earth etc. The area along the river is fertile alluvium. The ground slope of the construction area is greater than or equal to 35°; the percentage of coverage of forest and grass is about 60%. The protogene soil erosion of the construction area is mainly medium class.

1.4.3 Ecological environment

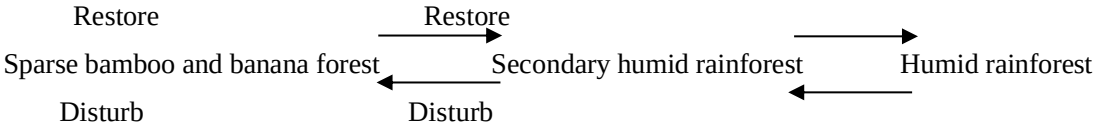
1.4.3.1 Terrestrial plants

Flora in Chipwi Nge Hydropower Station belongs to tropical Asia (India – Malaysia) region. This region is closely linked with Eastern Himalaysia region in its north and valleys of SalweenRiver taken as boundaries between China region in its east. Floristic elements in this region presents with convergence between east and west and compatibility between north and south.

According to the investigation, there are 556 species, 357 genera and 127 families of vascular plants in the Section Chipwi of Nmaihka River, including 21 families of Pteridophyta, 3 families of Gymnospermae and 103 families of Angiosperm. Tropical elements are very rich in this region.

According to the investigation results, existing vegetations in the area concerned in this project can be divided into 7 vegetation types, 9 vegetation sub-types and 13 communities. Form. Bombax ceiba and Dendrocalamus spp. of tropical spare tree-bamboo forest are most widely distributed in the project site. The community belongs to secondary vegetations formed after tropical rainforests are destroyed artificially. It is similar to spare monsoon community with respect to its appearance.

Zonal vegetation in the project area belongs to humid rainforest and now is degraded to spare bamboo and banana forest due to man-made interference. Cultivated land is little in this region and only a little has been degraded to shrub; while the riverside shrub is a type of disclimax community and a relatively stable type formed due to influence of periodic fluctuation of the river. Vegetation succession in the regional slope sections is described as below:



According to the investigation, rare and endangered plants in IUCN Red List are founded in Chipwi Section of Nmaihka River, including Tetrameles nudiflora, Aquilaria malaccensis Lam., Bhesa sinensis, Dipterocarpus retusus, Craibiodendron stellatum, Cephalotaxus griffithii Hook. f., Dipterocarpus turbinatus Gaertn. f., Taiwania cryptomerioides Hayata, and Bretschneidera sinensis Hemsl. In addition, species of Cyathea spp. and Orchidaceous species listed in CITES Appendices are sporadically distributed in the area.

1.4.3.2 Terrestrial animals

Chipwi Section of Nmaihka River where the project locates has relatively rich resources of wild animals; totally 41 species of mammal belonging to 6 orders, 18 families and 32 genera are recorded; 318 species of birds belonging to 18 orders, 56 families and 136 genera; 13 species of reptile belonging to 2 orders, 5 families and 13 genera; 14 species of amphibian belonging to 1 order, 4 families and 11 genera; and 216 species of butterfly belonging to 11 families and 125 genera.

According to the statistics and survey, totally 39 rare and endangered species are recorded, including 18 species of beast, 16 bird, 3 amphibian and reptile, and 2 butterfly. Totally 28 species are listed in IUCN Red List, including 18 species of beast and 10 bird; and 30 species are listed in CITES Appendices in total, including 17 species of beast, 8 bird, 3 amphibian and reptile, and 2 butterfly.

1.4.3.3 Aquatic animals

Totally 26 species of fish are collected in Nmaihka River, belonging to 3 orders and 4 families,

including 18 species of cypriniformes of 2 orders, 7 species of siluriformes of 1 order and 1 species of anguilliformes of 1 order.

In Chipwi River section, the utilization of fish resources is of a very low level, both the fishing method and the working tools are simple. There are no professional fishermen. Common fishery harvestings include Schizothorax meridionalis, Tor putitora and Garra qiaojiensis etc.

Chipwi River is a primary branch on the left bank of Nmaihka River. According to analysis on the habitat of Chipwi River, fishes species adapting to the torrential flow habitat such as Scaphiodonichthys, Sisoridae, Glyptothorax and Pseudecheneis are possibly distributed in Chipwi River.

The additional physical baseline data collection report and additional ecology report are presented in Appendix I and II.

1.4.4 Social environment

KachinState is located at the north of Myanmar, abuts on Yunnan ProvinceChina. Total area of KachinState is 89,000km^2, about 13% of Myanmar territory. It consists of 3 counties called Myitkyina, Putao and Bhamo and their governmental 18 towns, with a total population around 1,420,000. Besides Kachin as its main ethnic group, there are also Burman, Shan, Lisu, Axi, Laxi, Yawang, Xianu, Xiadu and Ganan ethnic groups etc.

Agriculture is the pillar industry for KachinState and the principal crops are paddy, sorghum, corn, sugarcane, rape etc. The total planted area of KachinState is about 120,000hm^2 of which 56,700 hm^2 is irrigated land and 20,200hm^2 is interplant area. For the planted area, 70% is paddy field and the rest is dry land, garden land and grove. Paddy is an important crop with the total planted area accounting for 75% of the total planted area. Paddy in this area is mainly planted on the plain and mountain. There is about 5,670km^2 protective forest land which is distributed in Morning, Myitkyina, Bhamo and Shwegu etc. The forest products are teak, hardwood and so on and they are another very important source of income.

Myitkyina is the capital of Kachin State Myanmar, it is the northernmost river port and railway terminal of Myanmar, with a distance of 1480km to Rangoon and 780km to Mandalay, about 45km downstream of the Myitsone at the confluence of the left source (Nmaihka River) and right source (MalihkaRiver) of AyayawadyRiver. The permanent residents in Myitkyina City is over 200,000, mainly consisting of Kachin, Shan and Burman nationalities.

According to the preliminary investigation, there is no great mineral resource in this project area. Gold dust appears in Nmaihka River and AyeyawadyRiver mainstream section, and gold mining has become an important industry and major source of income for the local residents.

The local epidemics are mainly malarial disease, dengue fever, cholera etc.

1.4.5 Current situations of environment quality

According to the investigation, there is no large-size industrial & mining enterprise in this project area, without source of industrial pollution. In addition, the domestic sewage is little since the reservoir surroundings are sparsely and dispersedly populated; crop farming is mainly adopted in villages within the reservoir area, major crops such as paddy, sorghum, corn, sugarcane, rape etc.; but fertilizer and agricultural chemicals are rarely used.

Entrusted by CPIYN, the Environmental Monitoring Station in Tengchong County, Yunnan Province of China monitored the water quality in sections of the dam site and power plant of Nmaihka River in October 2004. According to the monitoring results, the water quality of both sites is quite good and can meet " Environmental quality standards for surface water "(China, GB3838-2002) .

1.5 Environmental impact assessment

1.5.1 Hydrologic regime

Normal pool level of Chipwi Nge Hydropower Station is 740m; and the storage capacity below this normal pool level is about 789,000m^3. This reservoir is a typical river-channel type with daily regulation capacity. The reservoir area is about 0.10km^2 with a backwater length about 0.75km.

After completion of this project, there will be flow-reduction section about 15.9km between the dam site and river mouth. From November to next April, the diversion generation will result in significant decrease of flow below dam and the flow below dam in that period is the ecological flow released from the project (0.53m^3/s). In the meantime, the downstream water level below dam decreases, however, with confluence of numerous creeks, the flow in the flow-reduction section will increase gradually and the gaps between downstream discharge and water level and the natural condition will decrease gradually.

The power house is located at the main stream of Nmaihka River. Chipwi Nge Hydropower Station diverts water from the branch (Chipwi River) of Nmaihka River to the main stream of Nmaihka River. Designed discharge for power generation is 26.46 m^3/s, only accounting for 1.2% of the average annual flow of Nmaihka River at the location of power house. Therefore, there are basically no impact on the water regime of Nmaihka River channel upstream the power house.

1.5.2 Water environment

Impacts on water quality of Chipwi River during construction period mainly includes alkaline waste water from mixing, washing and curing for concrete; oily waste water from maintenance of construction mechanical equipment; foundation pit drainage; and domestic sewage from construction personnel etc.

The size of construction is fairly small with little sewage, and the composition of the pollutants is simple. After taking relevant treatment measures, there will be no obvious adverse impact on the water quality of Chipwi River, and the impact is temporary. After completion of the construction, the impact will disappear.

After the project being implemented, the normal pool level will be 740m and the backwater length will be about 0.75km. The water level of the reservoir area section will be higher than the level before the dam being built. The water surface will become relatively wider and the water volume in this project and its backwater area will be increasing. The diluting impact will be strengthening and the water quality in the reservoir area will be improved as a whole. The decrease of the discharge capacity between the dam site and the river mouth section will affect the dilution and self-cleaning capacity of the water body.

Chipwi Nge Hydropower Station is provided with daily regulation capacity. Calculated by runoff storage method, a>20. Thereby, the reservoir is identified as a mixed type and there will be not lamination in water temperature of the reservoir. There is no impact on the water temperature of the reservoir by the construction and operation of this project.

1.5.3 Aquatic organism

The fish stocks in the water system of Nmaihka River are mainly the those adapting to torrential flow. After completion of the project, the fish stocks in the reservoir area will migrate to the upstream torrential flow habitat. As Chipwi Nge Hydropower Station is a development type of low dam diversion, the backwater length for the reservoir area is about 0.75km, and the range of impact on the fishes that adapt to torrential flow (such as Scaphiodonichthys, Sisoridae, Glyptothorax and Pseudecheneis) by the construction is fairly small. Dam blockage will affect

the fish interflow between Chipwi River and Nmaihka River.

After the project is implemented, the amount of water in the 15.7km river section between the power house and downstream the dam site will be reduced sharply in dry season that will result in population decreasing for planktons and bottom faunas in that river section, so that amount of fish resources in that river section will be reduced accordingly. However, as the fishes in this river section are widely distributed in Nmaihka River basin, the construction of the station may only reduce the range of habitat adaptation, and the reduced range is relatively small, so that the range of impact on fishes by reducing the amount of water in the flow-reduction section is limited.

1.5.4 Terrestrial organism

The construction activities (such as reservoir inundation, dam & power house construction, construction road, headrace tunnel, adit etc.) of Chipwi Nge Hydropower Station will provide an area of damaged surface vegetation of 12.2hm^2. The project implementation will not lead to the disappear of species or the sharp decrease of quantities of individuals. In terms of the vegetation in the project area, the damaged vegetation area due to construction is fairly small with a relatively low impact.

All vegetation damaged due to the project construction except for permanent buildings will be restored gradually since the works are completed and the measures of water & soil conservation, afforestation and beautification are taken gradually, and in the construction area, the high air temperature, rich rainfall, fast vegetation grow and strong vegetation resilience. Productivity of the terrestrial plants can be almost restored to their original level by means of manual work.

The reservoir size of Chipwi Nge Hydropower Station is fairly small, and the reservoir area will only be increased by 0.08km^2 after reservoir impoundment. There is basically no impact on the reptiles and mammals inhabiting around the reservoir area.

Purchase of wild animals by construction or management personnel will promote the wild animal trade activities in the project area, so as to induce the hunters to increase the intensity and frequency of hunting and thus lead to the decrease in quantity of wild animals. Therefore, greater emphasis on control of the construction or management personnel shall be laid.

1.5.5 Soil erosion

The increased soil erosion possibly due to the construction of Chipwi Nge Hydropower Station may be mainly caused by the construction activities such as foundation excavation of dam & power house, excavation of diversion tunnel, borrow site excavation, construction road, auxiliary enterprises and office & living areas, spoil yard etc.

According to the present situations of soil erosion in the project area, total soil erosion possibly caused by the project construction is around 16,262t based on analysis and forecast, including 9,241t newly-increased soil erosion. However, the newly-increased soil erosion can be effectively mitigated and controlled after taking appropriate measures.

1.5.6 Others

All other adverse effects, such as influence on air, sound, solid wastes to a certain extent in the construction area, are temporary, with small range and low level of influence. All those can be effectively mitigated or controlled by taking corresponding prevention measures.

1.6 Social impact assessment

1.6.1 Social economy

Chipwi Nge Hydropower Station, with the installed capacity 99MW and the average annual power generation 599,000,000kW·h, is mainly developed for purpose of supplying electric

power for the development of Myitsone and Chipwi Hydropower Stations of Ayeyawady River; meanwhile besides meeting the requirement for construction power source, electric power for commercial use will be supplied to Kachin State as required, so as to mitigate the insufficient power supply in the northern part of Myanmar, bring benefits to the local residents, and promote the local socioeconomic development.

The construction of Chipwi Nge Hydropower Station and other cascade stations in upper reaches of Ayeyawady River in sequence will help to improve the external traffic conditions; while the input of capital for project development and construction will bring a great number of employment opportunities for local people and promote the development of other related industries, thus it will play an active role in improving the life quality of local residents and promoting the economic development. Implementation of Chipwi Nge Hydropower Station will play an important role in promoting the socioeconomic development in the river basin and even in KachinState.

1.6.2 Religious and ethnic culture

Construction of Chipwi Nge Hydropower Station does not involve resettlement or local religious facilities and thus will not affect the regional space combination structure of minority culture. However, foreign culture will possibly affect the local minority culture to a certain extent. Kachin, Shan and Burman nationalities, all relatively great in Myanmar are mainly involved in the project construction, with long culture and history. Thus foreign culture has limited influence on them.

The project construction will help to promote the local economic & social development, improve the life quality of local residents, enhance the further cooperation and unity of various nationalities and solve the problems and difficulties encountered during the development of relationship between local nations.

1.6.3 Indigenous people

Indigenous people (the ethnic minorities), as a social group having obvious difference with dominant groups in the society, always belong to the mostly marginalized and weak group in local population. Their economic, social and juridical status always restrict their interest and capacity for protecting their own land, territory and other productive resources, or limit their capacity for obtaining benefit from development projects that they have joined in. Therefore, we should give extensive attention and emphasis on the adverse effect on indigenous people due to reservoir inundation during the construction of Chipwi Nge Hydropower Station and take feasible measures to protect interests of indigenous people.

1.6.4 Vulnerable groups (women etc.)

Construction of Chipwi Nge Hydropower Station will bring a number of employment opportunities for the local; while the demand of construction & technical personnel for food and daily necessities etc. during the construction will help to promote the development of the tertiary industry i.e. rendering auxiliary service. Beside mitigating the life stress of vulnerable groups (women etc.), this project will give employment opportunities to them, so as to improve life quality of the women. More capital will be provided to the medical & educational infrastructures if fiscal revenue of the government increases, so as to greatly improve the educational level and physical health of the vulnerable groups.

1.6.5 Land resources

The reservoir has a water area of 9.7hm^2 and the inundated land area 8.1hm^2. Permanent land occupation is 4.8hm^2 in the construction area of the dam site. Chipwi Nge Hydropower Station has relatively small size and small inundated and land occupation area. Thus, it will have little

influence on the land resources in the project area.

1.6.6 Water resource utilization

AyeyawadyRiver Basin above Myitkyina is located in the northernmost part of KachinState, north of Myanmar, where Myanmar national grid can't get access to. There is a severe shortage of power. The government and residents with good economic conditions (shop and hotel owners), have self-equipped small diesel generators to supply power. Chipwi Nge Hydropower Station can, upon its completion, improve the ratio of hydropower resource utilization, provide power guarantee for the local economic & social development, mitigate the long-term power shortage of local residents, and furthermore play an important role in promoting the water resource development in AyeyawadyRiver.

1.6.7 Influence on water use in lower reaches

Upon completion of Chipwi Nge Hydropower Station, there will be a flow-reduction section about 15.7km between the dam site and river mouth. According to the project design scheme, 0.53m^3/s ecological flow will be released by the dam. In addition, the nearest two creeks are 1.6km downstream the dam with a catchment area of 10.0km^2 and 5.45km^2 respectively. As estimated, the average annual discharge is 0.73m^3/s and 0.4m^3/s respectively, with 0.53m^3/s release from the dam added in, the average discharge of the location 1.6km downstream the dam is up to 1.66m^3/s.

According to field survey, the residential areas are distributed on a scattered basis on both banks of the river section between the dam site and the river mouth, and these residential areas have a fairly large elevation difference from Chipwi River with a long distance. The domestic water for the local people is mainly from the streams and springs nearby without the water directly taken from Chipwi River. There are no requirement for irrigation and water supply in the discharge-reducing section. Therefore, Chipwi Nge Hydropower Station will have no great influence on the production and domestic water in the lower reaches upon its completion.

1.6.8 Infrastructure

To facilitate the material transportation, the investor will improve the grade of roads in the northern part of Myanmar, to obviously improve the traffic conditions in the project area, facilitate the travel of local people, and provide convenience for investment promotion and economic development.

Infrastructure construction of Chipwi Nge Hydropower Station are still developing and quite weak. Construction of Chipwi Nge Hydropower Station will increase the economic & social development level in Chipwi and then improve the medical & educational infrastructures in the project area.

1.6.9 Population health

Construction personnel will gather at the site during the construction, thus the population density is increased in this region. Diarrhea, virus hepatitis and other intestinal infectious diseases will spread if fails to strengthen the sanitation management environment, drinking water and food. Construction and technical personnel from other regions are more apt to be affected by endemic disease as compared to the local people. The construction personnel from different places may carry with pathogen from their origins. Consequently, corresponding measures for prophylactic immunization and preventing epidemics shall be taken.

The updated SIA and Public Consultation Report is shown in Appendix III.

1.7 Environmental risk assessment

1.7.1 Environmental risk analysis

According to the construction unit plan of Chipwi Nge Hydropower Station, totally two oil depots and one explosive magazine are built during the project construction. However, oil depot and explosive magazine will encounter with emergencies and then possibly lead to explosion accident during the construction, so as to pollute the air and water environment, cause environment risk and will possibly give rise to water supply risk in the downstream construction area; thus it is classified as a new risk. The reservoir will possibly cause geological disaster risk after impoundment; emergent pollution of the reservoir area will possibly lead to water pollution risk; and change in living condition will cause the alteration of aquatic animals' habitats; possibility of all those risks will increase due to reservoir impoundment.

1.7.2 Environment risk prevention measures

(1) Environment risk prevention measures for oil depot

1) Establish strict safety management system for oil depot, and specify the requirements on oil transport, storage and use.

2) Provide the perfect accident alarming system, guarantee the timely accident treatment; and ensure the normal operation of shockproof, smoke-prevention and lightning protection facilities in the oil depot;

3) Oil depot will be equipped with fire pump and fixed type low-expansion air foam fire extinguishing system in the fire pump house; provided with one semi-aboveground fire water pool with the capacity meeting the demand for one fire extinguishing; and built with the fire water collecting tank, to lessen the damage of nearby water and soils caused by oily fire water; and

4) The oil depot shall be equipped with some emergency equipment and tools for emergency oil leakage control, explosive oil well pump and oil vessels, blockings used for ditch excavation, and special tools & instruments for emergency repair etc.

(2) Environment risk prevention measures for explosive magazine

1) Quantity of explosives in each magazine shall comply with the specification.

2) The magazine shall be built with corresponding protective earth embankment, as per the layout that every two buildings have one protective barrier; the area is provided with gate and wall, distance between the wall and various magazine shall be greater than 15m; sentry shall be deployed in the magazine; and duty room shall be situated at the proper location 250m outside the magazine.

3) Outdoor fire hydrants shall be installed outside the explosive magazine and the shot house. Fire pool shall be sited on a mountain slope outside the magazine; both the water pressure and volume shall conform to the specification.

4) According to the specification, the magazine shall be provide with no any electrical equipment. Power supply line shall adopt concealed cable inside and adopt overhead laying outside the magazine.

5) The magazine shall adopt independent lightning tower for protection, to protect it against direct lightning stroke. All metal parts of the magazine shall be subject to multiple & equipotential grounding, to prevent from static.

1.7.3 Emergency plan for risks & accidents

On the premise of taking risk prevention measures, the development unit shall coordinate and organize, jointly with local governmental department, scientific research institutes, construction

unit and other such emergency headquarters for risk & accidents, the implementation of risk emergency response plans with respect to emergent environment risks (mainly pollution), for purpose of effectively mitigating the hazard and environment loss after the risks & accidents.

Designate the emergency plan zone, establish the emergency organization and appoint corresponding commanders and site rescuers; provide the special contact information for alarming and communication; popularize the emergency protection measures; and establish the personnel evacuation and removal plan.

1.8 Management plan

1.8.1 Mitigation measures for environmental influence

(1) Water environment protection measures

In view of intermittent drainage and low water volume of the concrete mixing system, the simple sedimentation pond of same form and scale will be adopted for treatment; domestic sewage will adopt packaged treatment facilities; oily sewage of the repair system will use small-size oil separation tank for treatment; for wastewater in the foundation pit, feed the flocculant consisted of copperas and polyacrylamide to the foundation pit, keep still for 2h, pump out water and promptly remove the residual sludge through manual work.

(2) Terrestrial organism protection measures

Attention shall be paid to publicity and education and personnel training. By means of those measures, public awareness of protection of the terrestrial wildlife can be enhanced. This is good for formation of good protection atmosphere.

Cultivated land should adopt crop rotation and intercropping as practical as possible, to reduce burning vegetation for farmland. Meanwhile, local residents should be encouraged to popularize and use energy-saving stove, methane tank and electric power, to decrease the consumption of fire wood, so as to reduce consumption of forest.

Assist the local government to train the local residents, so as to make them step into modern agricultural production from slash-and-burn farming method, to reduce destruction for forest resource especially virgin forest.

Enhance the protection awareness of the construction personnel. Strictly prohibit hunting wild animals, and completely eradicate activities of wildlife and products trade etc. that may cause influence on wild animals in this area.

The works, especially construction roads, shall be done by lowering down and avoiding high cut & fill as practical as possible, to prevent disturbed surface and mitigate the damage to natural ecology and vegetation as much as possible.

The general plan of soil and water conservation measures should be prepared for exposed surface of the temporary soil yard, borrow site, temporary construction area, construction roads. After completing the construction, stabilization of side slope and land reclamation shall be carried out promptly on the periphery of the hydropower stations, borrow site and spoil yard, and suitable species of indigenous plant will be planted for vegetation restoration.

(3) Water and soil conservation measures

Control zones classified for soil & water conservation include main works area, construction road area, construction production & living area, borrow site and spoil yard etc. in this project.

1) Main works area

The main works design has weighed protective measures for excavation of high slope and slopes of headrace tunnel, so as to achieve safe project construction and good soil and water conservation results. The soil and water conservation measures in the main works area are

mainly of planning vertical afforestation on excavated slopes in the power house area upon completion of project.

2) Construction road area

Soil and water conservation measures are planned for the construction road combined with project construction and operation. These measures include: slope protection, road drainage etc.

3) Construction production and living area

During the construction period, the appropriate temporary drainage system is planned in the construction production and living area; upon completion of the project, site leveling and afforestation are required.

4) Borrow sites

During mining in the borrow sites, appropriate drainage ditches should be arranged in surrounding areas of the sites; upon completion of the project, site leveling and afforestation are required.

5) Spoil yard

According to the "retaining before discarding" principle, retaining measures are arranged at the bottom of the spoil yard. Also the intercepting and drainage ditches are set in its surrounding area to ensure fluent drainage and reduce possibly loss of spoil. After spoiling, the top of site leveling on top of the spoil body and afforestation are required.

(4) Population health protection measures

To ensure the environmental health in the construction area, measures such as killing & disinfestation shall be taken in the construction camp, to lower down the density of various pathogenic microorganism and entomoplily in the construction area, prevent & control the prevalence of malaria & such infectious disease etc. and natural focal disease in the construction area.

Before mobilization, a sanitary cleaning should be implemented in the camp buildings and activity-dense places in construction area. Weeds, rubbish and solid waste should be cleared out. At least twice sanitary cleaning and disinfection shall be done every year during the construction.

Every construction unit and engineering management department should assign responsible persons for sanitary and epidemic prevention, to take charge of sanitary and epidemic prevention works within the management scope and be responsible for the publicity and education regarding construction safety and health for the construction personnel by means of broadcasting, wall newspaper and brochure etc., so as to enhance their awareness on disease prevention.

Health quarantine should be implemented before mobilization. No any infectious victim is allowed to join in the construction, so as to prevent cross-infection and prevalence of diseases. Health quarantine and period physical examination for construction personnel shall be done throughout the entire project.

Pay attention to the drinking water sanitation during the construction. Water directly taken from rivers can only be used after being disinfected and proving that it complies with the standard for drinking water sanitation. In addition, carry out periodic monitoring on water resource and drinking water as required, to prevent water-borne infection disease.

Pay attention to food sanitation during the construction. Carry out frequent food sanitation inspection and monitoring for various catering industries in the construction area, and all personnel engaged in the catering industry are only allowed to work after obtaining corresponding sanitary license.

Public health facilities should be reasonably allocated in the construction area. The vectors (such as mosquitoes, mice, flies etc.) should be regularly killed. It is advised to assign or employ professionals to take charge of the public health management, cleaning and disposal in the construction area of this project.

Medical center in the construction area must be provided with sufficient medicines for preventing and curing malaria. In addition, medicines for preventing malaria must be given to the construction personnel periodically. Malaria patients should receive timely treatment.

For construction personnel working at the construction sites with high dust yield, dust prevention devices (such as dust respirator etc.) should be provided.

Shift system should be implemented for operators of concrete mixers, drivers of bulldozers and excavators, and workers of comprehensive processing plant.

(5) Air environment protection measures

Wet working method is preferred for drill-splitting, boring and blasting, and construction machinery equipped with dust collector should be used as practical as possible to reduce the dust generation. During the open blasting, straw bag shall be used to cover up the blasting surface as practical as possible, to reduce the dust generation.

Construction machinery and transport facilities under good working conditions should be adopted. Cement shall be kept under good sealing conditions by means of storage tank and sealed transport during the handling and transporting, to prevent dust pollution.

Lay greater emphasis on the management of large-size construction machinery and vehicles. Mechanical equipment shall be provided with corresponding smoke prevention and dust control facilities and vehicles shall be equipped with exhaust purifier.

Highway should be maintained periodically. The maintenance work should be enhanced especially for temporary road with mud stone pavement, to prevent pavement from breaking and dusting. Sprinkle water along highway except for rainy days, to reduce dust generation.

Carry out afforestation and landscaping works at both sides of the highway in combination with water and soil conservation measures, to reduce dust generation.

(6) Sound environment protection measures

According to the bidding contract, the construction unit should select construction machinery and tools under good working conditions, choose low-noise equipment and technology, pay attention to the equipment maintenance, make machines be lubricated properly, and lower down the working noise.

Mechanical equipment with heavy vibration shall use vibration-absorbing pedestal to lower down noise.

Working time should be reasonably arranged. Open blasting and comprehensive processing plant shall be stopped from 10:00pm to 7:00am, to lower down influence on the surrounding construction personnel.

Traffic sign or warning sign should be erected in sections where vehicles passing through living quarter and construction camp; running speed of vehicles should be limited in the construction area. Specify clearly on the guideboard that construction vehicles should not whistle in the daytime and must not whistle in the nighttime, to prevent affecting nearby residents and construction personnel.

Improve the automation level and realize long-distance monitoring for strong noise source, which can not only decrease the number of workers but also make workers stay away from the noise source.

During the construction, workers shall wear appliances for noise protection when entering into the working area of strong noise, i.e. rock drilling, boring, excavation and machine driving etc.

(7) Solid waste treatment

Garbage bins with different colors should be provided in the living area and the owner's camps, which are used for collecting inorganic and organic wastes respectively. Waste cleaning and transporting vehicles should be provided and dustmen should be assigned for the cleaning and transporting of routine domestic waste. Inorganic waste (such as coal ash and demolition waste) should be dropped to the spoil yards near the dam site area and the power house site respectively to be landfilled and protected, and the afforestation of blanks should be recovered according to water and soil conservation measures for the spoil yards. Smoke-free incinerator can be adopted for treatment of organic domestic wastes.

After completion of the construction, the construction camps should be removed in time and the surrounding domestic waste, temporary toilets and cesspits should be cleaned up and leveled up, and carbolic acid and calcium lime should be used for disinfection.

The construction contractor should arrange full-time staff for collecting production waste. Assigned positions should be provided for piling up waste iron, rebar and wood fragments etc. Cluttering is prohibited.

During transportation, the construction materials should be covered to avoid falling along the way. The pavement of main road should be cleaned up regularly.

1.8.2 Environmental management

It is proposed to establish an environmental protection management organization below Department of Construction of Chipwi Nge Hydropower Station and assign 1~2 full-time staff and several part-time staff, for purpose of realizing the unified leadership and organization of environmental protection works during the construction period.

Main duties and responsibilities of the above organization include: establishing the implementation planning and management method for environmental protection during construction period; compiling the annual work plan for environmental protection, including environmental protection investment plan; organizing the bid invitation for special work of environmental protection; supervising the implementation status of environmental protection measures of the contractor; supervising and inspecting the operation status of environmental protection measures related to the project; assisting the construction unit to deal with environment dispute related to the project and solve environmental pollution accidents; timely reporting to the superior or related management department; organizing the environmental supervision & monitoring works; periodically compiling and submitting the environmental quality report of the construction area; carrying out the publicity, education and training on environmental protection, and; compiling the environmental protection acceptance report etc. for project completion.

During the operation of Chipwi Nge Hydropower Station, the main contents of environmental management including the establishment of specialized environmental management agency,the implementation of the environmental mitigation measures and the establishment of environmental management and supervision system.

Environmental management plan during operation period is presented in section 11.2.7.

1.8.3 Environmental supervision

Main duties and responsibilities of the environmental supervisor are described as follows: review the construction organization plan, scheme, schedule, change order and application for commencement & completion etc. submitted by the construction unit in combination with the

requirements on construction environment protection; and deliver detailed opinions on the environmental protection plan and measures drafted by the construction unit.

Supervise the implementation status of various environmental protection measures during the construction and issue the rectification order in case of violating the environmental protection requirement or causing adverse effect on the environment.

Supervise and check the self-inspection works of the construction unit with regard to environmental protection.

Properly compile and record the supervision log and keep its integrity and authenticity; establish the environmental supervision file and carry out the management of environmental protection results and data. Submit the monthly supervision report to the environmental management organization every month and submit the annual report and the final report every year.

Check and supervise the implementation status of environmental protection plan and measures during the operation period; pay attention to the supervision and inspection of operation status of ecological and environmental protection facilities; check and supervise the ecological and environmental monitoring work in the reservoir area and its downstream area, and; timely put forward the rectification requirement and adjustment opinion in case of any problem.

1.8.4 Environmental monitoring

According to the project construction and the region environment characteristics, environmental monitoring for this project is determined in combination with the influence of construction on region environment, including: water environment, air environment, sound environment, terrestrial & aquatic ecology, water & soil conservation and population health etc.

1.8.5 Environmental protection investment

According to the price level in the third quarter of 2007, investment for environmental protection is 20,844,500 Yuan, including 4,268,500 Yuan special investment for environmental protection and 16,576,000 Yuan special investment for water & soil conservation.

1.9 Conclusion

Overall assessment on environmental impact of Chipwi Nge Hydropower Station is as follows:

Main positive impacts: Chipwi Nge Hydropower Station is mainly developed for power generation, supplying construction power for near-term Myitsone and Chipwi Hydropower Stations in hydropower development of Ayeyawady River Basin above Myitkyina; and meanwhile, supplying electric power for commercial use to Kachin State as required besides the construction power, in order to mitigate the existing power shortage in the northern part of Myanmar, bring benefits to the local residents and promote the local socioeconomic development. This station will, upon its completion, provide sufficient electric power and energy to ChipwiTown Kachin State, change the status of long-term power shortage, improve the conditions of local electric power & traffic infrastructures, facilitate the production and livelihood of local people, provide facilities for poverty alleviation and well-off; and in addition, increase local fiscal revenue and promote sustainable development of regional social economy. Meanwhile, it will also play a very important role in the hydropower development of AyeyawadyRiver.

Main negative impacts: project construction, reservoir inundation, land occupation and dam blockage may affect the integrity of regional ecosystem, terrestrial animals and plants, aquatic lives etc. Construction of this project will intensify soil erosion of the construction area in a short period. In addition, waste water & gas, noise and spoil generated during the construction period may affect the surrounding environment and the health of construction personnel. However, those impacts are limited to the construction period and will gradually reduce or

disappear along with the completion of project and the implementation of environment protection measures.

The abovementioned negative impacts caused by project construction and operation can be minimized after taking corresponding measures of environmental protection as follows: water and soil conservation, ecologic environment protection, construction wastewater & sewage treatment, solid waste treatment, atmospheric environment protection and population health protection etc. Therefore, there are no restraining factor that may affect project construction in respect of environmental protection.

2 General rules

2.1 Assessment purpose

In the decision-making process of the project, our company gives due consideration to environmental problems related to Chipwi Nge Hydropower Station, andcoordinates the relationship between the construction of Chipwi Nge Hydropower Station and social & economic development as well as environmental protection of Kachin State so as to prevent and reduce the possible unfavorable environmental impact after the implementation of the project, and ensure the coordinate development of Chipwi Nge Hydropower Station and local ecological environment, society and economy.

2.2 Assessment principles

(1) Principle of sustainable development: natural resource is the material basis for human survival and development, and sustainable development is the highest criterion for the assessment of impact on ecological environment. As for the assessment of Chipwi Nge Hydropower Station's impact on the environment, it is required to assess the project construction's impact on terrestrial and aquatic biological resources as well as water resource from the perspective of the integrity of the ecological system so as to prevent the project from gravely affecting the sustainable development of the area.

(2) Principle of the harmonious development between human and nature: environmental protection is consistent with economic & social development in terms of the long-long and overall interest of Myanmar. However, they might be in conflict with each other sometimes from the short-term, regional perspectives. The assessment of the project's environmental impact should, on the basis of stressing long-term interest and overall interest, take into consideration short-term unfavorable impact and reduction measures.

(3) Principle of ecological protection: hydropower stations should be of non-pollution ecological damage. Assessment of environmental impact should aim to meet needs of biodiversity protection, water and soil conservation. The construction of hydropower stations should not lead to the extinction of any species, and not affect rare and endangered species whenever possible. If unavoidable, the corresponding protection measures should be brought forth.

(4) Principle of up-to-standard discharge: during operation, hydropower stations basically do not discharge toxic and harmful pollutants. Nevertheless, the discharge of "three wastes" during construction can not be ignored. Pollutants should be controlled rigorously, and discharged up to standard.

(5) Principle of reasonable environmental protection measures: fully reveal environmental impact assessment's adjustment to the project construction, offer the basis for the comparison and selection of project design schemes from the angle of environmental protection, and optimize the selected design scheme. Environmental protection measures should be directed at specific problems and operable for the convenience of supervision and management by environmental administrations.

Besides, the assessment of environmental impact should also comply with basic principles such as science, objectiveness, fairness, and giving prominence to key points.

2.3 Project assessment types

Chipwi Nge Hydropower Station is an energy project of hydro-electrical power, which is the Type A project categorized by the Environmental Assessment Guideline by Asia Development Bank.

2.4 Assessment basis

The assessment of Chipwi Nge Hydropower Station's environmental impact is mainly based on technical guidelines and manuals of the World Bank, and refers to technical guidelines and standards of Asia Development Bank and China in the aspect.

2.4.1The World Bank's manuals and guidelines in the assessment of environmental impact

(1) The World Bank Operational Manual - *Environmental Assessment* (OP/BP/GP4.01)

(2) The World Bank Operational Manual - *Environmental Action Plan* (O P /BP 4.02)

(3) The World Bank Operational Manual - *Natural Habitat* (OP/BP/4.04)

(4) The World Bank Operational Manual - *Indigenous Peoples* (OP/BP4.10) ;

(5) The World Bank Operational Manual-*Natural Culture Resources* (OP /BP 4.11) ;

(6) The World Bank Operational Manual - *Involuntary Resettlement* (OP/BP4.12) ;

(7) The World Bank Operational Manual - *Forests* (OP/BP4.36)

(8) The World Bank Operational Manual - *Dam Safety* (OP/BP4.37)

(9) The World Bank Operational Manual - *Projects on International Rivers* (OP/BP7.50)

(10) The World Bank Operational Manual - *Information Disclosure* (OP/BP17.50)

(11) The World Bank*NGO Participation*(GP14.70)

(12) The World Bank *Social Assessment Guide*(1998)

(13) The World Bank Social Analysis Resource Manual (2002)

(14) The World Bank Pollution Prevention &Reduction ManualPollution Prevention and Abatement Handbook (1998)

And also Asian Development Bank's *Environmental Assessment Guideline* (2003), *Social Analysis Manual*, *Policies for Involuntary Resettlement*, and *Immigrant Manual*, and also China's technical guidelines concerning environmental impact assessment.

2.4.2 Related laws, rules and policies of Myanmar

Environmental Protection Law of Myanmar(2012) ;

Water Resource & River Protection Law of Myanmar(2006);

Forestry Law of Myanmar;

Protection of Wildlife and Wild Plant and Conservation of Natural Areas Law of Myanmar(1994) ;

The Union of Myanmar Foreign Investment Law and Detailed Rules for the Implementation of The Union of Myanmar Foreign Investment Law;

Agenda and Environmental Policies of Myanmar in the 21st Century (1994).

2.4.3 Technical documents

Planning Report of Hydropower Development in Nmaihka River, Malikha River and Myitsone of Ayeyawady River, Myanmar (CDC, December 2007);

Environmental Impact Report of Hydropower Development in Upper Reaches of Ayeyawady River (CDC, March 2010) ;

Special Research Report on Aquatic Organism Investigation &Assessment in the Upper Reaches of Ayeyawady River (Institute of Hydroecology, March 2010) ;

Special ResearchReport on Terrestrial Organism Investigation &Assessment in the Upper Reaches of Ayeyawady River (South China Botanical Garden, March 2010) ;

Report on the Assessment of Hydropower Development's Impact on Society and Immigrants in the Upper Reaches of Ayeyawady River(CDC, March 2010) ;

Investigation Report on Public Participation in Hydropower Development in the Upper Reaches of Ayeyawady River (CDC, March 2010) ;

Environmental Quality Status Investigation & Monitoring Results in the Upper Reaches of Ayeyawady River (Myanmar BANCA, 2009);

Feasibility Study Report of Chipwi Nge Hydropower Station (Construction Power Plant), Hydropower Project in Upper Reaches of Ayeyawady River (CDC, 2007);

2.5 Assessment scope

This engineering environmental impact assessment covers the hub engineering, reservoir area, and water-reduced river reach. Investigation and assessment scope of different environmental factors should be determined according to impact mechanism and impact degree. Considering the fact that Chipwi Nge Hydropower Station is located at Nmaihka River, and its tail water basically does not affect the water environment and aquatic ecology of the River, the assessment of Chipwi Nge Hydropower Station's impacts on hydrological regime, water environment, and aquatic ecology is only limited to the mouth of Chipwi River. See Table 2.5-1 for the assessment scope of each environmental factor.

Table 2.5-1 Scope of Environmental Impact Assessment of Chipwi Nge Hydropower Station

Environmental factor	Assessment scope
Hydrological regime	From the end of reservoir of Chipwi Nge Hydropower Station to the mouth of Chipwi River, plant tail water involving Nmaihka River section
Water environment	From the end of reservoir of Chipwi Nge Hydropower Station to the mouth of Chipwi River, plant tail water involving Nmaihka River section
Atmospheric environment	Construction management area extends 2km both to the upstream and downstream of the river valley.
Acoustic environment	Construction management area and 200m around the boundary of construction management area
Terrestrial ecology	From the end of reservoir of Chipwi Nge Hydropower Station to the area below Grade I watershed at the two sides of the mouth of Chipwi River, and 500m around the plant
Aquatic organism	From the end of reservoir of Chipwi Nge Hydropower Station to the area below Grade I watershed at the two sides of the mouth of Chipwi River, plant tail water involving Nmaihka River section
Social environment	Kachin State

2.6 Goals of environmental protection

(1) Coordinate the relationship between the construction of Chipwi Nge Hydropower Station and regional environmental protection, economic and social development, and facilitate the sustainable development of the regional economy.

(2) Reasonably develop water resources of Chipwi River, and minimize the unfavorable impact caused by changes of hydrological regime.

(3) Keep the current water quality of Chipwi River so as to make the water quality not decline due to the project during the construction of the project and after the operation of the project.

(4) Relieve possible unfavorable impacts on rare and endangered wild animals and plants by hydropower development within the assessment scope; and relieve possible unfavorable impacts on aquatic organism by hydropower development.

(5) Reserve forests and farmlands, reduce farmland loss whenever possible, protect forest vegetation, restore the vegetation of lands occupied by construction temporarily, and reduce possible unfavorable impacts on drainage landscape and ecological environment by project construction.

(6) Guarantee the health of construction personnel, and avoid the spreading of infectious diseases and local diseases in the construction area during the construction period.

2.7 Working procedures of environmental impact evaluation

The compilation of this environmental impact assessment report is mainly divided into the following two stages.

(1) Compilation and consultation of the guideline for the environmental impact evaluation

Conduct the preliminary engineering analysis on the design scheme of Chipwi Nge Hydropower Station, select key assessment factors and coefficients, determine the assessment and content of each environmental factor, and clarify work organizations and work divisions.

(2) Compilation of environmental impact report

Based on the existing data, carry out the forecast assessment of the impact on regional ecological environment and social environment by the development of Chipwi Nge Hydropower Station, formulate the corresponding environmental protection countermeasures and abatement measures, bring forth environmental monitoring and management plan, formulate the *Environmental Impact Report of Chipwi Nge Hydropower Station (Construction Power Plant), Hydropower Project in Upper Reaches of Ayeyawady River*, and submitit to CPIYN

2.8 Overview of the finished works

CDC and its partners have finished the following works:

(1) Environmental Impact Report of Hydropower Development in Upper Reaches of AyeyawadyRiver

In March 2010, CDC finished the compilation of *Environmental Impact Report of Hydropower Development in Upper Reaches of Ayeyawady River*, which is composed of Chapter I Foreword; Chapter II Project Overview & Analysis; Chapter III Environmental Status Investigation & Analysis; Chapter IV Environmental Impact Identification; Chapter V Environmental Impact Forecast & Analysis; Chapter V Social Impact Forecast & Assessment; Chapter VII Typical Hydropower Station Environmental Impact Analysis; Chapter VIII Environmental Impact Abatement Measures; Chapter IX Environmental Impact Economic Analysis; Chapter X Public Participation; Chapter XI Environmental Management Plan; and Chapter XII Assessment Conclusions & Suggestions.

(2) Special Research Report on Aquatic Organism Investigation &Assessment in the Upper Reaches of AyeyawadyRiver

The undertaker of the special research report is Institute of Hydroecology, MWR & CAS. From January to May 2009, Institute of Hydroecology, together with aquatic organism experts of Myanmar, conducted the in-depth research into the status quo of aquatic ecological system in the upper reaches of Ayeyawady River**,** and obtained the first-hand data.

(3) Special Research Report on Terrestrial Organism Investigation &Assessment in the Upper Reaches of AyeyawadyRiver

The undertaker of the special research report is South China Botanical Garden and South China Endangered Animal Research Institute. From January to May 2009, Institute of Hydroecology, together with terrestrial organism experts of Myanmar, conducted the in-depth research into the status quo of aquatic ecological system in the upper reaches of Ayeyawady River**,** and obtained the first-hand data.

(4) Environmental Quality Status Investigation & Monitoring Results in the Upper Reaches of AyeyawadyRiver

Entrusted by CPIYN, Biodiversity And Nature Conservation Association (BANCA) undertook the monitoring and investigation of environmental quality status of hydropower development in the Upper Reaches of Ayeyawady River.

(5) Report on the Assessment of Hydropower Development's Impact on Society and Immigrants in the Upper Reaches of Ayeyawady River

In March 2010, CDC, based on site investigation and collected data, compiled *Report on the Assessment of Hydropower Development's Impact on Society and Immigrants in the Upper Reaches of Ayeyawady River*. The report is composed of nine chapters, and makes emphatic analysis on the impact on immigrants, society and economy by hydropower development in AyeyawadyRiver.

(6) Investigation Report on Public Participation in Hydropower Development in the Upper Reaches of AyeyawadyRiver

In March 2010, CDC, based on the results of questionnaires, compiled the *Investigation Report on Public Participation in Hydropower Development in the Upper Reaches of Ayeyawady River*, analyzed local people's wills and suggestions, and reflected their key concerns to the main designer and the owner.

(7) Result of design stage of Chipwi Nge Hydropower Station

The feasibility study report and bidding design report of Chipwi Nge Hydropower Station include chapters concerning environmental impact assessment and environmental protection design, which systematically elaborate on Chipwi Nge Hydropower Station's favorable and unfavorable impacts on social environment and ecological environment, and formulate the corresponding highly operable environmental protection measures.

3 Laws and regulations of Myanmar

3.1 Environmental policies of Myanmar

To reasonably develop water, land, forest, mineral and ocean resources and also other natural resources, and avoid the degrading of natural environment and ecological environment, federal government of Myanmar promulgated *Agenda and Environmental Policies of Myanmar in the 21st Century* on December 5, 1994. The policy stipulates that: "People, cultural heritage, environment and natural resources are the first wealth of the country. Our environmental policy is aimed at considering the possible environmental impact during the development and realizing the harmony and balance between economic development and environmental protection, so as to improve the life quality of our people. Each country has its sovereignty to use natural resources in compliance with its environmental policy but must be careful to not exceed its jurisdictional limits or infringe the interests of other countries during the development of natural resources. The country and every citizen have the liability to protect the current and future natural resources and should always deem environmental protection as the key target during the development process."

3.2 Environmental protection law of Myanmar

Myanmar promulgated the *Environmental Protection Law* on March 30th 2012, which was passed by the federal congress and signed by the president U Thein Sein. The law is composed of 42 articles in 14 chapters, including purpose of environmental protection law, responsibilities of environmental protection department, environmental quality standard, environmental protection, urban environment management, reservation of natural resources and cultural relics, project implementation license, and punishment.

Its Chapter IX reservation of natural resources and cultural relics requires: related departments should comply with stipulations of the federal government and commission when protecting, managing, effectively using forest resource, land resource, water resource, mineral resource, agricultural resource, ocean resource, and aquatic resource.

Its Chapter X implementation license requires: to obtain advanced licenses, enterprise owners should offer project license applications to the environmental protection department according to stipulations; the environmental protection department can decide whether to issue advanced licenses after examination; when issuing advanced licenses, the environmental protection department can make stipulations on environmental protection, which are regarded as the basis of supervision of other governmental departments and organizations; if discovering an applicant fails to follow environmental protection stipulations in advanced license, the environmental protection department can warn or punish the applicant.

Its Chapter XII clearly points out that projects requiring advanced license can not start construction until they are licensed.

3.3 Myanmar's laws and regulations related to environmental protection

According to collected data, Myanmar's laws and regulations related to environmental protection are as follows:

(1) Forestry Law of Myanmar (1992)

(2) Wildlife and Natural Area Protection Law (1994)

(3) Water Resources and River Protection Law(2006)

(4) Mineral Resource Law (1994)

(5) Fresh Water Fishery Lawof Myanmar(1991)

(6) Marine Fishery Law of Myanmar (1990)

Forestry Law of Myanmar and*Wildlife and Natural Area Protection Law* aim to manage forests in a sustainable way and maintain the biological diversity in a sustainable way, and reinforce forest law enforcement and harnessing. *Fresh Water Fishery Law of Myanmar*and *Marine Fishery Law of Myanmar* aim to develop the fishing industry, avoid fish extinction, maintain and prevent environmental deterioration, and ensure the sustainable development. *Mineral Resource Law*makes some stipulations on environmental protection (especially gold mine exploitation's unfavorable impacts on environmental protection), and also restrictions on the holder of mining license, prohibiting any activities that may have unfavorable impacts on the public.

However, the situation is complicated within the boundary of Kachin state, including policies, law enforcement and harnessing. Apparently, the state government controls all aspects of Kachin state,, including forest resource and mineral resource. However, most of forests and mines are actually in the hands of local armed groups, which reach peaceful agreements with the federal government.

The laws related to the present Hydropower Project are described in Table 1-2 and the Chipwi Nge Hydropower Company will follow these laws and regulation during construction and operation of the present hydropower project.

Table 3.3-1 Legal Framework related to the present project.

Title	Brief Description
National Environmental Policy (1994)	To establish sound environmental policies in utilization of water, land, forest, mineral resources, and other natural resources in order to conserve the environment and to preserve it degradation. It is the responsibility of every citizen to preserve its natural resources in the interests of present and future generations. Environmental protection should always be the primary objective in seeking development.
Myanmar Agenda (1997)	Agenda encourages on mobilization and focus national efforts to achieve sustainable development and facilitation the incorporation of environmental considerations in the development process of the economic and social sectors
The 2008 Constitution	Governments' commitment to protect and preserve natural environment
Environmental Conservation Law (2012)	Provision of basic guidance to integrate environmental conservation in sustainable development, ministry's responsibility to develop relevant guideline and regulation, setting up monitoring system, waste management, conservation of natural resource and cultural heritage.
Environmental Conservation Rule (2014)	The principle of this rule is to support the execution conducted by ministry as required by environmental conservation law.
EIA Procedures (2015)	Description of categories of project to conduct EIA and IEE requirement, content of EIA, submission and approval principle, environmental certificates, responsibilities of ministry and project proponent
National Environmental Quality (Emission) Guidelines (2015)	MOECAF formulated the National Environmental Quality (Emission) Guidelines (NEQG) in coordination with ADB in December 2015. The NEQG determines the guideline values for general emission such as air emissions, wastewater, noise levels, odor, and those for sector-specific emission such as emission from forestry, agribusiness/food production, chemicals, oil and gas, infrastructure, general manufacturing, mining, and power.
The Forest law (1992)	To implement forest policy and environmental conservation policy, to promote the sector of public cooperation in implementing these policies, to develop the economy of the State, to prevent destruction of forest and biodiversity, to carry out simultaneously conservation of natural forests and establishment of forest plantations and to contribute to the fuel requirements of the country.
The protection of wildlife, wild plant and Conservation of Natural Area Law	To protect wildlife, wild plants and conserve natural areas, to contribute towards works of natural scientific research, and to establish zoological gardens and botanical gardens. Law describe (a) to implement the policy of protecting wild life and wild plants of the Government,(b)To implement the policy of conserving the natural areas of the Government,(c) To carry out in accordance with

Title	Brief Description
(1994)	International Conventions adopted by the State in respect of the preservation of wild life and wild plants, living and non-living organisms and migratory birds (d) To protect wild life and wild plants liable to the danger of extinction and the habitats thereof(e)To contribute towards works of natural scientific research.
The protection of preservation of Cultural Heritage Region Law (1994)	Obligation not to carry out any of the following in the cultural heritage region (a) Destroying an ancient monument; (b) Willfully altering the original ancient form and structure or original ancient workmanship of an ancient of an monument; (c) Excavating to search for antiques; (d) Exploring for petroleum, natural gas, precious stones or minerals.
Land Acquisition Act (1894)	Enacted in 1894 during British Colony time, this act highlights the process and duty of government to acquire the land for sake of country with notification to owners, compensation for land and damage to land
Farmland Law and Rule 2012	The law provides the rights of farmers to a certain extent than the similar laws in the last 50 years. There is significant improvement in this law with regard to the right of farmers such as right to sell the land and ownership. Any form of acquiring farm land to convert to investment project for sake of country shall be strictly followed in accordance with these law and rule
The Myanmar Citizen Investment Law (2013)	The New Citizens Investment Law was enacted in 2013, repealing the Myanmar Citizens Investment Law of 1994. This law is to promote the inducement of domestic investment so as to lead to promotion of production and exports by the private sector.
The Electricity Law (2015)	Generally, set forth the principle of permission required by relevant authorities to installation, generation, transmission, distribution and inspection tasks. Permission might be withdrawn under the circumstance that licensed organization infringe the requirements stipulated in agreement. Projects are divided into three categories as small, medium and large.
The Conservation of Water Resources and River Law (2006)	This law aims at protection of water resources and river, avoidance of environmental impact, enhancement in navigation and safe water way and contribution to State economy
The Conservation of Cultural Heritage Objects Law (2015)	Generally, set for steps to adhere in the event of discovering objects which are judged as culturally valuable. Types of cultural heritage objects and reporting process are also listed.
Protection and prevention of ancient buildings (2015)	This law aims at conservation of historically valuable buildings deemed under the law.
The Prevention of Hazard from Chemical and Related Substances Law (2013)	The Prevention of Hazard from Chemical and Related Substances Law, the central law of chemicals management in Myanmar enacted in 2013, stipulates that when chemicals and related substances is to be transferred, stored, used, or disposed, operating approval certificate should be obtained in accordance with the regulations based on the international treaties.
Social Security Law (2012)	The Social Security Law, enacted in 1012, was amended the Social Security Act in 1954. It stipulates the formation and implementation of social security system.
Workmen's Compensation Act (1923)	It stipulates that employer is required to make payments to employees who become injured or who die in any accidents arising during and in consequence of their employment. Such compensation also must be made for disease which arise as a direct consequence of employment, such as carpal tunnel syndrome.
The Minimum Wage Law (2013)	The law was replaced the 1949 Minimum Wage Act. The Law provides a framework for minimum wage determination, the presidential office establishing a tripartite minimum wage committee shall decide minimum wage with industrial variation base on a survey on living costs of workers possibly every two years. This also stipulates equal payment.
Employment and Skill Development Law (2013)	The law aims to facilitate employment which is appropriate to the age and ability of the job seeker and to help workers obtain employment and to provide stability of employment and skills development for employees ant also too help employers obtain appropriate employees.

Title	Brief Description
The Leave and Holiday Act (1951)	This act has been used as the basic framework for leaves and holidays for workers with minor amendment in 2006 and 2014. This defines the public holidays that every employee shall be granted with full payment. It also defines the rules of leaves for workers including medical leave, earned leave and maternity leave.
The Labour Organization Law (2011)	The Labour Organization Law replaced the Trade Union Act enacted in 1927 for protecting the rights of the workers, having good relations among the workers or between the employer and the worker, and for forming and carrying out the labour organizations systematically and independently. Under the law, the labour organization has the right to carry out freely in drawing up their constitution and rules. It has the right to negotiate and settle with the employer if the workers are unable to obtain the right of the workers contained in the labor laws. On the other hand, the employer shall recognize the labour organizations and assist as much as possible if the labour organizations request for help for the interest of his workers.
The Labour Dispute Settlement Law (2012)	This law was enacted for safeguarding the right of workers or having good relationship between employer and workers and making peaceful workplace or obtaining the rights fairly, rightfully and quickly by settling the dispute of employer and worker justly. It stipulates that employer in which more than 30 workers are employed shall form the workplace coordinating committee consisting of the representatives of workers and the representatives of employer.
The Protection and Preservation of Antique Objects Law (2015)	It aims to implement the policy of protection and preservation of the perpetuation of antique objects and to protect and preserve antique objects so as not to deteriorate due to natural disaster or man-made destruction.
Motor Vehicles Law (2015)	It aims to drive safely motor vehicles in public area through registration according to official rules and regulations, to provide driving license, to protect the road users from the road risks and vehicles perils, to avoid traffic congestion and to use high technology transportation systems.
Export and Import Law (2015)	It aims to implement the economic principles of the State successfully, to lay down the policies to export and import that support the development of the State, and that are to be in conformity with the international trade standards.
The Explosive Substances Act (1908)	The Explosive Substance Act stipulates the prohibitions on production, possession and use of explosives without permission
The Myanmar Citizen Investment Law (2013)	The New Citizens Investment Law was enacted in 2013, repealing the Myanmar Citizens Investment Law of 1994. This law is to promote the inducement of domestic investment so as to lead to promotion of production and exports by the private sector.
Kachin State Municipal Act (Kachin State Parliament Law No. 10/2013)	This municipal act aim to protect the environment and supervise the discharge of solid waste and municipal waste.

3.4 International conventions signed by Myanmar

International conventions and agreements signed by Myanmar are shown as Table 3.4-1. Table 3.4-1 Schedule of International Conventions and Agreements Signed by Myanmar.

Chinese name	Title	Time approval
东南亚及太平洋地区植物保护协议，罗马，1956 年	Plant Protection Agreement for the South-East Asia and the Pacific Region, Rome, 1956	4-11-1959 (Adherence)
防止船舶污染国际公约，伦敦，1973 年	International Convention for the Prevention of Pollution from Ships, London, 1973	(Accession)
国际防止船舶造成污染公约的 1978 年议定书，伦敦，1973	Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, London, 1973	4-8-1988 (Accession)
联合国气候变化框架公约，纽约，1992 年 (UNFCCC)	United Nations Framework Convention on Climate Change, New York, 1992 (UNFCCC)	25-11-1994 (Ratification)

生物多样性公约，里约热内卢，1992 年	Convention on Biological Diversity, Rio de Janeiro, 1992	25-11-1994 (Ratification)
国际热带木材协定 (ITTA)，日内瓦，1994 年	International Tropical Timber Agreement (ITTA), Geneva,1994	31-1-1996 (Ratification)
保护臭氧层维也纳公约，维也纳，1985 年	Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985	24-11-1993 (Ratification)
关于消耗臭氧气层物质蒙特利尔协议，蒙特利尔，1987 年	Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1987	24-11-1993 (Ratification)
对关于消耗臭氧层物质的蒙特利尔议定书伦敦修正案，伦敦，1990 年	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990	24-11-1993 (Ratification)
保护世界文化和自然遗产公约，巴黎，1972 年	The Convention for the Protection of the World Culture and Natural Heritage, Paris, 1972	29-4-1994 (Acceptance)
亚洲及太平洋区水产养殖中心网络协议，曼谷，1988 年	Agreement on the Networks of Aquaculture Centres in Asia and the Pacific, Bangkok, 1988	22-5-1990 (Accession)
联合国关于在发生严重干旱和/或荒漠化的国家特别是在非洲防治荒漠化公约，巴黎，1994 年 (UNCCD)	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/ or Desertification, Particularly in Africa, Paris, 1994 (UNCCD)	2-1-1997 (Accession)
野生动植物濒危物种的国际贸易公约，华盛顿，D.C.，1973 年;和此公约在波恩的经修订公约，德国，1979 年 (CITIES)	Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, D.C., 1973; and this convention as amended in Bonn, Germany, 1979 (CITES)	13-6-1997 (Accession)
促进遵守公海捕鱼船保育与管理措施协定，罗马，1973 年	Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, Rome, 1973	8-9-1994 (Acceptance)
东南亚国家保护自然与自然资源协定，吉隆坡，1985 年	ASEAN Agreement on the Conservation of Nature and Nature Resources, Kuala Lumpur, 1985	
生物安全议定书，哥伦比亚港口卡塔荷娜，2000 年	Catagena Protocol on Biosafety, Cartagena, 2000	
东盟跨疆界烟霾协议	ASEAN Agreement on Transboundary Haze Pollution	13-3-2003 (Ratification)
粮食和农业植物遗传资源国际条约，2001 年	International Treaty on Plant Genetic Resources for Food and Agriculture, 2001	4-12-2004 (Ratification)
京都议定书，京都，1997 年	Kyoto Protocol to the Convention on Climate Change, Kyoto,1997	13-8-2003 (Accession)
东盟遗产公园宣言	Declaration on ASEAN Heritage Parks	
关于持久性有机污染物的斯德哥尔摩公约 (POP)，2001 年	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	18-4-2004 (Accession)
关于特别是作为水禽栖息地的国际重要湿地公约，1971 年颁布，1982 年与 1987 年修订	The Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat, 1971 as amended in 1982 and 1987	8-11-2004 (Accession)
生物多样性的东盟区域中心确立	Establishment of ASEAN Regional Centre for Biodiversity	

4 Project overview

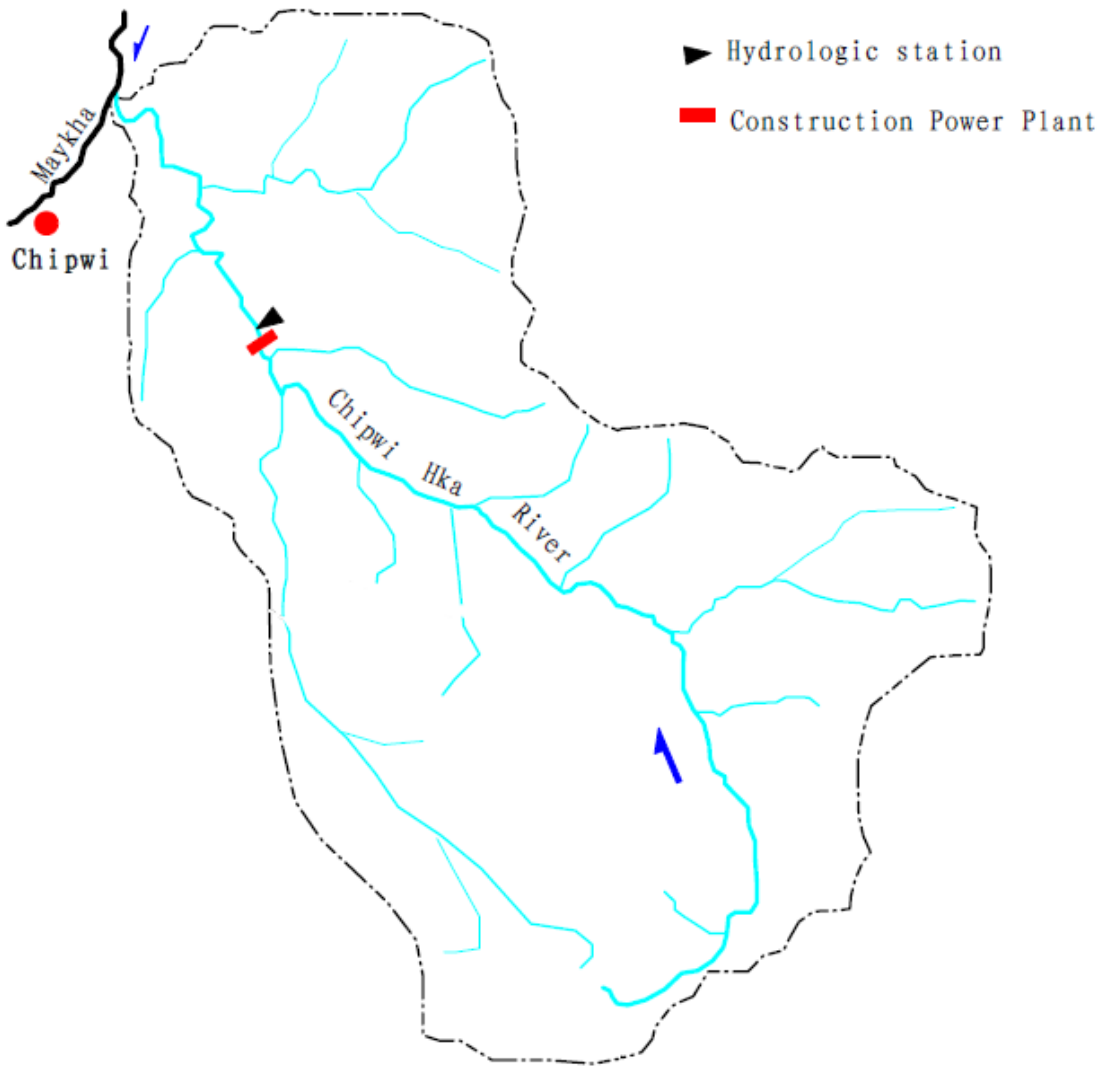
4.1 Drainage basin planning, development and utilization

4.1.1 Drainage basin overview

Nmaihka River originates from the southwest foot of BoshulaMountains in the boundary of Zayu County, Tibet, China, and flows into Myanmar from Maku of Gongshan County, Yunnan Province, and converges with Malikha River at Myitsone which is about 45km north of Kachin Myitkyina.And then, it is called AyeyawadyRiver, and also the major source of the river. Nmaihka River is 353km in length, 24,200km^2 (including 4,200km^2 in the Chinese boundary) in drainage area, and 1,010m in natural head.

Chipwi River is a tributary on the left bank of Nmaihka River, and the geographical coordinate is eastern longitude 98°8′ ~ 98°28′ and northern latitude 25°30′ ~ 25°52′. It originates from GaoligongMountain at the boundary of China and Myanmar, flows from southeast to northwest, and converges with Nmaihka River close to ChipwiTown. Chipwi River is 743.6km^2 in drainage area, 58.0km in length, 3,000m in natural head, and 52‰ in gradient. Average annual discharge is 54.0m^3/s.

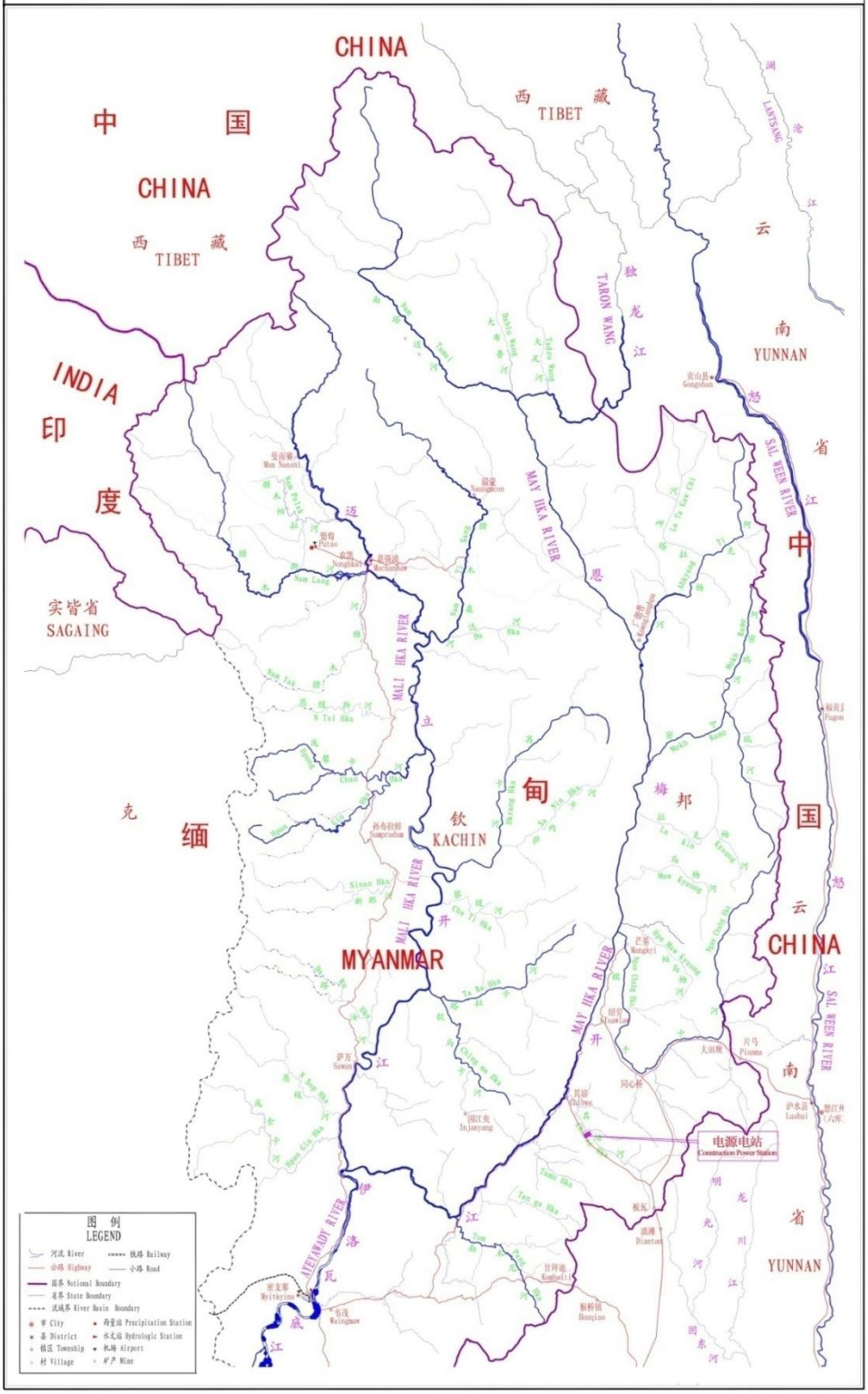
The dam of Chipwi Nge Hydropower Station is planned to be located about 15km away from the river mouth. Riverbed elevation there is about 710m, control catchment above the dam 552.3km^2, river length42.1km, and gradient 54‰.



Firgure 4.1-1 Schematic map of river systems of Chipwi Hka River

附图2 电源电站水系图

FIGURE 2 DRAINAGE MAP OF CONSTRUCTION POWER PLANT



4.1.2 Hydropower planning in the drainage basin

Ayeyawady River basin above Myitkyina owes abundant water resources, which has relatively valuable development. In recent years, with the demand of social and economic development, Myanmar government lists hydropower development as the national priority, and at the same time, transforms its advantage of resources into economic advantage. According to the geological location and the condition of hydropower resources, Myanmar government plans to focus on developing hydropower resources in AyeyawadyRiver basin above Myitkyina.

In December2006, Ministry of Electric Power No. 1, Myanmar (MOEP 1) and China Power Investment Corporation (CPI) signed the *Memorandum of Understanding on Hydropower Projects in Nmaihka River, MalikhaRiver and Chipwi Nge of Ayeyawady River, Myanmar*. Entrusted by CPI, CDC formulated the *Planning Report of Hydropower Development in Nmaihka River, MalihkaRiver and Chipwi Nge Hydropower Station of Ayeyawady River, Myanmar*in December 2007. In October 2009, CDC formulated *Feasibility Study Report of Chipwi Nge Hydropower Station in Upper Reaches of Ayeyawady River*.

According to the characteristics of Ayeyawady River basin above Myitkyina and the requirement of the national economy of Myanmar on river development, the mission of the planned drainage basin development is power generation while controlling flood and improving shipping along the lower reaches and irrigation conditions. The plan recommends scheme I for the Cascade Development of Ayeyawady River basin above Myitkyina after analyzing and comparing the comprehensive utilization profits, engineering technical condition and engineering economic indexes, namely:

Enmaynua River, Ayeyawady River: Yenan(1010m)—Kaunglanhpur(875m)—Pisa(665m)—

Wutsok(525m)—Chipwi(400m)—Myitsone(245m)

Malinka River: Laza (370m)

The recommended scheme for the cascade development of AyeyawadyRiver basin above Myitkyina is of 18400MW total installed capacity and 99.11 billion kW-h annual energy output.

According to MOA agreement, Myanmar, it is planned to spend 15 years on developing this valley cascade power station. according to the development condition, pre-phase work foundation and the cascade power station profit, the power stations of Myistone and Chipwi are listed as recent projects to be developed, Wutsok, Pisa, Kaunglanhpur and Laza power stations, which have relatively good development condition and economic indexes, are listed as the second batch of projects to be development, and Yenan power station the third batch.

4.2 Necessity of project construction

(1) The need of water resource development in the drainage basin

AyeyawadyRiver basin above Myitkyina is not covered by state grid of Myanmar, and gravely runs short of power supply. In addition, the state grid of Myanmar can not supply enough power, and frequently breaks down, so it can not offer construction power for the development of hydropower resources in AyeyawadyRiver basin above Myitkyina. To ensure the smooth implementation of the development of hydropower resources in Ayeyawady River basin above Myitkyina, and guarantee construction safety, it is planned to build Chipwi Nge Hydropower Station first, which features short transmission distance and good economic indexes, and is able to provide electric power for both power stations at Myistone and Chipwi. Therefore, it is extremely necessary to build Chipwi Nge Hydropower Station in the early stage.

(2) The need of social and economic development

Chipwi Nge Hydropower Station is located in the boundary of KachinState at the north of

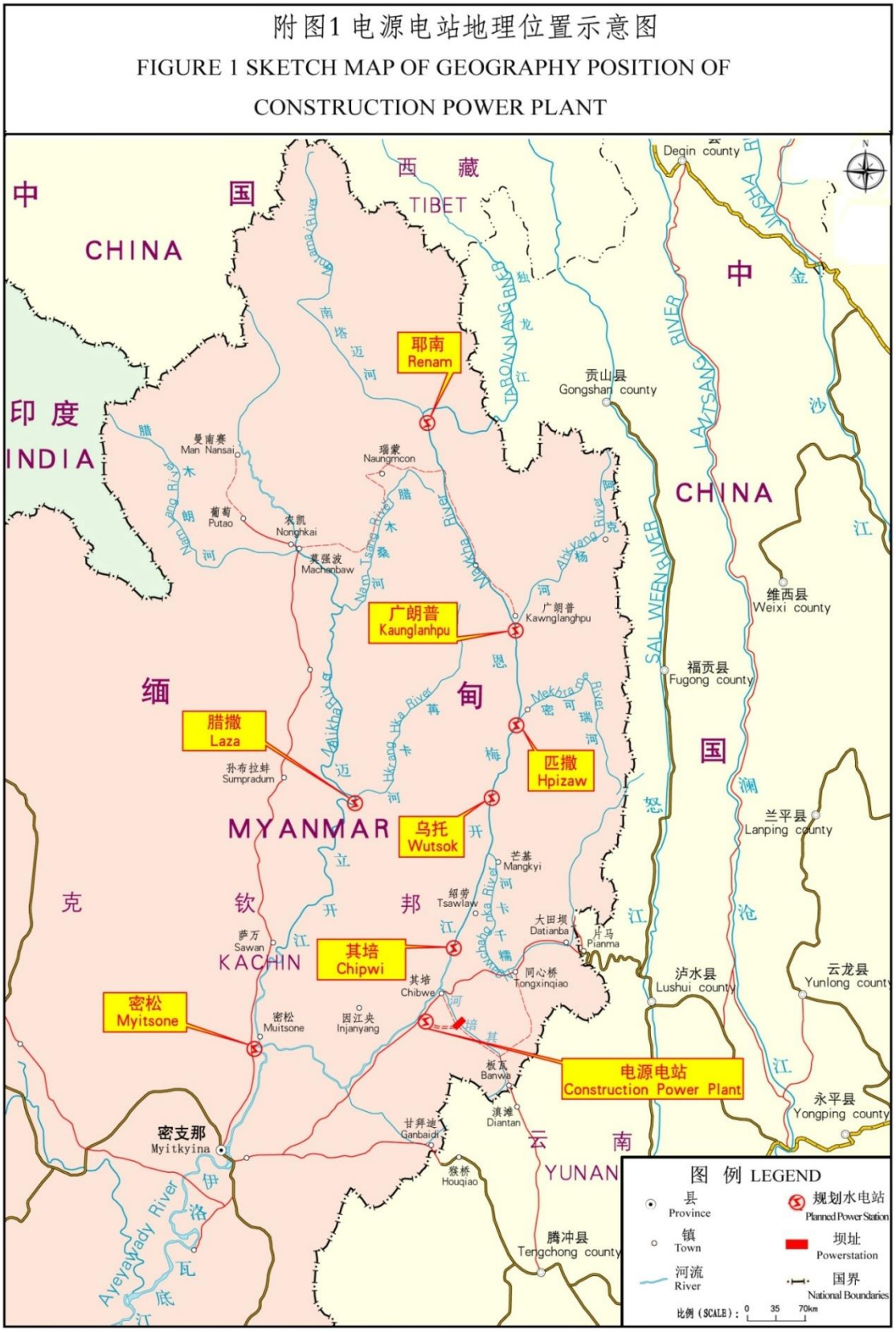
Myanmar, where boasts rich natural resources but is short of necessary capital, technology and equipment. Therefore, such resources are poorly developed and utilized. The construction of Chipwi Nge Hydropower Station can improve local traffic conditions, and is important for developing local resources, improving local economy and local people's living level.

(3) The concrete measure of strengthening the long-term strategic partnership between China and Myanmar

Developing hydropower resource in AyeyawadyRiver basin above Myitkyina is a win-win strategic project between China and Myanmar, the need of mutual benefit and common development of both countries, and also the need of maintaining and developing their long-term strategic partnership. The construction of Chipwi Nge Hydropower Station symbolizes the formal start of the development of hydropower resource in AyeyawadyRiver basin above Myitkyina, and also the concrete action of reinforcing the long-term strategic partnership between China and Myanmar.

4.3 Geographical location of the project

The dam of Chipwi Nge Hydropower Station is located on Chipwi River, a tributary on the left bank of Nmaihka River, in the straight river valley about 1.5km ~ 2.0km at the upstream of Labang Bridge, about 15km away from Chipwi Town; the plant is on the left bank of Nmaihka River, about 9km away from the upstream ChipwiTown, about 62km away from the downstream Myistone Hydropower Station, and about 20km away from the upstream Chipwi Hydropower Station.



4.4 Project development task, scale and operating way

4.4.1 Project development task

According to the need of the development of water resources in AyeyawadyRiver basin above

Myitkyina and also the actual situation of Chipwi River, the development task of the project is determined to be power generation, offering construction power to recent Myistone and Chipwi hydropower stations for the development of water resources in AyeyawadyRiver basin above Myitkyina. At present, due to changes of external conditions, the project task of Chipwi Nge Hydropower Station is to supply power to ChipwiTown and Myitkyina City.

Normal pool level of Chipwi Nge Station is 740m, and regulation storage 281,000m^3, with daily regulating capacity. The installed capacity of the power station is 99MW, guaranteed output 25.9MW (P = 90%), and average annual generating capacity 599 million kW·h. The runoff of Chipwi River is changing frequently, and allocation in a year is uneven. If water shortage happens in the peak construction period of Myistone and Chipwi hydropower stations, and there is a short supply of power, the power for the construction of Chipwi Hydropower Station can be guaranteed first. The power inadequacy of Myistone Hydropower Station can be solved through other means (such as self-prepared diesel generator).

4.4.2 Project scale and major features

Normal pool level of Chipwi Nge Station is 740m, maximum flood level 745.99 m, and corresponding reservoir capacities 789,000m^3 and 1,234,000m^3 separately. The installed capacity of the power station is 99MW, and average annual generating capacity 599 million kW·h. According to *Flood Control Standard* (GB50201-94) and *Classification & Design Safety Standard of Hydropower Projects*(DL5180-2003), the project is a medium Grade III project, major buildings such as dam and diversion power generation system are of Grade III, secondary buildings of Grade IV, and temporary buildings of Grade V. Hydraulic structures are of Grade II security.

Engineering features are shown as Table 4.4-1.

Table 4.4-1 Engineering Features of Chipwi Nge Hydropower Station

No. and name	Unit	Qty. or feature	Remarks
I. Hydrology			
1 Control catchment area above the dam	km^2	552.3	
2 Average annual runoff	100 million m^3	12.6	
3 Dam representative runoff			
Average annual runoff	m^3/s	40.1	
Designed flood runoff	m^3/s	1710	P=2%
Maximum flood runoff	m^3/s	2540	P=0.2%
II. Reservoir			
Maximum flood level	m	745.99	P=0.2%
Designed flood level	m	744.26	P=2%
Normal pool level	m	740.00	
Dead water level for power generation	m	735.00	
Total storage	10,000m^3	123.4	
Regulation storage	10,000m^3	28.1	
III. Performance indicators			
Installed capacity	MW	99	
Guaranteed output (P=90%)	MW	25.9	
Average annual power output	100 million kW·h	5.99	
Annual utilization hours	h	6050	
III. Inundated area and permanent land occupation			

Table 4.4-1 Engineering Features of Chipwi Nge Hydropower Station (continued)

No. and name	Unit	Qty. or feature	Remarks
Inundated area	hm^2	8.1	
Permanent land occupation	hm^2	7.6	
V. Major buildings and equipment			
Project grade and major building grade		Grade III	
1 water retaining structure			
Type		Concrete gravity dam	
Foundation feature		Diorite granite gneiss	
Seismic basic intensity/design intensity	Grade	Ⅷ/Ⅷ	
Crest elevation	m	747.5	
Maximum dam height	m	47.5	
Dam crest length	m	220.0	
2 Gate-free overflow surface outlet			
Outlet number	Outlet	5	
Single outlet width	m	13	
Maximum discharge flow	m^3/s	1942	
Generator model		SF33-16/3250	
Stand-alone diversion flow	m^3/s	8.82	
Rated head of unit	m	433	
Maximum head	m	483	
Minimum head	m	431	
Unit total capacity	MW	99	
Unit number	Pcs	3	
Transformer type		S10-40000/121±2×2.5%/10.5	
Transmission line voltage grade	kV	110	
VI. Project construction			
1 Quantities of major works			
(1) Earth work excavation	$10,000m^3$	104.97	
(2) Earth work backfilling	$10,000m^3$	10.73	
(3) Concrete placement	$10,000m^3$	17.8	
(4) Reinforcement	t	4180	
(5) Installation of metal structures	t	3551	
2 External traffic	km	111	
3 Construction diversion way		Tunnel diversion	Section size 3m×4m
4 Overall construction period	Month	32	
Generation period of the first unit	Month	28	
VII. Static total investment	RMB 100 million Yuan	11.19	RMB

4.4.3 Project operating mode

Chipwi Nge Hydropower Station is mainly to provide construction power for Myitsone Hydropower Station and Chipwi Hydropower Station, being a daily adjustment power station. Its daily operating mode should be adjusted moderately according to the demand of the electric power system. When the daily average output is smaller than the installed capacity, the reservoir will perform daily regulating. When the daily average output reaches the installed capacity, the

station is operated under base load.

The operation mode of flood discharge and sand removal for the flood releasing structure shall comply with the original design scheme. Barrage of the power station locates on Chipwi River – a first-grade tributary of the Nmai Hka River, where the river channel has the natural longitudinal gradient up to 54‰ and has distinct characteristics of mountain storm flood in flood season, i.e. high flow, short runoff generation time, numerous surface floating objects and high content of sediments etc. "Open" type flood discharge shall be adopted. Meanwhile, to protect the intake of water conveyance structure against sediment blocking, sediment flushing outlet for flood discharge shall be used at the beginning and the end of flood season each year for sand removal. Detailed application is explained as follows:

(1) When the water inflow reaches about $80m^3/s$ at the beginning and the end of flood season each year, the sediment flushing outlet for flood discharge must be used for one operation of sand removal.

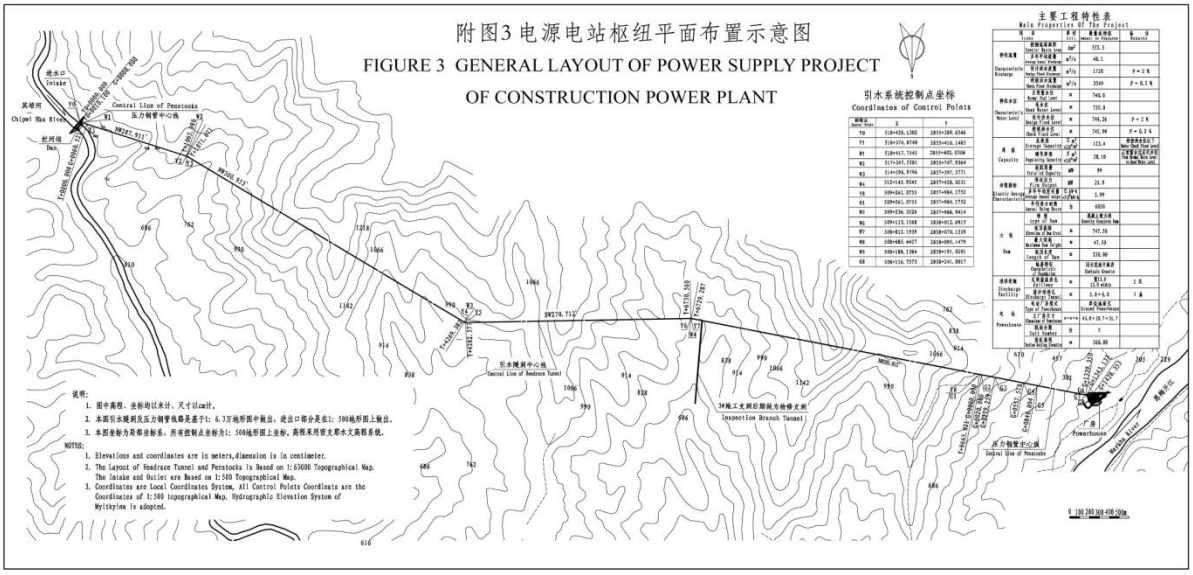
(2) The sediment flushing outlet for flood discharge shall be put into operation when the discharge flow of the complex reaches $170m^3/s$, then closed when the reservoir level is down to 735m and started again when the discharge flow reaches $170m^3/s$. Repeat the foresaid procedure and carry out the sand removal.

(3) With regard to the relatively numerous floating objects and serious silting in the reservoir at present, they are mainly caused by construction wastes in the upper reaches. Before impoundment and power generation, the sediment flushing outlet for flood discharge shall be put into operation and dredging & excavation work shall be done if necessary, to reserve a sufficiently effective capacity of the reservoir.

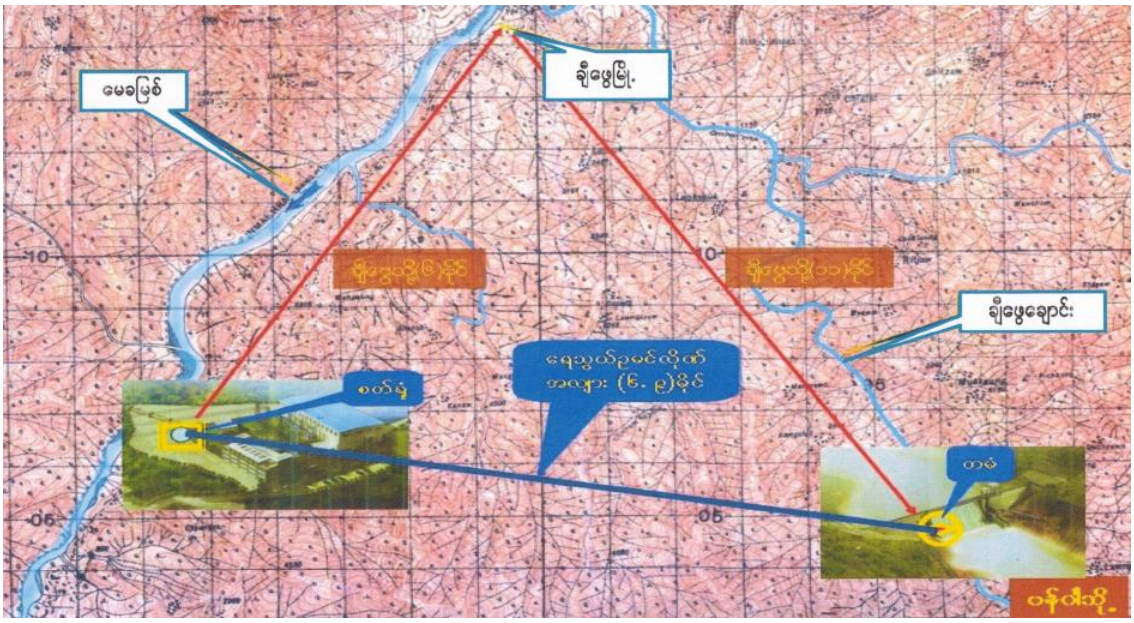
4.5 Project junction layout and major buildings

Chipwi Nge Hydropower Station is a diversion-type power station, and the hub building is mainly composed of dam, diversion system, diversion building and plant.

The recommended hub arrangement of Chipwi Nge Hydropower Station is: the dam and power station water intake are located on Chipwi, and the dam is a concrete gravity dam. Dam water intake is adopted, and diversion route is a broken line. Internal diameter of tunnel is 4.0m; the plant and tail water channel are located at the left bank of Nmaihka River, and the plant is an open plant. The plant axis forms a 30° angle with pressure steel pipes.



The layout plan of the Chipwi Nge Hydropower Project is shown in the following figure.



Geographic Location of Chipwi Nge HPP

(1) Dam

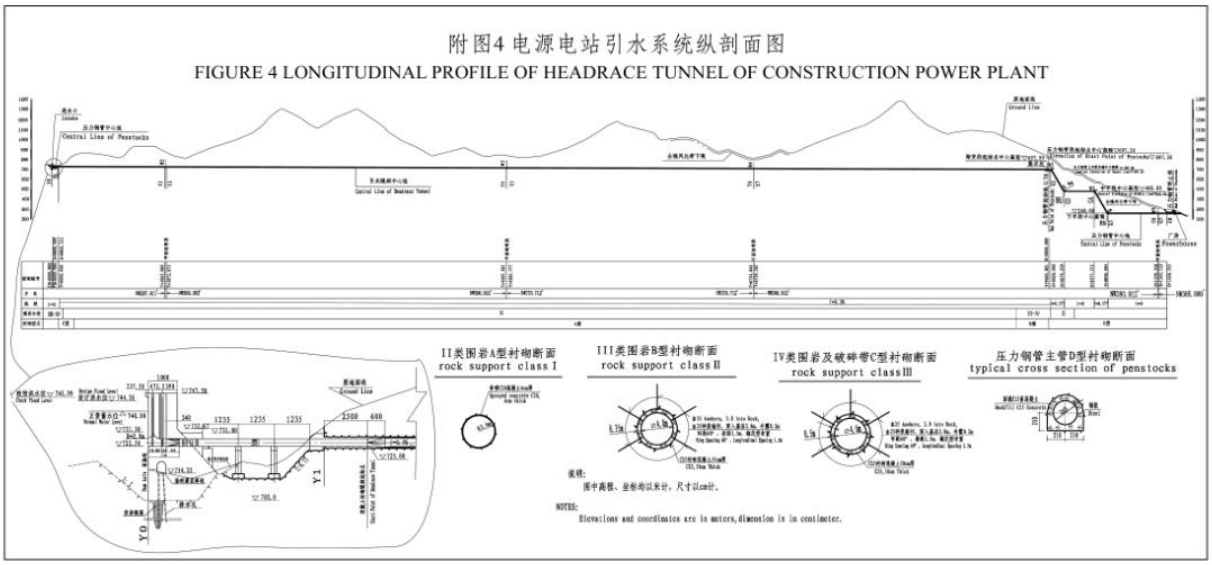
Dam axis is the up dam line, and dam type is the normal concrete gravity dam. The crest elevation is 747.5m, maximum dam height 47.5m, and crest length220m. The dam is composed of non-overflow dam section and overflow dam section. Overflow dam section, 86m long, is arranged on the riverbed. It is provided with five-hole open gate-free control downflow weir, with the weir top elevation being 740.0m, single-hole downflow weir width 13m, and overall net width of downflow front edge 65m. The non-overflow dam at the left bank is 62.5m long, and that at the right bank is 71.5m long.

Flood discharge sediment flushing outlets with opening size being 5m×6m are arranged in the left overflow dam section. Its bottom elevation is 715.0m. Close to the right side of flood discharge sediment flushing outlets are ecological flow drainage holes, which are of round-pipe type, internal diameter D=20cm, and central elevation 720.0m. The central line is 1.5m away from the right wall of flood discharge sediment flushing outlets. Surface downflow weir and flood discharge sediment flushing outlet are of flip trajectory bucket.

The following figures show the detailed of dam area.

(2) Water diversion system for power generation

Power generation water diversion system is composed of water intake, pressure diversion tunnel and pressure steel pipe. Water intake is dam-type water intake, with bottom elevation being 725.50m. It is designed with a trash rackand an accident bulkhead gate. Diversion tunnel is of round section, with internal diameter being 4.0m and tunnel length 9,665m. There is a stone pit at the end of the tunnel, which is connected with pressure steel pipe through transition section. Pressure steel pipe is buried underground, and pipe diameter is 2.6m. Pressure steel pipe is divided into upper level section, upper inclined section, middle level section, lower inclined section, and lower level section. After going out of the mountain, the lower level section forms an open pipe, and is divided into three branch pipes of 1.4m in diameter to get access to the plant. The central elevation of the upper level section is 697.20m, that of the middle level section 480.00m, and that of lower level section 260.00m. Axial length of pressure steel pipe in mountain is about 1,428m.



附图4 电源电站引水系统纵剖面图

FIGURE 4 LONGITUDINAL PROFILE OF HEADRACE TUNNEL OF CONSTRUCTION POWER PLANT

(3) Diversion works

Diversion structures mainly include diversion tunnel and cofferdam. Diversion tunnel is located at the left bank, and the section is like a city gate opening. The cross section dimension is 3m (width) ×4m (height). Inlet bottom elevation 713.0m, outlet bottom elevation 705.0m, and

tunnel length 264.42m. Both upstream, and downstream cofferdams are earth-rock cofferdams. Upstream cofferdam axis is 86.3m long, cofferdam crest elevation 724.0m, crest width 6m, and maximum cofferdam height about 12.0m. Downstream cofferdam axis is 97.8m long, cofferdam crest elevation 708.0m, crest width 6m, and maximum cofferdam height about 13.0m.

(4) Plant

The plant is ground plant. Buildings in the plant area include the main plant, installation yard, auxiliary plant, tail water channel, permanent electromechanical warehouse. Installation yard is arranged at the right side of the main plant. Auxiliary plant is arranged at the upstream of the main plant and installation yard. The lane of the access road to the plant is 6m in net width, and firefighting channel in the site is 6m in net width. Three sets of vertical impact water turbine generators are provided in total, with single installed capacity being 33MW. 110kV Grade I voltage, in isolated network operation, is adopted to supply power to construction substations of Myitsone and Chipwi. The power station has three loops of 110kV outgoing lines, one to the construction substation of Chipwi, one to the construction substation of Myitsone, and another for standby (reserved for Waxiao).

According to the Seismic Safety Assessment Report for the dam site area of the adjacent Chipwi hydropower station, the dam site is located at an area with relatively stable regional structure. With 1：4000000 *seismic peak acceleration zonation map of China* (2001), it is analyzed that the seismic peak acceleration over 10% in the area is 0.20g for 50 years with a basic earthquake intensity of Ⅶ. Main structures are ranked grade 3, and the design of earthquake intensity employs Ⅷ. Earthquake resistance protection of the project is category C.

Mapping of Seismic Zones and Seismic Activity Seismic zones generally refer to zones where earthquakes are concentrated and are controlled by active tectonic belts or crustal structural variations. The power plant is located at the area between the Myanmar Sagaing Seismic Belt (West Side) and the China Tengchong Earthquake Belt (East Side) ((Figure 4.5-1)). It is the “Regional structural safety island” on the region.

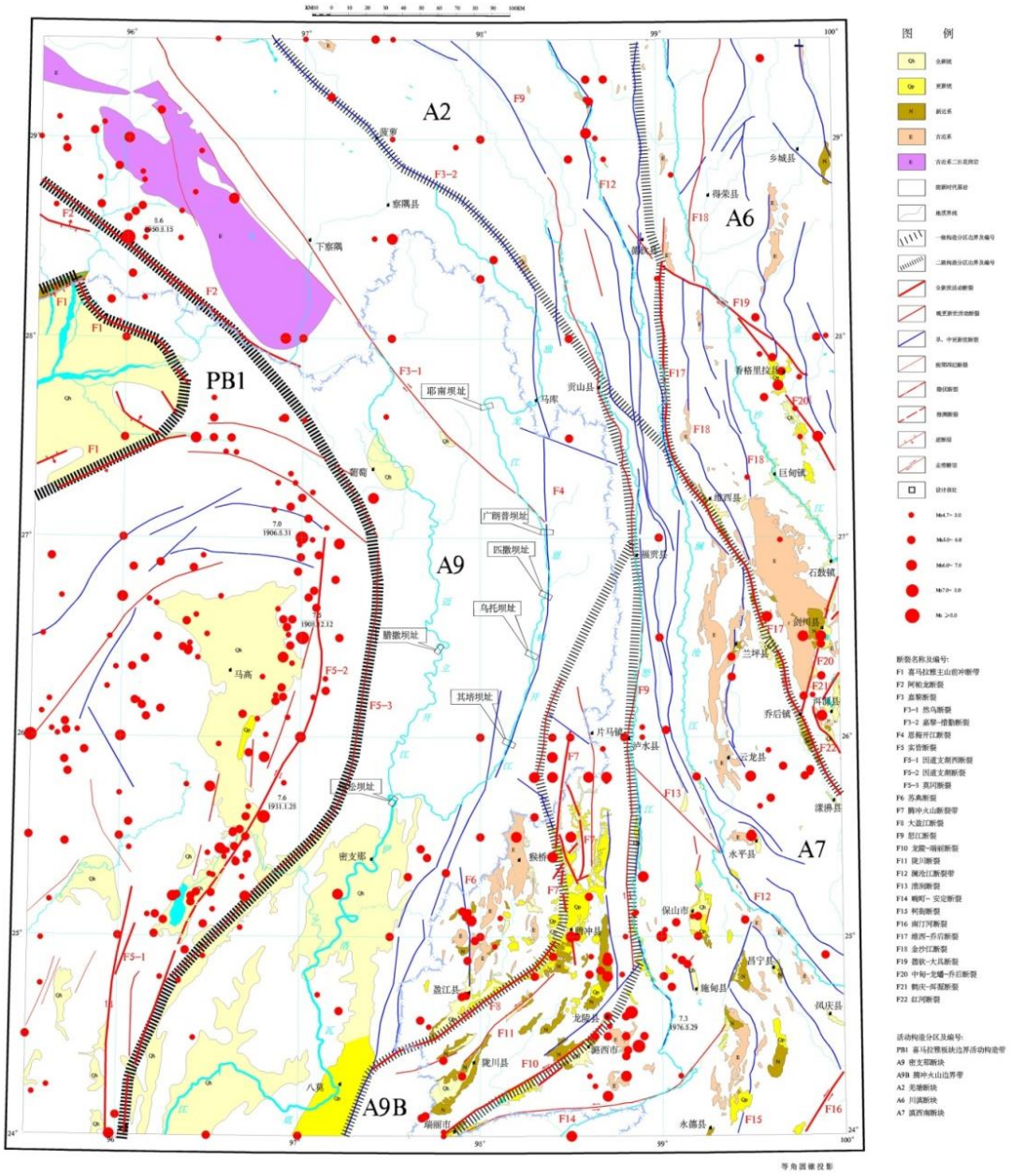
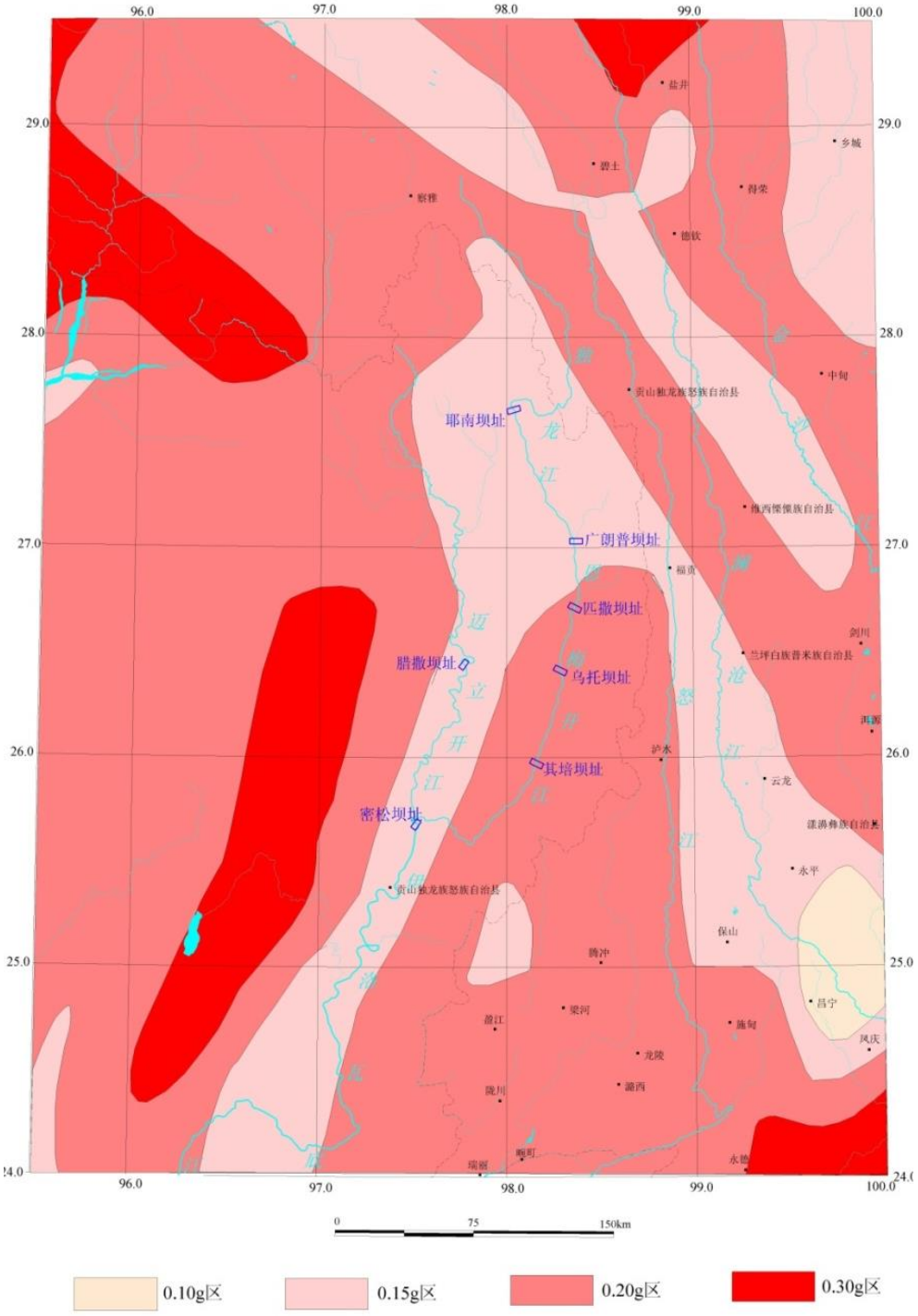


Figure 4.5-1 Distributionof Regional Seismic Zonesnear the project area

Based on the regional and near-field seismic geology, seismic activity analysis, potential seismic source area division, and determination of seismic activity parameters, analysis of earthquake risk was conducted using the attenuation relationship of the ground motion peak acceleration obtained. Based on the bedrock acceleration peaks, a map of peak ground motion acceleration zoning with a exceedance probability of 10% in 50 years of the study area was compiled (Figure 4.5-2).



4.5-2 Zoning of Seismic Acceleration near the project area (with exceedance probability % in 50 years)

The pictures of aerial view of power house, office, dam, living camps, reservoir, transmission system, operation, maintenance, training and line patro of Chipwi Nge Hydropower Project are shown in the following figures.

Arial View of Chipwi Nge HPP

Arial View of Dam

Arial View of Living Campus

Dam

Dam

Reservoir

Power House

Transmission System

Gate of Power House

Inside the Power House

Inside the Power House

Inside the Power House

Central Control Room

Central Control Room

Living Campus

Operation

Maintenance

Training

Line Patrol

Road in the Chipwi Township which Built by the Company

4.6 Engineering construction planning

4.6.1 Overall layout of construction site

4.6.1.1 Construction conditions

(1) Topographical and geological conditions

Chipwi River is winding and zigzagging from southeast to northwest. The average hydraulic gradient is 5%～6%. River valleys are deeply cut and take on the shape of "V." The reservoir area is of low middle mountain gorge river valley landform, and mountains on both banks are steep. Topographic slope is 35°～45°, and distributed on Grade I and II bench platforms along the river. The quaternary loose sediments in the reservoir area mainly include: alluvial-proluvial, debris flow sediment and residual diluvial. Rocks in the reservoir area are mainly gray and grayish white granitic gneiss. Gneissic schistosity is developing along the direction of river, and the occurrence is stable.

The project area enjoys the sub-tropical rain forest climate. In rainy seasons, rainstorms always last long time, and the rainfall is big, thus offering water conditions for debris flow; Chipwi River is in a valley, and mountains at the two banks are steep, with highly developed rock fractures and serious weathering. The ground surface is generally covered with residual diluvial clay mixed with rock block and fully-weathered rocks. Loose materials are abundant, and collapse and earth slipping occur frequently after rains, and even small landslide, thus offering material conditions for the formation of debris flow; Chipwi River is of big gradient, being 5%～6% on average, thus offering conditions for material flow of debris flow.

(2) Major construction material supply

Major materials needed in the project include soil, rock block, gravel, cement, reinforcement, timber, and oil.

There are borrow pit, rock block quarry, and gravel quarry in the project area. Timber is supplied locally. Other construction materials should be transported across Yunnan, the boundary of China, and the transport distance is above 100km.

Ordinary external materials (including ordinary heavy pieces) are transported through railways and roads across Yunnan, China. Heavy pieces can be delivered through land transportation if they are from China; if they are from overseas, they can be shipped to AyeyarwadyRiver, and then transported to the construction site through roads.

(3) Water and electricity

Wind for construction is from mobile and fixed air compressors, and no air supply system is provided additionally.

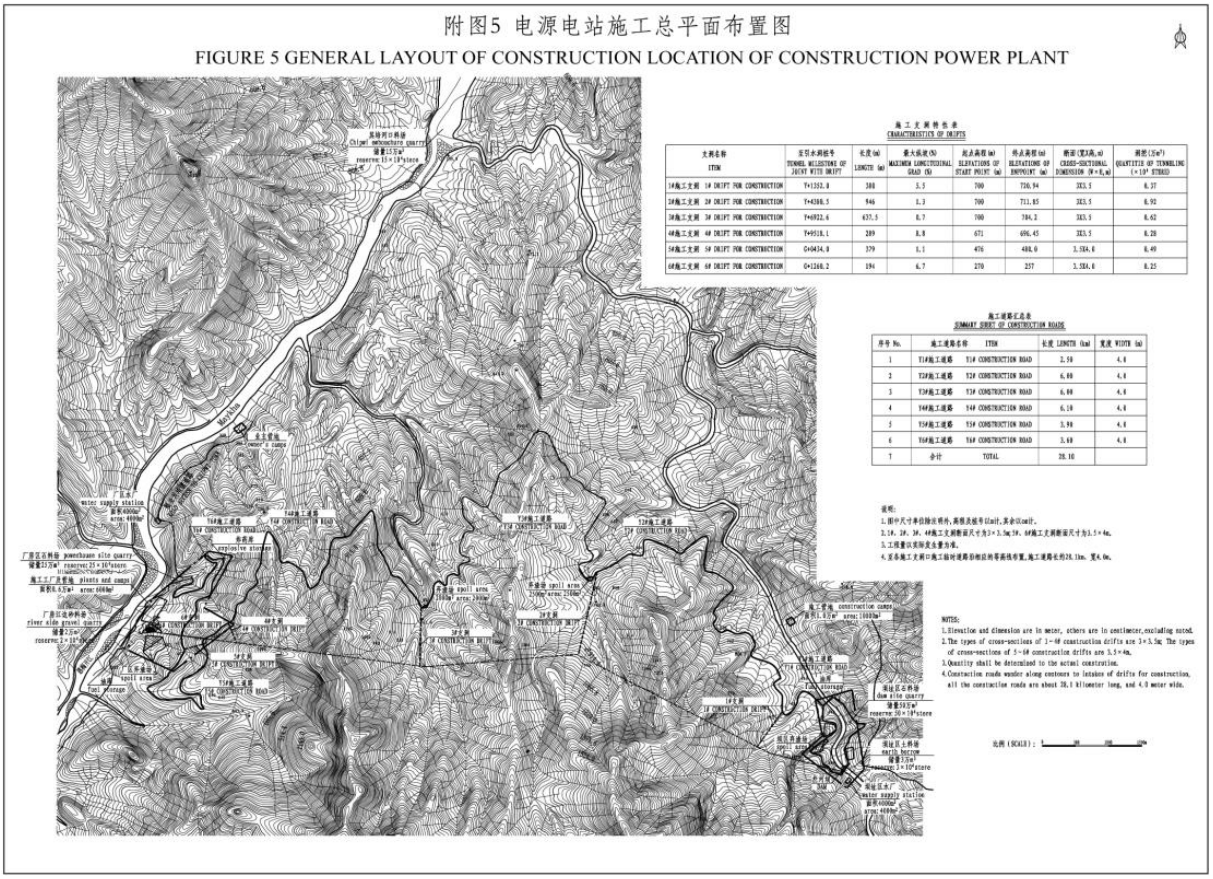
Construction water is mainly for concrete and mortar mixing. The construction area is close to Ayeyawady River and Chipwi River, where the water supply is adequate. Water source in the construction area does not have any corrosive effect on concrete, so construction water can be pumped from the rivers through submerged pumps directly. Living water is the same with drinking water of local residents. Local tapped water is preferable, or a small impounding reservoir is employed to supply water.

Electricity for construction includes electricity for construction machines, construction lighting and living. Since there is no power grid locally, electricity for production and living in each construction section is from the self-prepared power source.

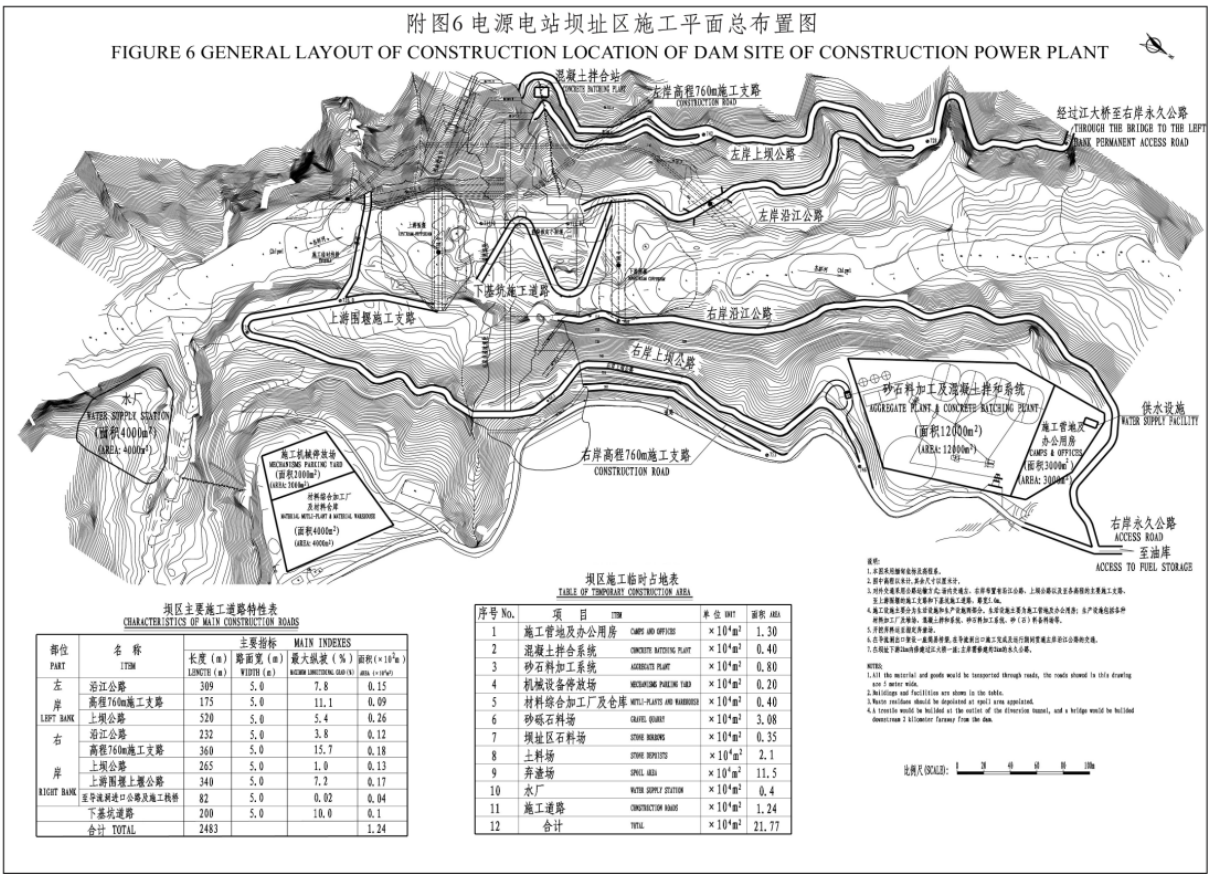
4.6.1.2 Construction general layout

The construction area is arranged in a concentrated way, and includes dam construction area,

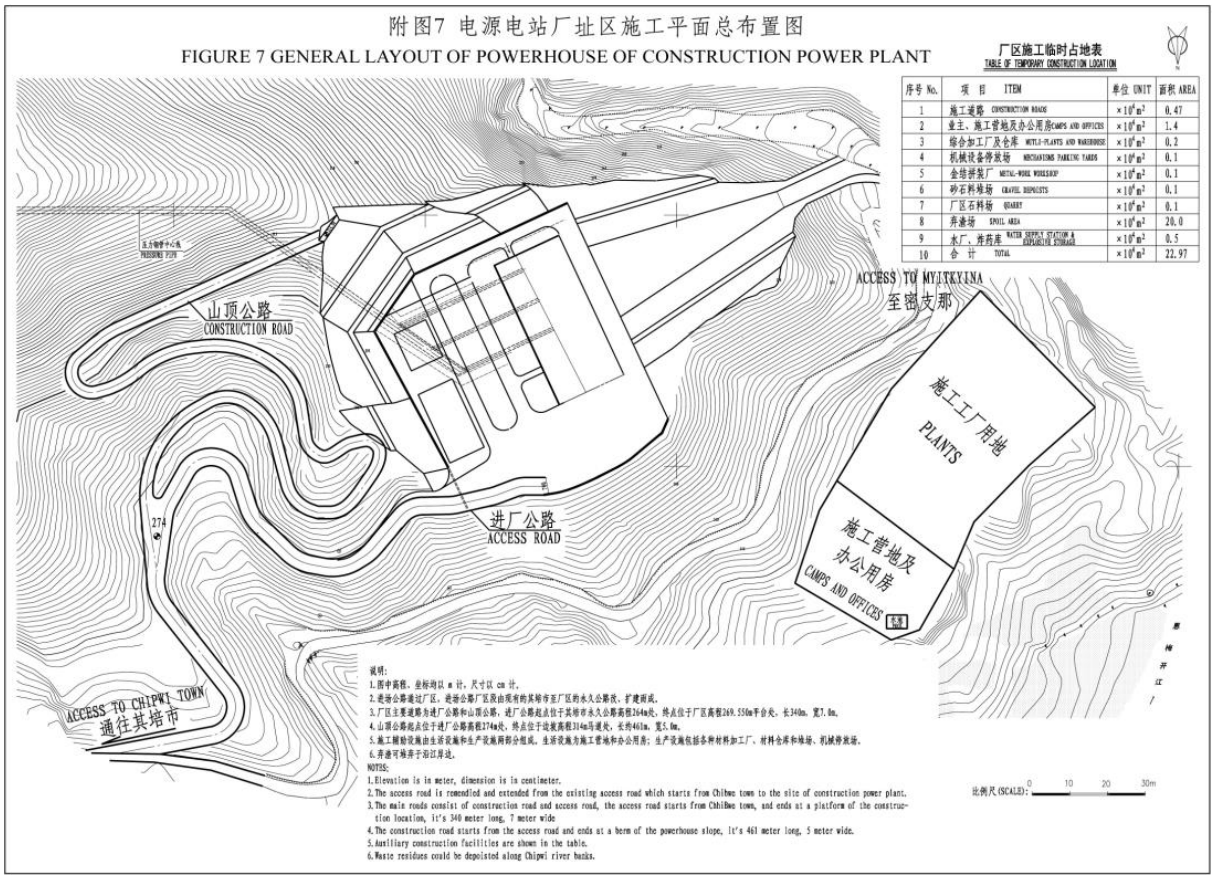
diversion tunnel construction and plant construction area. Construction auxiliary facilities are composed of living facilities and production facilities. Living facilities include construction camp and office occupancy; production facilities include concrete mixing system, various material processing yards, material warehouse and stockyard, and machine parking lot.



Aggregate processing and concrete mixing systems, construction camp and office occupancy, oil tank and quarry are arranged at the downstream right bank of the construction area of the dam. Construction camp and office occupancy are provided with water supply facilities; spoil yard is arranged at the downstream of the right bank; construction machine parking lot, material comprehensive processing plant and material warehouse, borrow pit and water plant are arranged at the high space of the right bank of the dam.



Construction camp and office occupancy are arranged close to the access road, with the elevation being 267.0m. Other production facilities are arranged close to the lower part of the plant area, with the elevation being 235.0m. In the early stage, dug waste is piled up here for site leveling. In the late stage, dug waste is piled up along the river.



Temporary construction road to each construction adit is about 28.0km long and 4.0m wide. Site leveling is conducted for 2# and 3# construction adits. Waste from the digging of construction adit and main hole is piled up in nearby areas. Waste dug from 1# construction adit and some waste from main hole are transported to the spoil yard of the dam area; Waste dug from 4#, 5#, and 6# construction adit and some waste from main hole are transported to the spoil yard of the plant area;

Major facilities in each construction area are shown as Table 4.6-1.

Table 4.6-1 Schedule of Major Construction Facilities

No.	Item	Floor area (10,000m^2)
I.	Construction area of the dam	
1.	Sand processing system and concrete mixing system	1.2
2.	Construction camp and office occupancy	1.3
3.	Construction machinery parking lot	0.2
4.	Material comprehensive processing plant and material warehouse	0.4
5.	Borrow pit	2.1
6.	Gravel quarry	3.08
7	Dam quarry	0.35
8	Spoil yard	11.5
9	Construction road	1.24
10	Water plant	0.4
11	Subtotal	21.77
II.	Construction area of the plant	
1	Camp of the owner	1.0
2	Construction camp and office occupancy	0.4
3	Comprehensive processing plant and material warehouse	0.2

Table 4.6-1 Schedule of Major Construction Facilities (continued)

No.	Item	Floor area (10,000m^2)
4	Construction machinery parking lot	0.1
5	Gravel stockyard	0.1
6	Hardware assembly plant	0.1
7	Quarry of the plant	0.1
8	Explosive magazine	0.1
9	Spoil yard	20.0
10	Construction road	0.47
11	Water plant	0.4
12	Subtotal	22.97
III.	Construction area of diversion system	
1	2#, 3#construction adit site leveling and spoil yard	0.45
2	Construction road to each construction adit	11.2
3	Subtotal	11.65
IV.	Total	56.39

The construction arrangement for headrace tunnel will adopt the method of drilling and blasting. Cycle operations during the single explosive excavation include: Measurement and survey setting-out, drilling, loose rock removal, blasting agent fill, explosion and ventilation, safety treatment, spoil transportation, temporary support and others.

According to project arrangement, the main works are implemented underground, so working gallery should be built to finish these works underground. Design principle for construction adit: Permanent channel should be used as much as possible to reduce the project investment; safety of construction adit and the structures interacted with it or its vicinity structures should be guaranteed; the construction intensity and progress demand should be fulfilled; while the transport requirements for construction work and other large pieces should also be taken into consideration. Six construction adits should be set for diversion and power generation system with total length of 2879.5m.

4.6.2 Construction diversion

4.6.2.1 Diversion way

Water retaining dam of Chipwi Nge Hydropower Station is located about 110m at the downstream of magma rock block disposal dam. The flow is big during flood seasons and small during dry seasons. There is a bottomland at the left bank of the dam, with the elevation being 705m ~ 713m. During dry seasons, river water is mainly discharged from the river channel at the right bank. In addition, according to dam scale and project quantity analysis, the dam can be poured in a dry season. Therefore, as for dam construction, it is preferable to intercept the riverbed once for all and adopt the tunnel or underport diversion.

4.6.2.2 Diversion standard

Water retaining dam of Chipwi Nge Hydropower Station belongs to Grade III permanent hydraulic structure. In the light of *Specifications for Construction Planning of Water Resources and Hydropower Engineering* (SDJ338-89), diversion building for the protection of permanent building construction is of Grade V. Upstream and downstream earth-rock cofferdams and diversion tunnel of water retaining dam are of Grade V.

The drainage basin of Chipwi River belongs to the typical mountainous river, where flood can converge quickly, and river channel storage is small. Floods may reveal typical features of mountainous floods, rising and falling sharply. Rainstorms mainly appear from June to September, or April, May and October in some years. Rainstorms occur the most frequently in June and August. According to the above flood features, design standards and feature water level of each diversion building are shown as Table 4.6-2.

Table 4.6-2 Construction Diversion Standard

Item		Time interval	Frequency (%)	Flow (m^3/s)	Discharge condition	Discharge flow (m^3/s)	Downstream water level (m)	Calculated upstream water level (m)
Diversion tunnel		Nov. ~ Apr.	20% instantaneous maximum	89.3	Diversion tunnel	89.3	706.80	722.38
Earth rock cofferdam	Water retaining	Nov. ~ Apr.	20% instantaneous maximum	89.3	Diversion tunnel	89.3	706.80	722.38
	Closure	Nov.	20% monthly average	25.4	Diversion tunnel	25.4	(713.0)	716.29
Diversion tunnel closure cofferdam		Nov. ~ Mar.	20% instantaneous maximum	77.8	Flood discharge sediment flushing outlet	77.8	706.72	720.60
Flood season during the construction period of the dam		Full year	10% instantaneous maximum	958	Diversion tunnel + Flood discharge sediment flushing outlet+Surface outlet	958	713.94	741.64

Note: those with () are ground elevations.

4.6.2.3 Diversion scheme and procedure

The scheme makes use of permanent flood discharge sediment flushing outlets as the diversion underports, which are arranged at the non-overflow dam section at the left side of overflow dam section. The upstream of diversion underports adopts diversion canals formed through foothill digging, and the downstream is combined with permanent flood discharge sediment flushing outlets for discharging.

The upstream diversion canal is 5m wide, and slopes at the two sides are 1:0.3. The bottom elevation of open channel is 715.0m; diversion underport size is 5m (width) ×6m (height), and underport elevation 715.0m; the downstream permanent flood discharge sediment flushing outlets adopt the type of dam open outlets. When upstream water depth exceeds 1.5 times of outlet height, the flowing type is pressure flow.

According to the overall progress plan of project construction, diversion procedure of water retaining dam of Chipwi Nge Hydropower Station is as follows:

Start to dig left and right dam shoulders in November of the first year, and start to dig diversion tunnel in February of the second year, and discharge water into diversion tunnel at the end of October. Water should flow over riverbed during the construction period of dam shoulders at both banks and diversion tunnel.

Close the major riverbed at the beginning of November of the second year, finish upstream and downstream cofferdam closure and fill, foundation pit water pumping in the first ten days of November, finish the rest dam sections of the riverbed under the protection of upstream and downstream cofferdams at the end of April of the third year. Water flows over diversion tunnel. Start temporary water retaining in May of the third year, close diversion tunnel in early

November, and lock flood discharge sediment flushing outlet at the end of December to accumulate water.

4.6.3 Construction traffic

4.6.3.1 External traffic

On the basis of collecting materials such as traffic condition, development planning and major building material sources around the power station, Chipwi ~ Panwa Road is selected as the main traffic route to the outside. Building materials and equipment (including heavy pieces)n are from China, and transported from Yunnan through railways and highways. The concrete transport route is Kunming→Dali→Bao Son→Tengchong→Panwa→Xinkong→dam site. Heavy pieces can be transported to Kunming and Dali through railways, and then transferred to the construction site through trucks. In addition, Tengchong→Waxiao→Chipwi road can be taken as auxiliary access to the site after partially repaired.

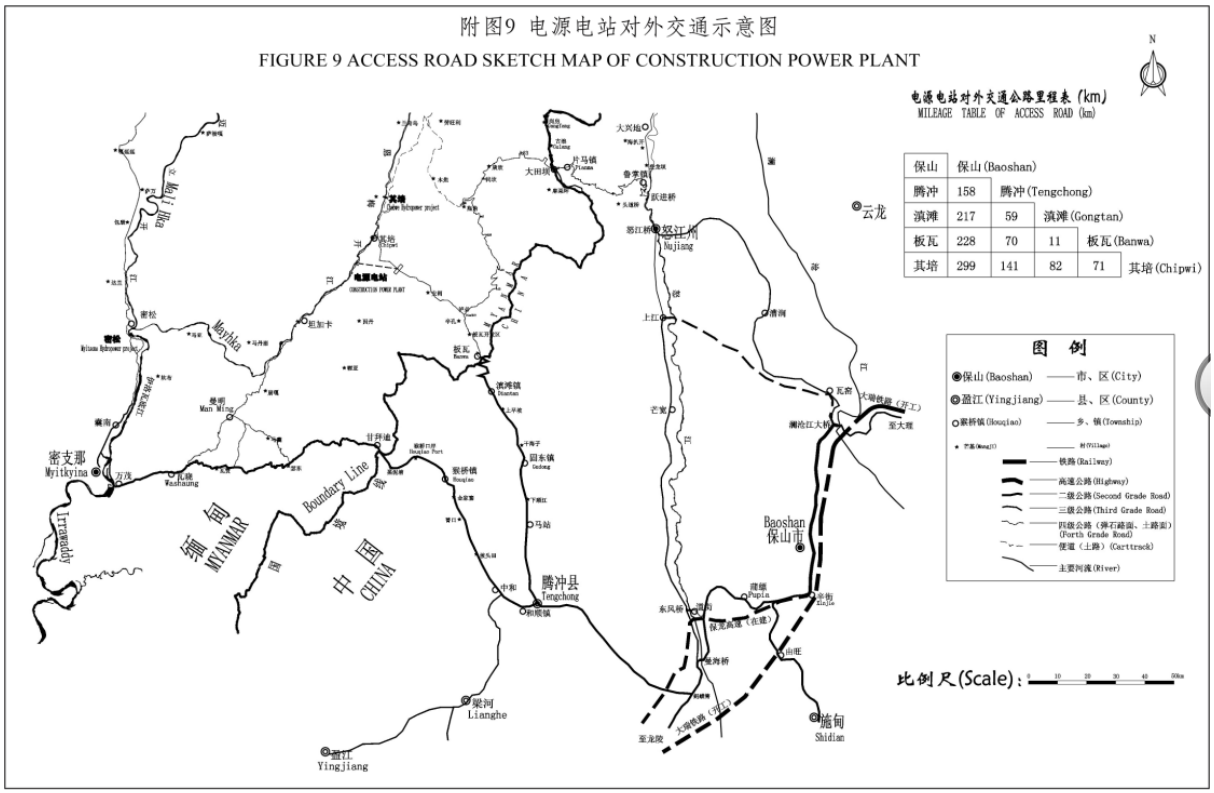
Due to the need of the construction of Chipwi Hydropower Station, the above roads are to be expanded. During the period of transporting materials for Chipwi Nge Hydropower Station, it is required to coordinate with the road constructing party so as to keep the roads clear.

(1) Tengchong ~ Panwa Road

Tengchong ~ Panwa Road is a newly built plain hilly Grade II road open to traffic and passing through Gudong Town and Diantan Town. Panwa at No. 4 boundary marker between China and Myanmar is the capital of the first special economic zone of Kachin State, and close to the boundary line. Teng Chong ~ Diantan is 59km, and Diantan ~ Panwa11km, with the total length being 70km. With bituminous pavement, Teng Chong ~ Diantan roadbed is about 10m wide, and Diantan ~ Panwa roadbed is about 8m wide. The highest elevation of the road is about 2,300m at No. 4 boundary marker between China and Myanmar (crossing of Panwa), and the lowest elevation is about 1,700m at Tengchong.

(2) Panwa ~ Chipwi Road

Panwa ~ Chipwi Road runs downward along Chipwi River to the dam site via Panwa and Xinkong, with the total length being 71km. It is of taw pavement, and roadbed width about 5m. The road condition is mediocre.



4.6.3.2 Internal traffic

A river-crossing bridge is built 2km at the downstream of the dam site. It is connected with a 2km permanent road leading to the dam site at the left bank. The left and right banks are connected with the main roads from the permanent road. Two roads are arranged, namely the road along the river and the road up to the dam.

Diversion system is from the access road at the left bank to the temporary zigzag road along the mountain, and finally to each construction adit.

The plant is connected with the access road through the road between ChipwiTown and Myitkyina. Construction traffic in the site is shown as Table 4.6-3.

Table 4.6-3 Construction Traffic in the Site

Name	Length (m)	Width (m)	Road grade
Permanent road at the left bank	2000	5.0	Grade III
Road along the river at the right bank	232	5.0	Grade III
Road leading to the dam at the right bank	265	5.0	Grade III
Road along the river at the left bank	309	5.0	Grade III
Road leading to the dam at the left bank	520	5.0	Grade III
Temporary roads for water diversion system	28000	4.0	Grade IV
Access road to the plant	340	7.0	Grade II
River-crossing bridge			

4.6.4 Stockyard planning

(1) Rock block stockyard planning

The dam area and the plant area are provided with a rock block stockyard separately. The rock block stockyard of the dam area is located at the right bank of Chipwi River. There is a mountain at the north side about 1km downstream of the dam site, and the working thickness is 50m, and reserves about 500,000m^3; the rock block stockyard of the plant area is located about 800m at the left upstream of Nmaihka River, and the debris flow gully is the boundary of the south side. The major area is the slope on the north side of the debris flow gully. The slope crest elevation is about 500m, and the slope bottom elevation about 245m. The working thickness is big, and reserves around 250,000m^3. It is planned to exploit 152,900m^3 of rock blocks for the project, including 117,990m^3 for the dam area and 35,900m^3 for the plant area.

Surface coverage and fully weathered layer of rock block stockyard adopt 180Hp bulldozer aggregates. Usable layers of rock block are exploited from up to bottom through the step blasting method, dug through1.5m^3 ~ 3m^3 grab, and transported through 10t ~ 15t dump trucks.

Average transport distances of rock block stockyards of the dam area and the plant area are 1.0km separately.

The two rock block stockyards are close to the project area, and can be exploited along the gully and road. Gravel roads leading to the dam site or plant area pass through the stockyard, thus rendering favorable traffic conditions. Stockyard reserves and quality meet requirements.

(2) Gravel quarry planning

Gravel quarry of Chipwi River is planned to be located at the convergence of Chipwi River and the left bank of Nmaihka River. The quarry is 250m long along Chipwi River. The external side is a sandy gravel low flood plain, which is about 200m long along Nmaihka River. The distribution area of the quarry is 25,000m^2, the working thickness 6m, and the sand reserve 150,000m^3. Gravel quarry of the plant is located at the left bank of the downstream Nmaihka River. It is a fine sand flood plain. It is about 150m long and 50m wide, the working thickness 2m ~ 3m, and reserve 20,000m^3. After comprehensive analysis, we select the gravel quarry of Chipwi River. Chipwi Nge Hydropower Station requires 56,100m^3 of gravel quarry.

Each covering layer and surface useless layer of gravel quarry of Chipwi River is cleaned off through 100Hp ~ 120Hp bulldozer. The useful layer is dug and loaded through 1m^3 ~ 2 m^3 grab, and transported to the concrete aggregate yard through 8t ~ 15t dump truck. The average transport distances of gravel quarry to the dam area and the plant area are 16km and 10km respectively.

Gravel quarry of Chipwi River is mainly fine aggregate. The quarry is of gentle landform, big distribution area, and favorable exploitation conditions. A road along Chipwi River is leading to the dam area. The reserves and quality can basically meet requirements.

(3) Borrow pit planning

Borrow pit is planned to be located at the upstream of the dam on the right bank of Chipwi River, and composed of Grade II bench platform and rear gentle slope behind it. Grade II bench platform distribution elevation is 775m ~ 785m. It is about 95m ~ 130m long along the river, 80m wide, and 9,000m^2 in area. The reserves are 25,000m^3. The rear gentle slope is located at the north side of the road. It is 80m ~ 100m long and 30m wide. The area is 2,500m^2, and the reserves 5,000m^3. It is planned to exploit 42,000m^3 of soil for Chipwi Nge Hydropower Station.

Adopt plane exploitation method in construction. 1.0m^3 grab is employed to dig and load soil; 100HP ~ 120HP bulldozer is employed to collect soil; and 5t ~ 10t dump truck is employed to transport soil to the site.

The distance from borrow pit to the dam area is less than 0.5km. The landform is gentle, distribution area big, and exploitation & transportation conditions favorable. Its reserves and quality can basically meet requirements.

4.6.5 Engineering waste and spoil yard planning

4.6.5.1 Engineering waste

Excavation quantity of buildings of the project is 812,600m^3 (natural cubic meter), including 28,100m^3 of diversion tunnel excavation, 159,500m^3 of dam excavation, 170,700m^3 of diversion system excavation, 409,800m^3 of plant excavation, 1,800m^3 of foundation treatment, 5,000m^3 of dangerous rock excavation, and 37,000m^3 of upstream earth-rock cofferdam dismantling.

Fill quantity of the project is 111,200m^3, including 6,400m^3 of rock block, 5,700m^3 of gravel, 57,100m^3 of rock ballast, and 42,000m^3 of clay (converted into 49,600m^3).

33,700m^3 of excavated material is used for building fill of the project; 110,000m^3 of excavated material from diversion tunnel is used as concrete aggregate of the processing plant, lower section of diversion tunnel, and the dam area. 68,300m^3 (natural cubic meter) and 16,300m^3 (natural cubic meter) are exploited from the quarry of the dam area and the quarry close to the plant area. In addition, 50,400m^3 natural fine aggregate is exploited from the gravel quarry of Chipwi River; 49,600m^3 (natural cubic meter) of filling soil in the project is exploited from the borrow pit of Chipwi River.

207,100m^3 waste is to be piled up at the spoil yard for the dam area while 359,400m^3 waste is to be piled up at the spoil yard for the plant area. 25,000m^3 and 19,400m^3 of waste should be planned for $2^{\#}$ construction adit opening leveling and spoil yard and $3^{\#}$ construction adit opening leveling and spoil yard respectively.

4.6.5.2 Spoil yard planning

1) Spoil yard for the dam area

Spoil yard for the dam area is planned to stock 207,100m^3 of waste, and to cover an area of 115,000m^3. It is located at the left downstream of the dam, and can stock wastes from the dam, some diversion tunnels, left dam shoulder, diversion tunnel inlet and dam section of diversion tunnel.

2) Spoil yard for the plant area

Spoil yard for the plant area is planned to stock 359,400m^3 of waste, and to cover an area of 200,000m^3. It is located at the left bank of Nmaihka River. The yard can stock excavated material of the plant (including using material of excavated material), and wastes (excluding rock waste for leveling the adit) from $4^{\#}$ ~ $6^{\#}$construction adit and the lower section (pile number Y+8015 ~ 9650m) of diversion tunnel of the corresponding construction adits and pressure steel pipes.

3)Waste disposal area for construction adit

To reduce the transport distance of waste, waste dug from $1^{\#}$ construction adit, waste from $2^{\#}$ ~ $3^{\#}$ construction adits, and waste dug from diversion tunnel of $2^{\#}$ ~ $3^{\#}$ construction adits are stocked at the spoil yard. Using material used for concrete aggregate in diversion tunnel is

stocked at the yard. It is required to plan 25,000m^3 waste for the leveling of the opening area of 2$^{\#}$ construction adit and spoil yard, and it is required to plan 19,400m^3 waste for the leveling of the opening area of 3$^{\#}$ construction adit and spoil yard.

4.6.6 Construction plant and camp

4.6.6.1 Construction plant

(1) Aggregate processing system

In the project of Chipwi Nge Hydropower Station, the dam area and plant area are provided with an aggregate processing system separately.

Aggregate processing system of the dam area mainly undertakes the tasks of concrete mixing and aggregate production needed by the dam, the upper section of diversion tunnel, and diversion work. The processing plant is arranged at the downstream of the dam, with the elevation being 740m, adjacent to the mixing system and covering an area of 8,000m^2. The designed production capacity of the aggregate processing system is 160t/h, including 1105/h broken stone and 50t/h sand. The total quantity of finished aggregate needed is 191,000m^3, including 128,000m^3 of broken stones and 63,000m^3 of finished sand.

Aggregate processing system of the plant area mainly undertakes the task of producing aggregates for the plant and the lower section of diversion tunnel. Due to the small concrete quantity of the plant area, mobile rock-crushing station is adopted for producing aggregate needed. Aggregate production capacity is 50t/h, and the total quantity of finished aggregate is about 95,000m^3.

(2) Concrete mixing system

The dam area is equipped with a concrete mixing system, and the plant area is equipped with a mixing station. The mixing system is configured according to the placing intensity of 26,000m^3 in peak months. The mixing system can produce 80m^3/h of concrete at normal times. AHL120-3F1500 mixing plant is configured, with the production capacity being 120 m^3/h on the nameplate. The mixing station is configured according to the placing intensity of 7,000m^3 in peak months. The mixing station can produce 25m^3/h of concrete at normal times. AHZ40-2F750 mixing station is configured, with the production capacity being 40 m^3/h on the nameplate. The mixing system of the dam area covers an area of 4,000m^2, and shares the aggregate stockyard with the sand system. The elevation of the stockyard is 740m. Major technical parameters of the concrete system of the dam area are shown as Table 4.6-4.

Table 4.6-4 Major Technical Indexes of Concrete Mixing System in the Dam Area

Serial No.	Item		Unit	Index	Remarks
1	Concrete design peak month strength		10^4m^3/month	2.6	
2	Normal temperature concrete production capacity		m^3/h	120	
3	Binding material storage quantity	Cement	t	2000	Sacked cement
		Coal ash	t	800	Sacked coal ash
4	Scale of compressor station		m^3/min	60	
5	Water consumption		m^3/min	100	
6	Production shift		Shift	3	
7	Production staff		Person	40	
8	Covered area		m^2	400	
9	Floor area		m^2	4000	

(3) Comprehensive processing plant

Comprehensive processing plant includes reinforcement yard, prefabrication yard, and timber yard. External goods are transported to the construction site through trucks. The upstream open space of the dam area is provided with comprehensive processing plant and material warehouse, and the plant area is provided with comprehensive processing plant.

(4) Machinery equipment parking lot

The dam area and the plant area are provided with a machinery equipment parking lot separately. They assume the maintenance, large and medium repairs of construction machinery, replacement of large parts, processing of some non-standard parts, and repair of transport vehicles.

(5) Water and electricity supply systems

1) Water supply system

According to statistics, production water quantity in the dam area is 5500m^3/d, and living water quantity is 800m^3/d, totaling 6300m^3/d. Due to the small water quantity, water is supplied to each part of the plant area according to the living water standard.

It is planned to provide a water supply system in the dam area and the plant area separately. The water supply system of the dam area is arranged at the right bank. Water intake pumping station is the simple float-type pumping station, and the water source is Chipwi River. The pumping station is located at the right bank about 400m downstream of the dam. The pumping station is configured with three submerged pumps, two in operation and one for standby. Unit water intake quantity is 130 m^3. The water supply system of the plant area is configured at the upstream. A simple float-type pumping station is arranged at the left bank of Nmaihka River, and configured three submerged pumps, two in operation and one for standby. Unit water intake quantity is 45m^3/h.

2) Power supply system

After calculation, the maximum construction electrical load is about 3500kW. Since there is no power grid, diesel generator is arranged for power supply in the light of actual need.

① Construction area of the dam: a diesel generator room is arranged at the aggregate processing and concrete mixing system, material comprehensive processing plant and material warehouse, left and right bank non-overflow dam section, and left bank concrete mixing system separately.

② Power generation diversion system: a diesel generator room is arranged close to the opening of each construction adit.

③ Power station plant area: a diesel generator room is arranged close to the mixing station and the construction area of the plant.

Power supply network of the dam, diversion system and power station plant requires laying 30km-long 0.4kV cables. The total capacity of diesel generators is about 7,000kW.

4.6.6.2 Construction camp

It is planned to arrange a construction camp and an office occupancy in the construction areas of the dam and the plant separately. The construction camp and office occupancy of the dam cover an area of 1.3hm^2, and that of the plant 0.4 hm^2. The owner's camp covers an area of 1 hm^2.

4.6.7 Construction progress

The overall construction period is 32 months. The construction preparation shall last three months, the construction of the main work 26 months, and power generation of the second and

third units four months.

(1) Construction preparation

Construction preparation starts from September, October and November of the first year, and covers the construction of internal and external traffic, site leveling, water and electricity supply, construction camps, aggregate processing system, concrete mixing system, etc.

(2) Dam project

Start to dig the non-overflowing dam sections at the two banks from November of the first year, and finish the work in July of the second year; start the construction of diversion tunnel in February of the second year and finish the work in October; start to place concrete in August of the second year, and finish the work in February of the third year.

Start to fill upstream and downstream cofferdams in November of the secondary and close the flow in the first ten days. Finish digging foundation pits within one month, and start to place dam concrete in December of the second year, and finish the work in May of the third year.

(3) Water diversion system

Finish the digging of the foundations of open pipe sections of water inlet before April of the second year; start to place concrete in November of the second year, and finish the work within two months; and install steel pipes from January to March of the third year.

Six construction adits for diversion tunnel will be started in November of the first year. The longest 2#construction adit will be completed in June of the second year; diversion tunnel will be finished before the end of June of the third year; concrete placement in the adit will be finished in October of the third year.

Start the installation of pressure steel pipes in February of the second year, and finish the work in August of the third year. External concrete placement of steel pipes will be finished one month later.

(4) Plant project

Start to dig plant foundation in November of the first year, and finish the work in July of the second year. Start to place concrete in November of the second year, and finish the work in April of the third year; units will be installed three months after concrete placement. The first unit shall start power generation in December of the third year. Block diversion tunnel in November of the third year, and lock the gate to accumulate water at the end of December.

4.6.8 Laborers and major construction machinery

(1) Laborers

The number of laborers during the peak construction period of the project is 830.

(2) Using quantities of major building materials

Using quantities of major building materials of the main works and temporary works are calculated according to the actual demand. Materials for temporary works include temporary buildings, steel formwork, reinforcement and tie bar serving the construction of major buildings.

Year-on-year using quantities of major building materials are shown as Table 4.6-5.

Table 4.6-5 Year-on-year Using Quantities of Major Building Materials

Serial No.	Name	Unit	1st year	2nd year	3rd year	Total
1	Cement	t	500	16950	18700	36150
2	Reinforcement, steel	t	550	4820	6655	12025
3	Timber	m^3	40	85	70	195

(2) Major construction machinery

Models and quantities of major mechanical equipment needed by Chipwi Nge Hydropower Station are determined according to construction procedure, progress and intensity, shown as Table 4.6-6.

Table 4.6-6 Major Mechanical Equipment of Earth-rock Works

Serial No.	Name	Model performance	Unit	Qty.
1	Dump truck	5t ~ 10t	Pcs	32
		8t ~ 15t	Pcs	52
2	Grab	1m ~ 2m^3	Pcs	12
		3m ~ 4m^3	Pcs	2
3	Bulldozer	180 Hp ~ 220Hp	Pcs	6
4	Vibrating roller	15t ~ 18t	Pcs	3
5	Down-the-hole drill		Pcs	16
6	Pneumatic drill	Air leg type	Pcs	36
7	One-arm drill jambo		Pcs	12
8	Shotcrete machine	4 m^3/h ~ 5m^3/h	Pcs	9
9	Ventilator		Pcs	9
10	Air compressor	9 m^3/min ~ 50m^3/min	Pcs	14
11	Crawler loader	0.25m^{3}clay type	Pcs	12
12	Trolley		Pcs	36
13	Battery truck		Pcs	12
14	Geological abrasion drill		Pcs	10
15	Grout pump	200/100	Pcs	10
16	Automatic recorder		Pcs	10

4.7 Land occupation and resettlement of inhabitants

4.7.1 Land occupation

(1) Permanent land occupation

Permanent land occupation is composed of reservoir inundation and land occupied by the project.

Normal pool level of the reservoir of Chipwi Nge Hydropower Station is 740m, total length of damming 0.75km, and total length of reservoir banks 2.13km, including 0.82km of left bank and 1.31km of right bank. Water area of the reservoir is 9.7hm^2, and land area inundated 8.1hm^2, including 0.1hm^{2}of garden area, 2.5hm^2 of economic forests, 0.6hm^2 of commercial forests, 1.6hm^2 of grassland, 0.1hm^2 of shrubwood, and 3.2hm^2 of other lands. No houses are involved.

According to the overall layout of the construction, the construction area of the dam covers 4.8hm^2(overlapping area of dam and reservoir is included into the reservoir area), including 0.6hm^2 of paddy field, 0.4hm^2 of garden, 1.9hm^2 of economic forest, 0.1hm^2 of commercial forest, 0.4hm^2 of grassland, 1.1hm^2 of shrubwood, and 0.3hm^2 of other lands. No houses are involved. The construction area of power house covers 2.8hm^2, including 2.1hm^2 of economic forest and 0.7hm^2 of grassland. No houses are involved.

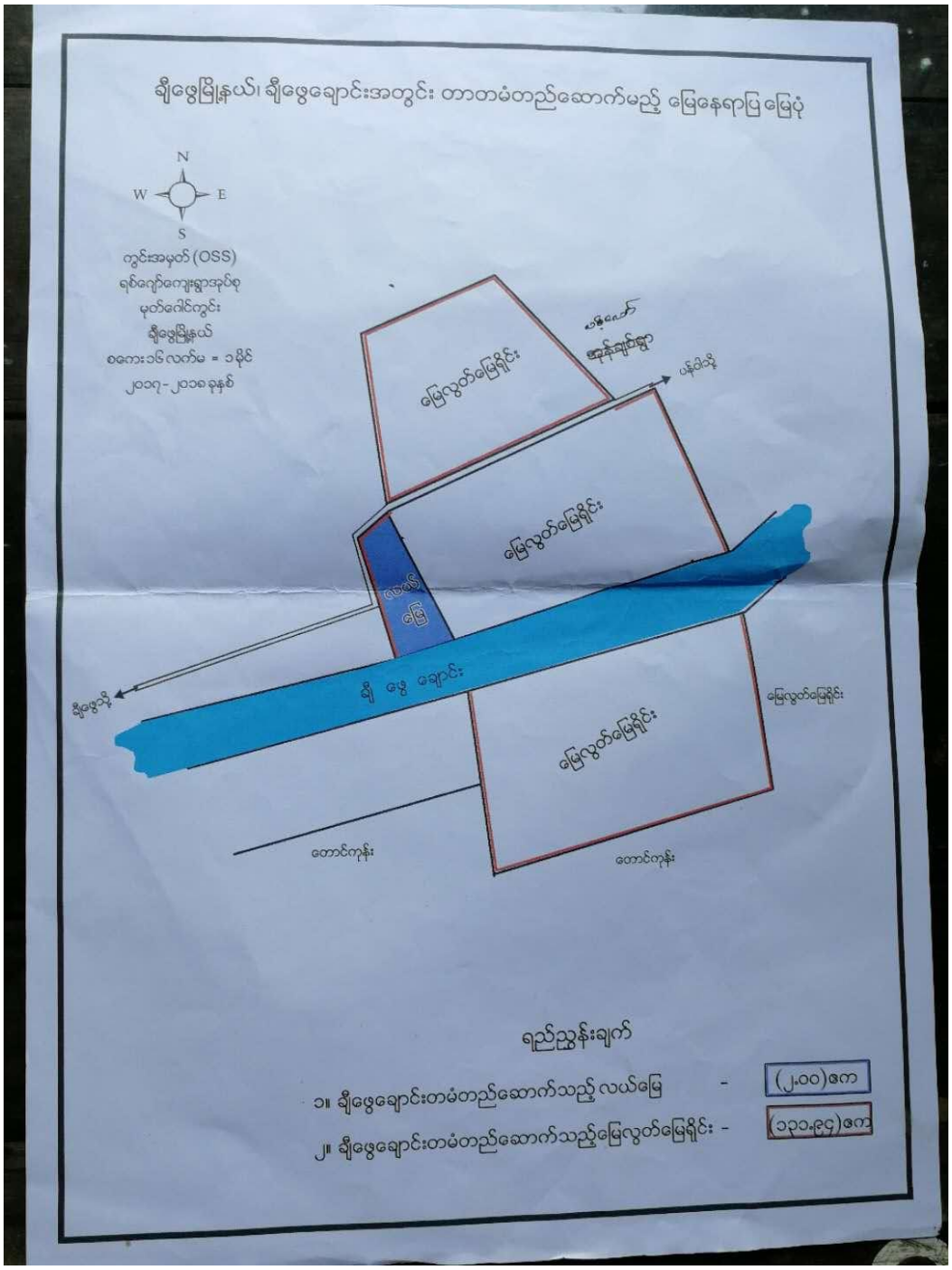
(2) Temporary land occupation

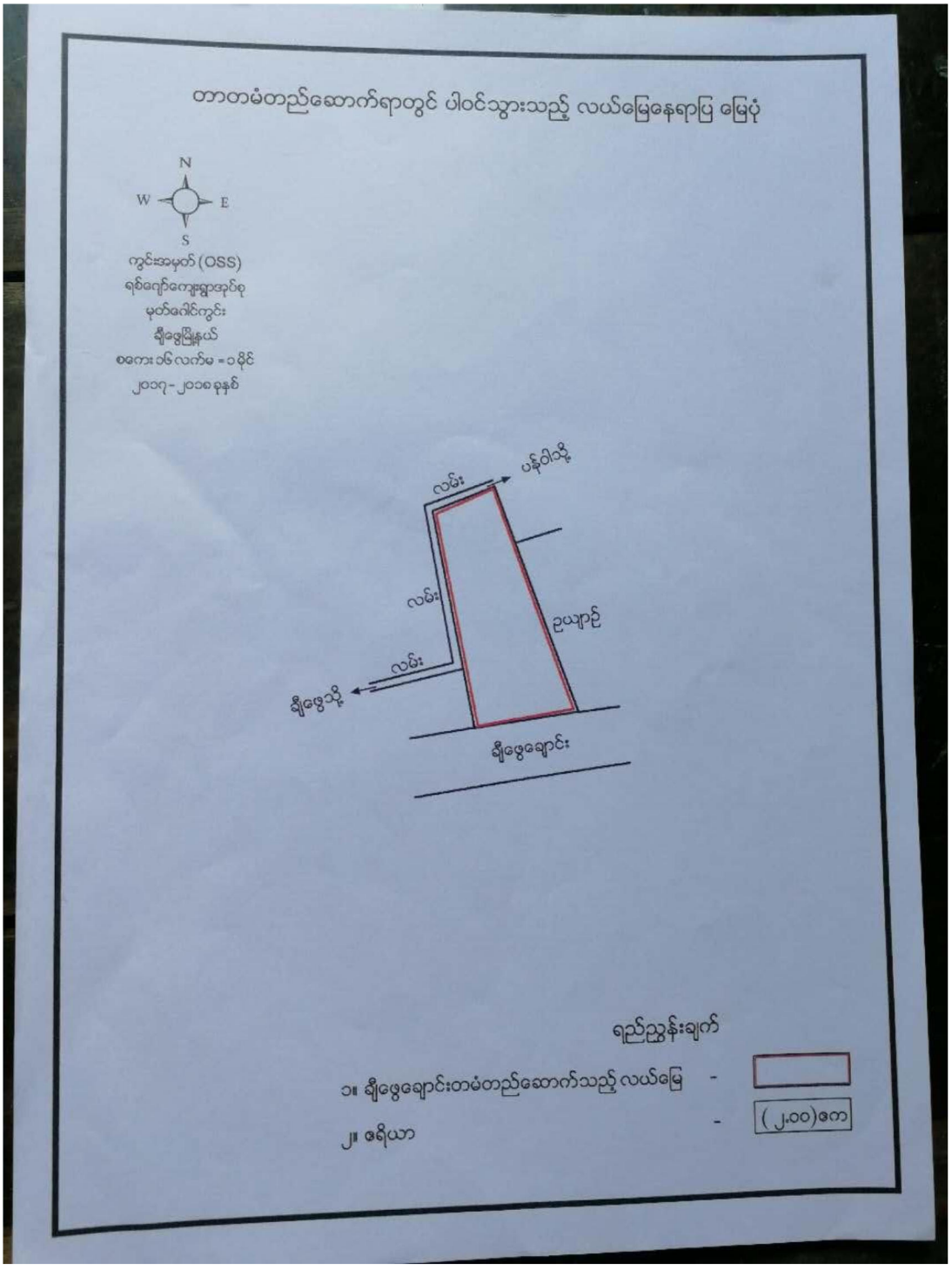
Temporary land occupation of the project mainly includes accessory facilities such as construction road, production and living areas, stockyard and spoil yard. Temporary land

occupation covers a total area of 56.39hm^2, including 12.91 hm^2 of construction roads, 5.90hm^2 of production and living areas, 5.63 hm^2 of stockyard, and 31.95 hm^2 of spoil yard.

Land for the enterprise (220.17 acres of uncultivated land and 2 acres of farmland); please refer to the following *figures.*

Currently, the Land Certificate declaration data is reported to Chipwi Land Bureau by EPGE person in charge of Chipwi Nge HPP as per 105 Format specified by Kachin State Government, and will be submitted level by level for review upon completion of archival arrangement by the Chipwi Land Bureau.

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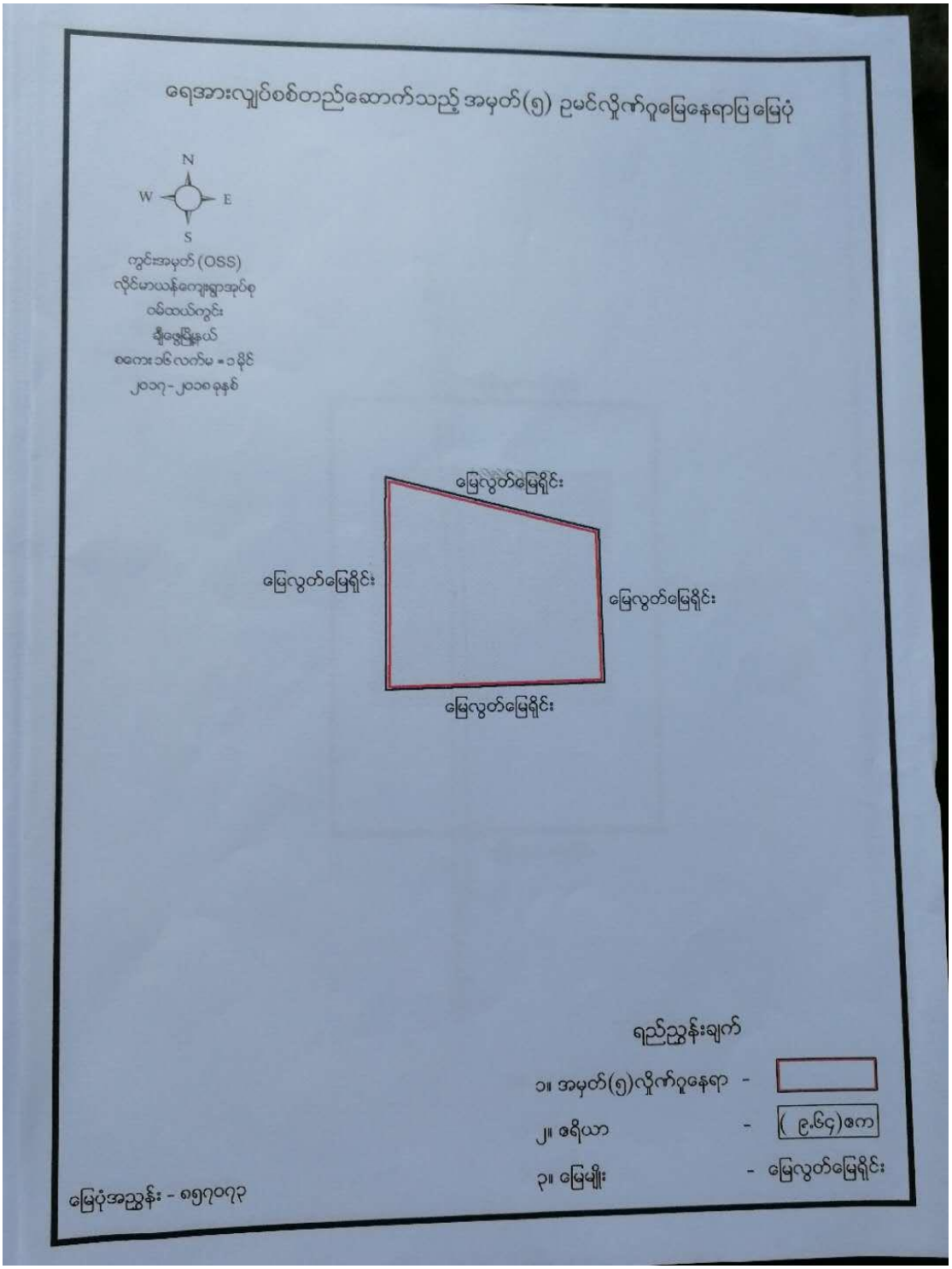
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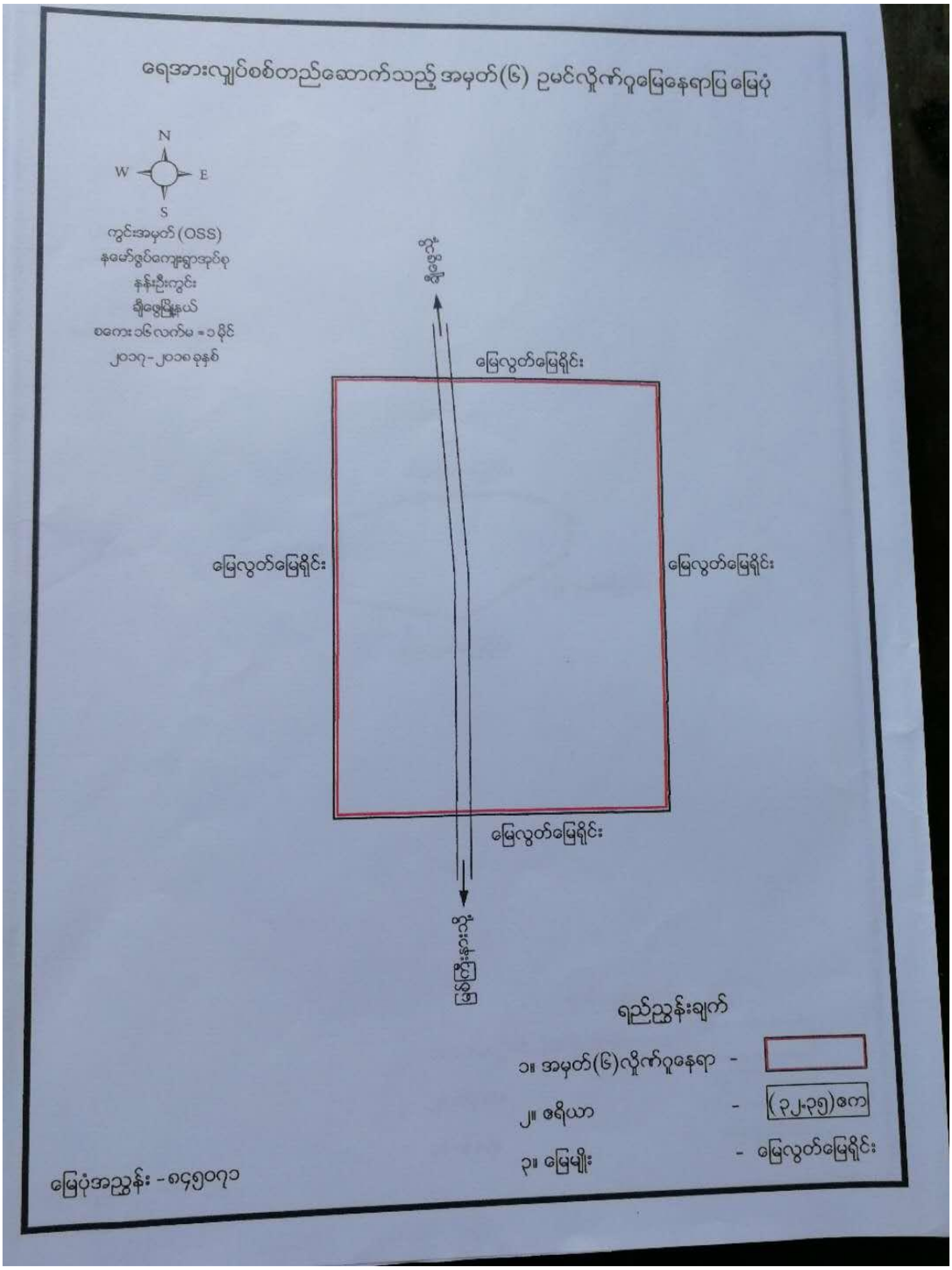
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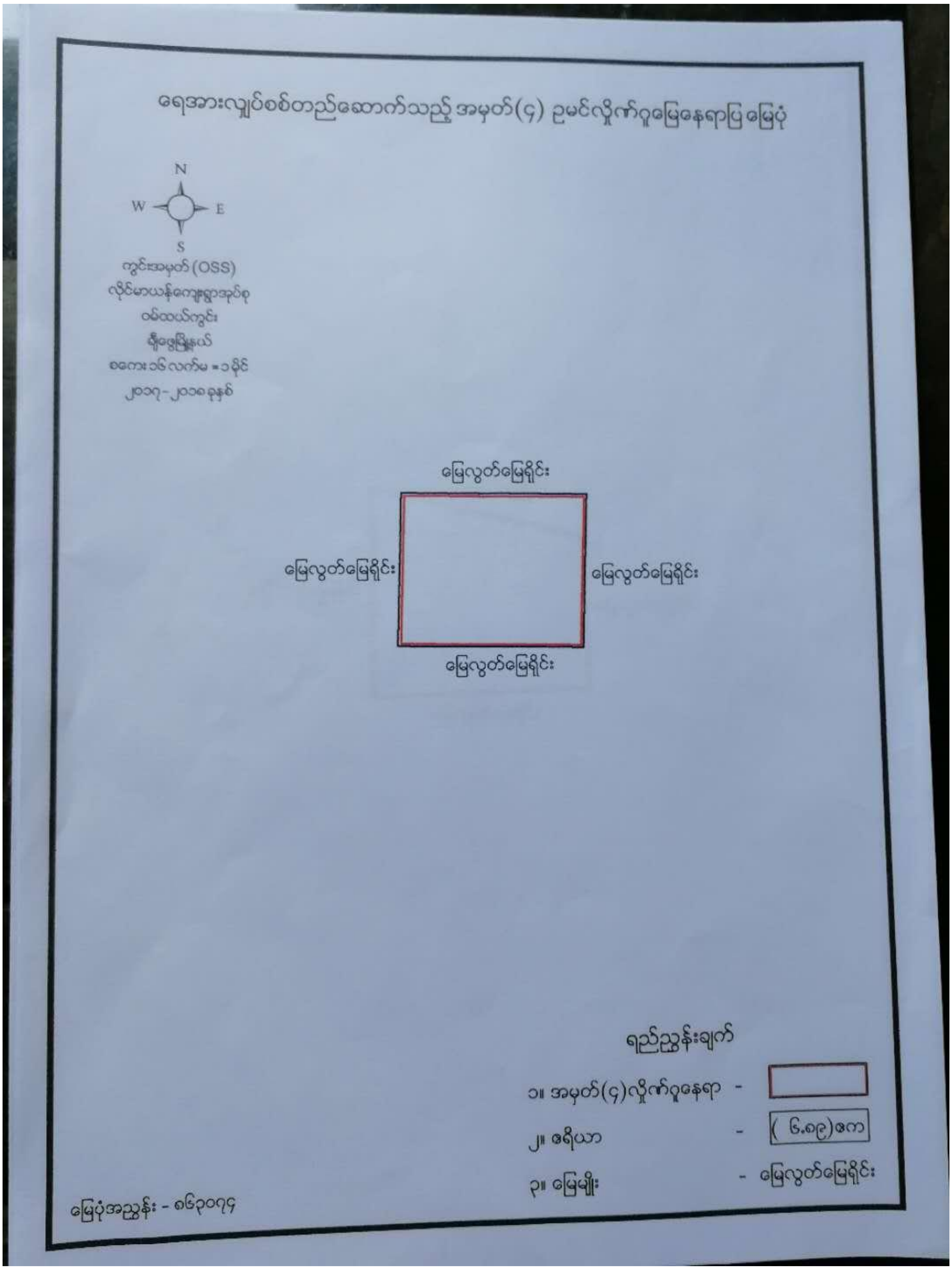

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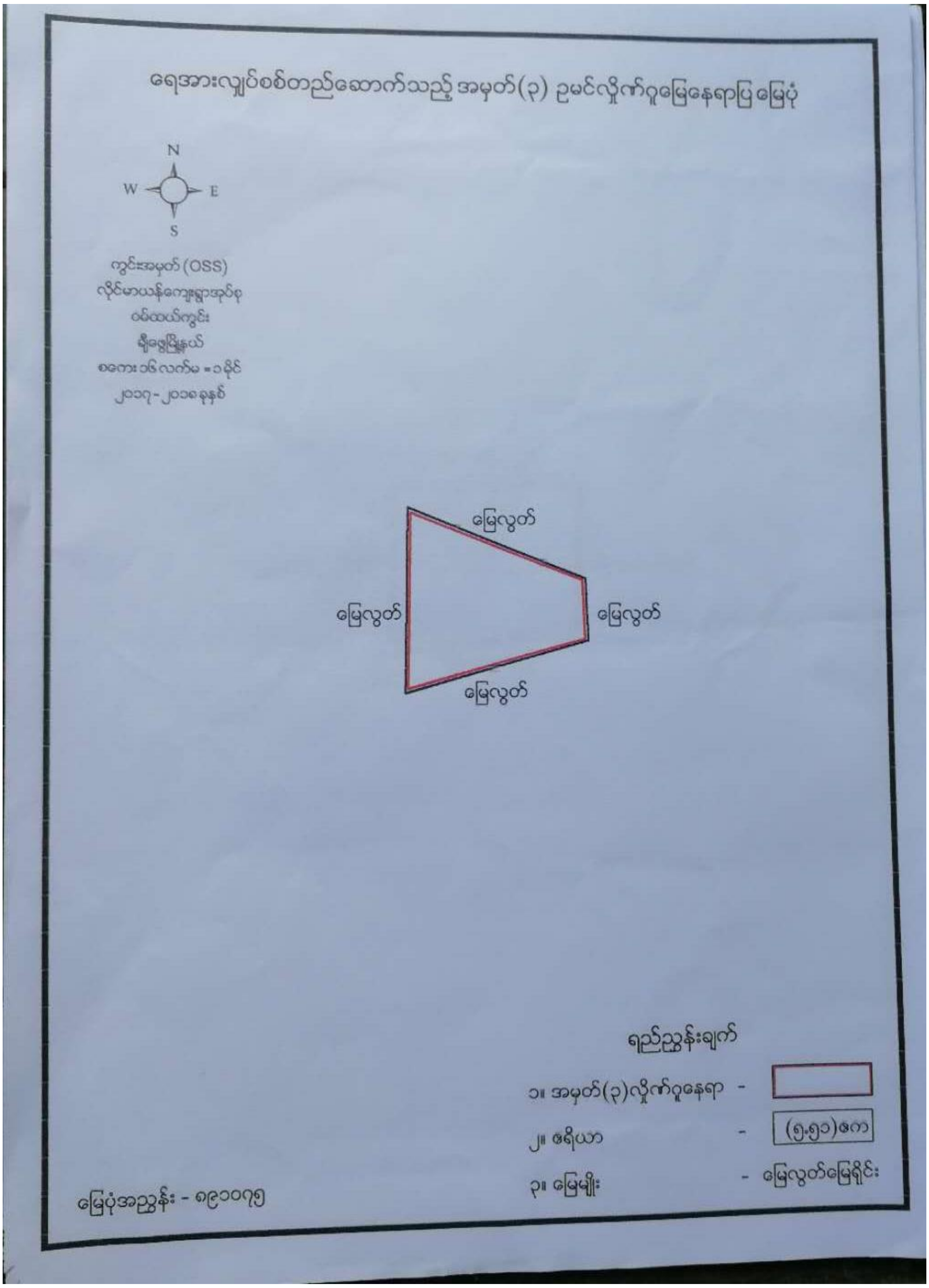
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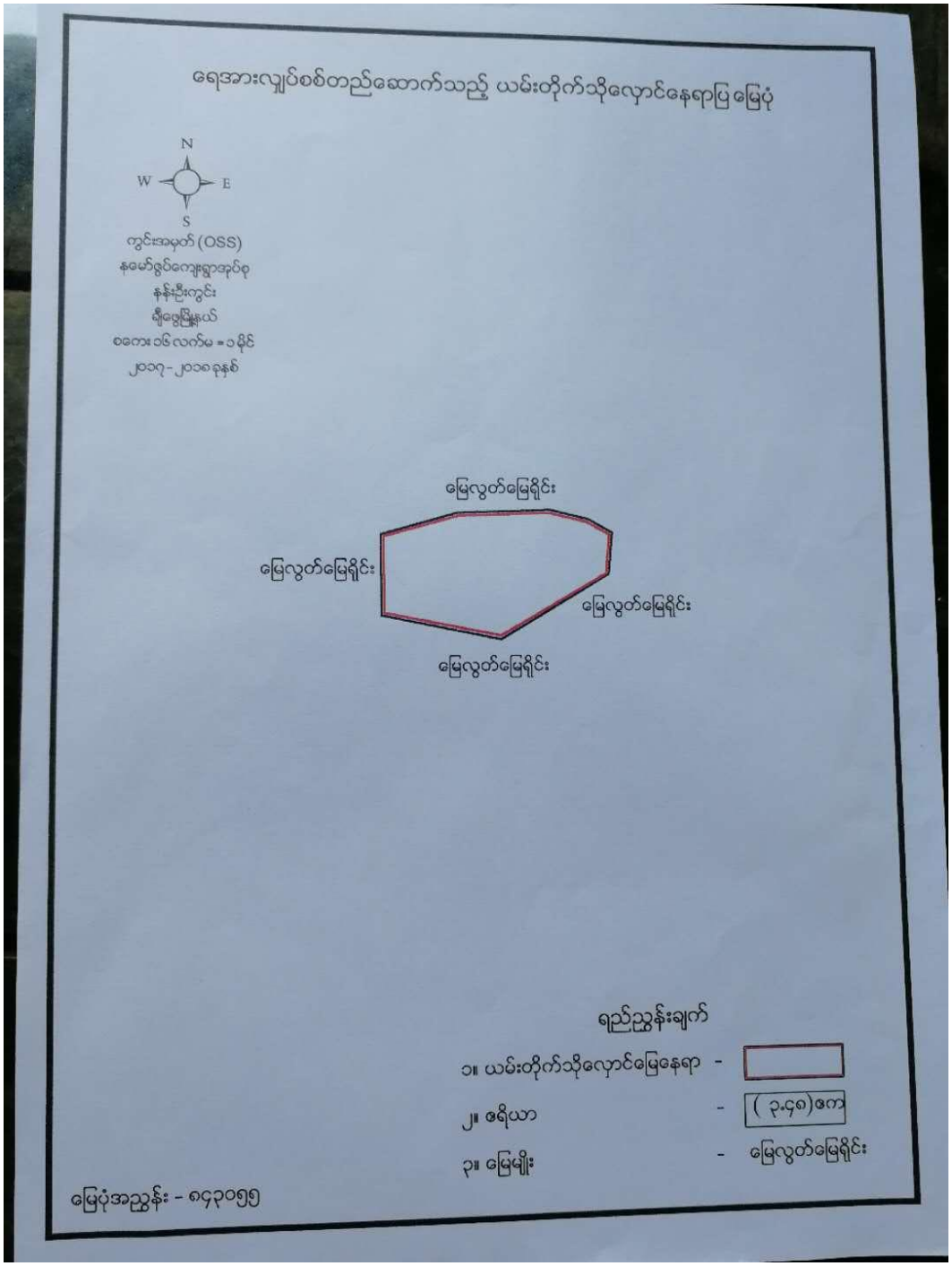
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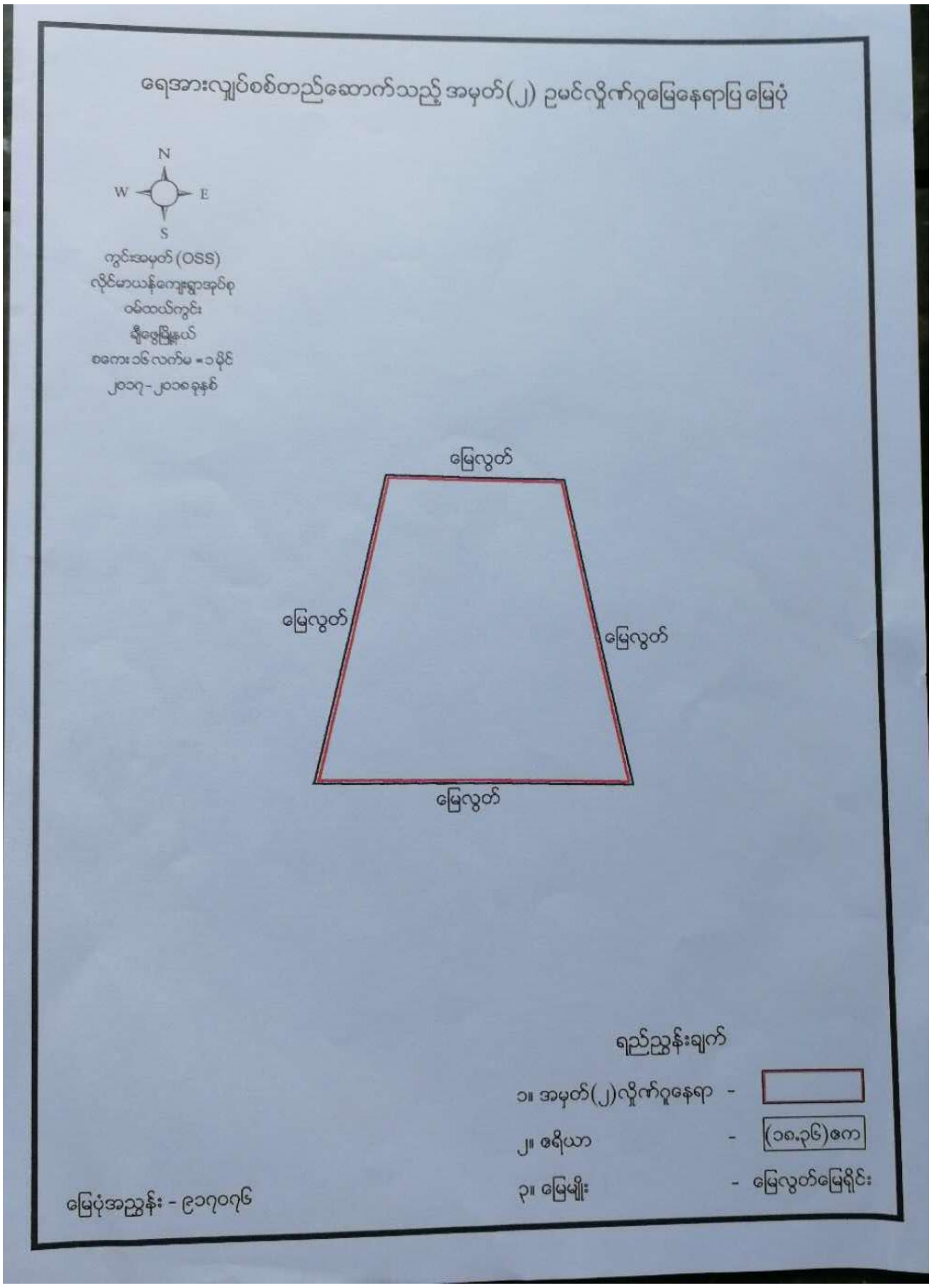
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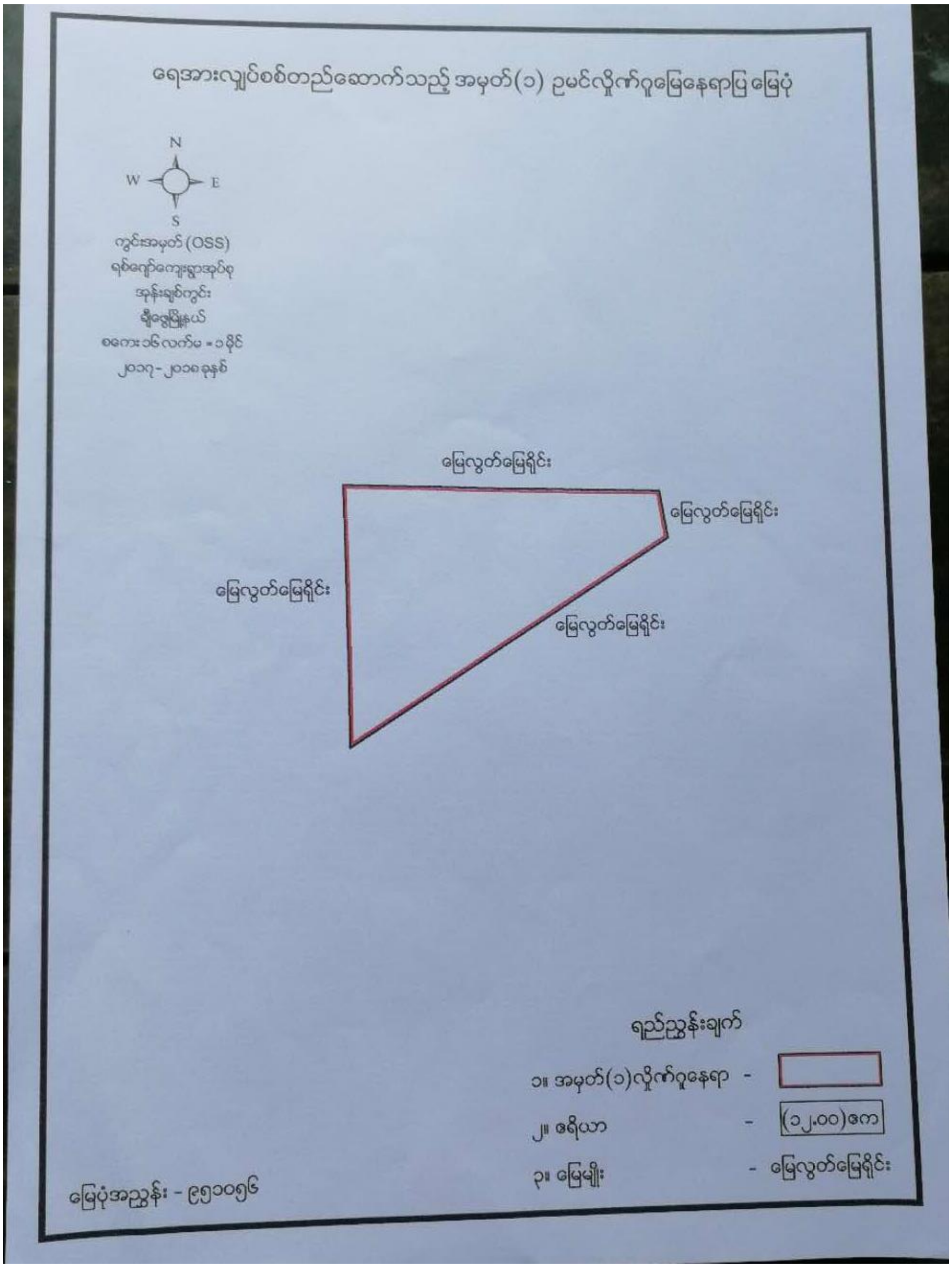
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4.7.2 Resettlement of inhabitants

Since land requisition does not involves resident houses but a tiny amount of gardens and forests, land requisition of the project will have little impact on local residents' production and living, and will not lead to resettlement of inhabitants.

4.7.3 Number of Personnel, Living Facilities and Disposal of Domestic Waste and Wastewater

There are 73 Chinese and Myanmar employees in the Chipwi Nge HPP, including 15 from China, 12 from EPGE, 42 from Myanmar and 4 dispatched workers. The HPP is equipped with single apartments and such living goods as quilts and televisions for employees. Staff canteen, with professional chefs, is provided. In order to enrich staff's life in spare time, billiard room, gym, basketball court, badminton court, sepak takraw court, KTV and other activity places are provided.

Both living quarters and office area have water dispensers and barreled water. To ensure the water safety, the domestic water system is inspected regularly, with water tanks cleared, and water samples are sent to Tengchong County in China for testing.

Water Dispensers and Barreled Water in Living Quarters

Badminton Court and Sepak Takraw Court

KTV Room

The domestic waste incineration disposal pit is provided adjacent to living quarters, and green bins are arranged in living quarters, office area and production area so that the wastes can be collected separately, stacked in a centralized manner and processed at specified locations.

4.7.4 Domestic Waste Storage Places during Operation

The domestic waste incineration disposal pit is provided adjacent to living quarters, and green bins are arranged in living quarters, office area and production area so that the wastes can be collected separately, stacked in a centralized manner and processed at specified locations.

Centralized Stacking Field of Domestic Waste

Domestic Waste Disposal Pit

Domestic Waste Sorting (Dustbin)

4.7-5 Transmission Line Information (starting / ending point, length and grade)

1) The transmission line from the powerhouse of Chipwi Nge HPP to Chipwi Town and the dam is a 10 kV double-circuit line: (0#--106#) 10 kV double-circuit line, with the length of 8.368 km; (106#--223#) 10 kV single-circuit line, with the length of 13.122 km. The total length of the line is about 29.858 km.

2) The transmission line from Myitsone Substation to Maliyan resettlement village is a 10 kV single-circuit line, with a total length of about 4.8 km.

3) The transmission line from Myitsone Substation to Aung Myin Thar resettlement village is a 10 kV single-circuit line, with a total length of about 5.4 km.

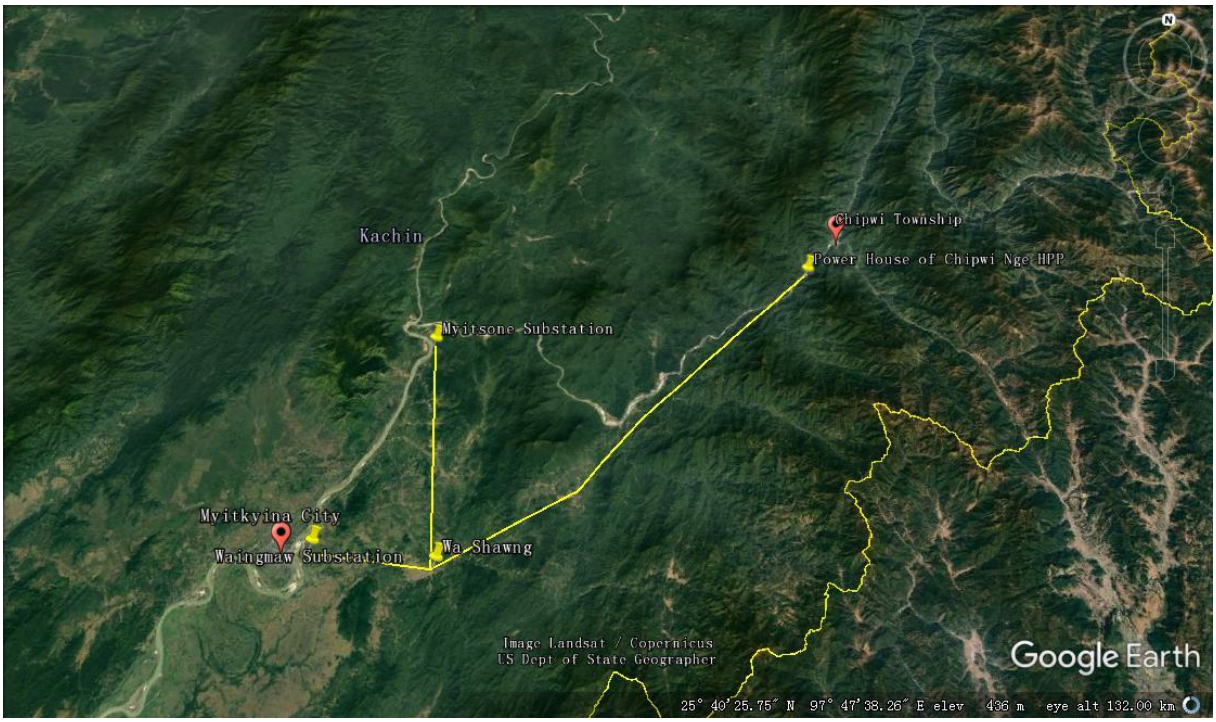
4) The transmission line from Myitsone Substation to Myitsone camp is a 10 kV single-circuit line, with a total length of about 2.5 km.

5) The 110 kV line from the powerhouse of Chipwi Nge HPP to Myitsone Substation is 124 km long in total. Specifically, a double-circuit line on the same pole with the length of about 82 km is adopted from powerhouse to Wa Shawng and a single line with length of about 42 km from Wa Shawng to Myitsone Substation.

The transmission line route and pictures of transmission line are shown the following figures.

4.8 Project investment

Static total investment in the project is RMB 1.119 billion Yuan.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Power House of Chipwi Nge HPP
Myitsone Substation
Myitkyina City
Waingmaw Substation
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US Dept of State Geographer
Google Earth
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5. Environmental Status

5.1 Overview of basin environment investigation

In accordance with the TOR of EIA on Hydropower Development of Ayeyawady River Basin above Myitkyina and requirements of Myanmar government departments, under the orgnization of CPIYN, CDC and BANCA, a joint investigation team comprised of SCBG, SCIEA, IHE and BANCA was established, to conduct a detailed investigation on the status of aquatic organisms, terrestrial plants, terrestrial animals, environmental quality and social environment in the region of seven cascade hydroelectric stations such as Myitsone; to organize a questionnaire survey for collecting attitude to hydroelectric development in Myanmar, environmental concerns and requirements from people affected by the hydroelectric development.Its investigation started in January 2009 and came to the end in May, which lasted five months. BANCA completed other investigation work in July. There are about 260 personnel involved in the investigation, including more than 100 experts from China and Myanmar.

Field Investigation

Field Investigation of terrestrial

Field Investigation of aqutic organism

5.2 Natural environment

5.2.1 Topography

(1) Reservoir area

Reservoir area of Chipwi Nge Hydropower Station is a low-medium mountain gorge type river valley, with steel mountains on both sides, terrain slope of 35 ° to 45 °, riverside mountain top elevation of 1000m to 1500m, river bed elevation of 710m to 760m and relative height difference of 300m to 800m. Level Ⅰ and Ⅱ of terraces are distributed along the river. There is a gully at the head of the reservoir area. It is more than 1000m long and 5m to 30m wide, with cutting depth of 5m to 20m and flow of about 1.5m^3/s. On the gully bottom are gentle slopes and platforms accumulated due to debris flow. Their terrain slope is generally lower than 10 °.

Chipwi River snakes with overall flow direction of northwest, average hydraulic slope of 5% to 6% and deep V-shaped valley.

(2) Dam site area

On both sides of the dam site are wide and thick mountains. The terrain is steep with a slope of 30 ° to 50 °. The area is covered with vegetations. Slopes on both sides follow the top elevation of above 1000m and relative height difference of above 300m. The area seems a narrow V-shaped valley. Chipwi River flows in the direction of NW325°, with valley bottom width of 60m to 90m, river surface elevation of about 700m to 710m and water depth of about 0.5m to 3m. The valley width will be about 155m to 169m when normal water level reaches 740m.

There are Level Ⅰ and Ⅱ terraces in the upstream of the upper dam line on the right bank. Terrace face is inclined to the river bed in the downstream and almost consistent with river bed in the slope. Level Ⅰ and Ⅱterraces respectively follow the elevation of 719m to 739m and 773m to 790m, between are bank slopes at the gradient of 33°. In the downstream of the lower dam line on the left bank, there is a terrace of Level I along the Chipwi River. The terrace face is inclined to the river bed in the downstream with an elevation of 692m to 712m.

On both sides of the dam site area are gullies in different sizes. There are mainly two gullies on the right bank to have a perennial stream respectively with a flow rate of 5L/min and 1.5m^3/s; there are 8 small gullies with a spacing of 30m to 230m on the left bank, of which some have a perennial stream with a flow rate of generally lower than 100L/min.

(3) Powerhouse area

The powerhouse area belongs ot low-medium mountains on the south edge of KachinMountains. It is located on the left bank slope of Nmaihka River about 9km in the downstream of ChipwiTown. The powerhouse ground elevation is 269.7m and machine stable excavation elevation is 252.5m. Nmaihka River flows through the powerhouse area by southwest 219°, with water level elevation of about 210.6m to 211m, slope top elevation of about 1100m to 1500m and relative height difference of about 800m to 1200.

The slope below the elevation of 240m is subject to river alluvium and torrential sediment. It is relatively gentle with a gradient of about 8°. Above 240m is a sloping terrain with a slope of about 25°, of which some can reach the slope of 40 ° to 50 °. The powerhouse is in the slope area on the rear side of riverside road, with an elevation of 266m to 321m. In the rainy season, slope surface suffers soil erosion. Silty clay and completely weathered layer are scoured to form gullies and even local soil chutes so as to cause broken slope.

There are small gullies along the slope in the powerhouse area, of which the upstream gullies about 800m from the powerhouse and downstream gullies are larger and have a perennial steam

respectively with a flow of 500L/min and 300L/min. Their average slope is greater than 10%.

5.2.2 Hydrogeology

Chipwi Nge Hydropower Station is located in KachinMountains in the north of China-Myanmar Mountains. Its geotectonic element belongs to Qinghai-Tibet rejuvenated orogen. It is mainly adjacent to Chipwi fault extended along Nmaihka River, Chipwi River as a branch and Chipwi – Tengchong nearly EW fault. The Chipwi fault has been not active since about 1.18 million years ago. There is no active fault within the range of 5km near the site. The site is located in a region with a relatively stable regional structure.

The region is located between the Myanmar medium-deep seismic belt and China Lonling – Tengchong – Lushui seismic belt. According to historical records, there were frequent earthquakes erupted in the Lonling – Tengchong – Lushui seismic belt mainly at a time around the 30s of 20th century, with the highest earthquake magnitude of 6.5 (in October 17, 1929 and August 11, 1933),where is about 29km away from the northwest of the dam site.

As the construction power plant is nearer to the Longling – Tengchong – Lushui seismic belt rather than the dam site of Chipwi Hydropower Station, according to the 1: 4,000,000 Seismic Dynamic Peak Acceleration Demarcation Map of China (GB18306-2001) and the comprehensive analysis on seismic parameters of the neighboring Chipwi dam site, it can be concluded that the seismic peak acceleration with 10% probability of exceedance in 50 years is 0.20g while the corresponding basic seismic intensity is Ⅷ.

(1) Reservoir area

There are more exposed bedrocks near river bed on both sides of the reservoir area. They are Precambrian gray and grayish white rough - medium granitic gneiss and locally loose Quaternary deposits of 1m to 15m thick; there is no fault or fold in the reservoir area. Gneissose structure is distributed along the river by SW225°to 240°with an inclination of 67° to 70°. Its occurrence is stable.

Gullies on both banks of Chipwi River are feather-shaped with a spacing of 70m to 500m. Groundwater is classified into bedrock fissure water and pore water according to burial conditions. No spring water is exposed on the surface and hydrogeological conditions are simple.

In summary, geological conditions are simple in the reservoir area without fault. The reservoir basin is in less permeable granitic gneiss rocks, so the reservoir has the better closure conditions without leakage. On both banks of the reservoir are mainly rocky embankment slopes. There are sporadic unstable rocks in the head and local sections, but there is no reservoir immersion. In the submerged area are mainly trees. Due to influences of debris flow in the upstream of the reservoir, solid flow materials are rich in the trunk and tributaries, so the reservoir is subject to sedimentation.

(2) Dam site area

Mountains on both sides of the dam site area are steep and diorite granitic gneiss is hard. Due to river cutting, unloading fractures are distributed along the river and gully. There are four positions to have dangerous rockmass in small scale. Geological structure is simple in the dam site area. Upon investigation, there is no fault or fold. Gneissic schistosity is subject to strike of NW315 ° to 330 °, inclination of SW225 ° to 240 ° and dip angel of 67 ° to 70 °.

Upon investigation, there is no bedrock fissure spring water. Two springs are distributed in eluvial layer above the road, with water outlet elevation of about 780m. a number of water flows out from left bank gullies, with the water point evaluation of above 780m. Groundwater in the dam site area is about 14.5m deep. Bedrocks in the dam site area are diorite granitic gneiss

belonging to medium-weakly permeable rocks.

Mountains on both sides of the dam site area are complete. The formation lithology is single. All rocks are diorite granitic gneiss with more fissures, simple hydrogeological conditions and water permeability. Dam foundation rocks are subject to high strength and completeness. There is no massive adverse geological phenomenon such as collapse and landslides in the area.

(3) Powerhouse area

Chipwi fault on the opposite bank of the powerhouse area runs along Nmaihka River on the right bank. Geological structure is simple in the powerhouse area, where there is no fault or fold identified in the investigation. Gneissic schistosity is subject to strike of NE20° to 45°, inclination of SE110°to 135° and dip angel of 67 ° to 76°.

Hydrogeological conditions are simple in the powerhouse area where there is no spring water identified in the investigation. Burial depth of groundwater is different. It is generally 19.3m to 26.7m in the mountain slope and 3.2m to 8.4m in the gentle slope near gullies and roads.

Terrain is relatively flat in the powerhouse area where overburden and highly weathered rocks are thick and foundation rock fissures are more but less complete. In the upper part of the slope is loose layer slope. It is prone to sliding after excavation. The lower rock slope has four groups of fissures which are mostly opened and locally filled with a small number of silty clay and gravel. Due to poor shape and properties, the slope may become unstable after excavation.

The additional physical environmental baseline data collection was done in August 2016 and the report is presented in Appendix-I.

5.2.3 Climate

The project area is located in the Asian southwest monsoon region. Its climate is dominated by the southwest monsoon. Three seasons prevail in the area, including summer of March to May, rainy season of June to October and cool season of October to next February. Minimum temperature occurs in January, 20℃ to 25℃ in average; maximum temperature occurs in April, 25℃ to 30℃ in average. In accordance with statistics of Lushui Station adjacent to Chipwi Nge, annual average number of thunderstorm days is 52.1. As shown from 2003-2004 water temperature data of Myitson Weather Station, annual average water is 23.0℃.

In the Ayeyawady River basin, the precipitation is rich. Annual precipitation is 2000mm to 4000mm in the delta and north area. It is a smaller value of 600mm to 1000mm in the midstream plains. The peak precipitation occurs in July. In every rainy season, the southwest monsoon prevails with abundant rainfall so that the river water sharply increases to often cause floods. The rainfall is less from March to mid-May so that river water level drops. A number of beaches and islands are exposed in the river valley and river width becomes reduced. For example, the river surface width is less than 500m in February but more than 3km in August with an annual level change up to 10m in Bhamo in the upstream of Ayeyawady River.

5.2.4 Hydrology and sediment

In the Ayeyawady River basin, runoff supply is mainly rainfall in the flood season but it is mainly deep groundwater and fewer high mountain snowmelt in the dry season. The flood season is mainly from May to October and its runoff accounts for about 81.0% of annual runoff; the dry season is mainly from November to next May and its runoff accounts for about 19.0% of annual runoff. In the basin of Chipwi River, rainstorms mainly occur in June to September. They reach the peak in June, accounting for 27% of annual number. The flow rate is 2540 m^3/s for five-hundred-year flood, 1980m^3/s for one-hundred-year flood and 1320 m^3/s for 20-year flood.

In Chipwi Nge Hydropower Station, annual average flow is 40.1 m^3/s, annual average runoff is 1.26 billion m^3 and annual average runoff depth is 2288mm. Control catchment area above the dam site of Chipwi Nge Hydropower Station is 552.3km^2. Annual average flow rate is 40.1 m^3/s and annual runoff is 1.26 billion m^3 at the dam site.

In Chipwi Nge Hydropower Station, annual average sediment discharge is 724,000 t, annual average bed load discharge is 145,000 t andannual average total discharge is 869,000 t.

5.2.5 Soil and soil erosion

Main soils in the project area include brown red soil, reddish yellow soil, yellow soil, yellow-brown soil, brown soil, dark brown soil and so on.Fertile alluvial soils are distributed in the riverside area. In the project area, ground slope is not lower than 35°, vegetation coverage is about 60% and native soil erosion is mainly moderate.

5.3 Ecological environment

5.3.1 Terrestrial plants

(1) Florology

In Chipwi Section of Nmaihka River involved in this project, floristic composition belongs to tropical Asia (India - Malaysia) distribution area. It is closely connected with eastern Himalayan vegetation region on the north and takes Salween River Valley in the east as the boundary between it and Chinese distribution area. Thus, the basin is subject to floristic composition mixing between the east and the west and between the south and the north. The area is close to southwest part of Yunnan. Its florology is largely similar to that of Gaoligong Mountains.

In the floristic composition of the vegetation are mainly ingredients of Southeast Asia followed by other tropical ingredients. The vegetation is mainly woody plants, of which many plants are direct descendants or relicts of Tertiary ancient tropical flora. Tropical rainforests are characterized by dipterocarpaceae and take special crypteroniaceae and tetramelaceae of Southeast Asia as the sign. Their number of genus and species is small, but it is sufficient to shown close relation with typical tropical rainforests in Southeast Asia. In addition to the above families, nutmeg, sapotaceae, garcinia, annonaceae, homalium cochinchinense, combretaceae, rhizophoraceae, barringtoniaceae, burseraceae and xanthophyllaceae all are tropical families.

As shown from statistics, there are 127 families, 357 genera and 556 species of vascular plants in Chipwi section of Nmaihka River, including 21 fern families, three gymnosperm families and 103 angiosperm families. Tropical composition is very obvious in the flora.

Due to intense human activities and serous deforestation, most tropical rainforests in the project influence area have been damaged over the past few decades. Small strips of secondary tropical rainforests are available locally. A large area of vegetation retrogressively becomes savanna bamboo forests generated after damage of the rainforests. They mainly consist of kapok and bamboo for animal husbandry.

(2) Vegetation type

As shown from line transect survey of terrestrial plants and sample investigation in typical sections, vegetation type is simple in the area. Most of the area is covered with dominated savanna bamboo forests, tropical monsoon forests and evergreen broad-leaved forests such as kapok, male bamboo, duabanga grandiflora, kapur and balau. Only in local sections are small strips of tropical rainforests. In river bank sections or central bars are riparian shrub and floodplain grass in zonal distribution.

In accordance with survey results, existing vegetation in Chipwi section of Nmaihka River includes 7 vegetation types, 9 vegetation subtypes and 13 formations. Classification of

vegetation type is as follows:

Rainforest

Tropical monsoon forest

Evergreen broad-leaved forest

Tropical savanna bamboo forest

Tropical savanna banana forest

Shrub

Artificial vegetation

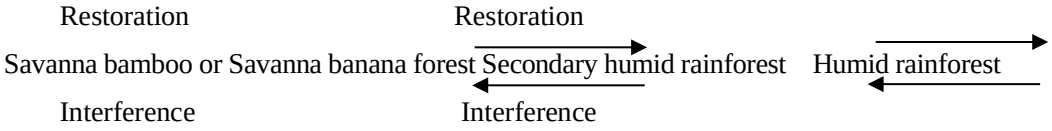
Table 5.3-1 Classification of Vegetation in Chipwi section of Nmaihka River

Vegetation type	Vegetation subtype	Formation
Rainforest	I Humid rainforest	1. Dipterocarp and balau
Tropical monsoon forest	II Semi-evergreen seasonal forest	2. Duabanga grandiflora, chukrasia tabularis and Polyalthia spp.
Evergreen broad-leaved forest	III Monsoon evergreen broad-leaved forest	3 Castanopsis forest in India
		4. Castanopsis forest
		5. Form.Schima wallichii
		6 Engelhardtia roxburghiana and alder grove
Tropical savanna bamboo forest	IV humid savanna bamboo forest	7. Kapok and male bamboo forest
Tropical savanna banana forest	V Humid savanna banana forest	8 Balau and wild banana forest
Shrub	VI tropical roadside wasteland evergreen shrub	9. Alangium, bauhinia – mikania and fragrant eupatorium herb community
	VII tropical floodplain shrub	10. Water willow - rose - arundo donax community
Artificial vegetation	VIII artificial woody vegetation	11 Citrus Park
	IX artificial herbal vegetation	12 Farmland
		13 Slope farmland (slash-and-burn cultivation)

Kapok and male bamboo formations of tropical savanna bamboo vegetation are most widely distributed in the area. The community is a secondary vegetation generated after artificial destruction of tropical rainforests. Its appearance is similar to savanna monsoon rainforest community. *On the lowlands and the lower slopes, the upper arbors comprising kapok and other large big arbors highlight on top of the crown canopy. Common big arbors include duabanga grandiflora, radermachera sinica, excoecaria sebifera, bischofia javanica, quebracho and a variety of banyans. In the middle and upper part of mountain slope, big arbors mainly include balau, dipterocarp and dipterocarp.* The lower and middle layers of the community are dominated by sympodial bamboos such as dendrocalamus brandisii. The dendrocalamus brandisii and small-medium arbors form the dense secondary canopy, mainly including ironwood, chisocheton siamensis, leea guineensis, mallotus japonicus and bridelia tomentosa.

(3) Characteristics of vegetation succession

Zonal vegetation type in the area is humid rainforest. Due to artificial destruction, the vegetation has been degraded to savanna bamboo forest and savanna banana forest. Farmlands are rare, so the vegetation is rarely degraded to shrub type. Floodplain shrub is a disclimax community. It is a relatively stable type under influences of periodical river water fluctuations. Vegetation succession in the mountain slope section is as follows:



(4) Vertical distribution of vegetation

In accordance with investigation and analysis, the area below the elevation of Chipwi section of Nmaihka River is covered with humid rainforest; that of 1000m to 1500m is covered with tropical monsoon forest; that of 1500m to 2000m is covered with subtropical evergreen broadleaf forest; that of 2000m to 2400m is covered with warm temperate broadleaved deciduous forest; that of 2400m to 3000m is covered with temperate hemlock; that of 3000m to 3500m is covered with boreal spruce-fir forest; that of 3500m to 5500m is covered with cold temperate shrub and alpine meadow; that of above 4500m is covered with snows. Vertical change of project influence area is as follows: the vegetation of 10m to 20m above the river surface is mainly benchland scrub-grassland, above which are tropical monsoon forest, evergreen broadleaf forest and savanna bamboo forest in the embedded distribution. Vertical distribution of vegetation type in the appraisal area is shown in Figure 5.3-1.

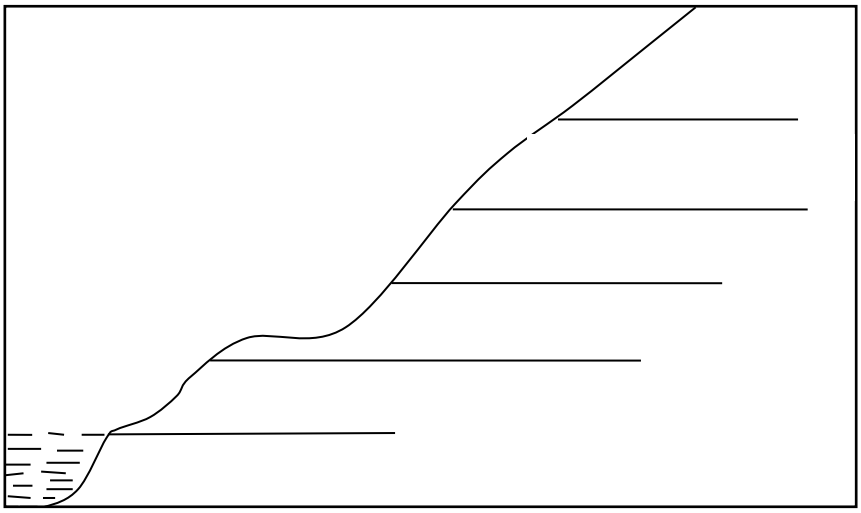


Figure 5.3-1 Diagram for Vertical Distribution of Vegetation Type in Chipwi Section of Nmaihka River

(4) Horizontal distribution of vegetation

Under the influence of altitude, human disturbance and other factors, horizontal distribution of vegetation is complex in the area. But the dipterocarpaceae – based tropicl rainforest is the zonal vegetation. Dominant species of secondary forests depend on specific areas; composition of the savanna bamboo forest also depends on specific areas; in terms of stand composition, for the reason of altitude and humidity, there are more large palm plants in the high-altitude area while areca triandra and other palm plants are more in the low-altitude area. Due to seasonal rise and recession of river water, floodplain plants grow on river shores and beaches, such as syzygium jambos, salix leaf pungent litse fruit, rapanea neriifolia, eurya japonica, homonoia riparia and so on.

(5) Rare or endangered plants

According to the investigation, in Chipwi section of Nmaihka River are rare or endangered species listed in the IUCN Red List, including tetrameles nudiflora, aquilaria malaccensis, bhesa robusta, dipterocarpus retusus, stellatum, cephalotaxus mannii, dipterocarp, taiwania cryptomerioides and bretschneidera sinensis. In addition, there also are scattered cyatheaceae and orchid plants listed in CITES appendix.

In accordance with general status investigation, ecological environment is good in the area. Local plants mainly include native plants and local indigenous plants. Due to human intrusion of native vegetation and plant resources, the vegetation has a clear secondary nature.

Table 5.3-2 Rare and endangered species found in the project area

family	species	IUCN Category	elevation	G P S	Location and number
Thymelaeaceae	*Aquilaria malaccensis* Lam.	VU/ A1cd	＜270m	N26.01.978; E098.10.709; Ele.332m	The roadside from Phala to SawLaw, Chibwe. few
Anacardiaceae	*Mangifera sylvatica*	LR/lc	600-1900 m	N26.19.564; E098.20.349; Ele.1097m	From Chuangmaw to Kyithtan,Chibw，east side of Nmai Hka，1tree
Celastraceae	*Bhesa robusta*（Roxb.） Ding Hou	LR/lc	50-500 m	N25.56.998, E098.08.926, Ele.250	From Phala to Chibwe，1tree
Cephalotaxaceae	*Cephalotaxus griffithii* Hook. f.	LR	1100m		Chibwe
Taxodiaceae	*Taiwania cryptomerioides Hayata*	VU/ A1d			Chibwe 、Khaunglanphu
Ericaceae	*Craibiodendron stellatum*	LR/lc	（200–）700–1600（–2700）m	N26.09.211; E098.16.221; Ele.1670m	From SawLaw to Phala, near SawLa，Chibwe east side of Nmai Hka, 3 trees

5.3.2 Terrestrial animals

(1) Species of terrestrial animal

In Chipwi section of Nmaihka River, wildlife resources are abundant, including 6 orders, 18 families, 32 genera and 41 species of mammals; 18 orders, 56 families, 136 genera and 318 species of birds; 2 orders, 5 families, 13 genera and 13 species of reptiles; 1 order, 4 families, 11 genera and 14 species of amphibians; 11 families, 125 genera and 216 species of butterflies.

In accordance with survey statistics and query, there are 39 rare and endangered species in the area, including 18 species of animals, 16 species of birds, 3 species of amphibians and reptiles and 2 species of butterflies. A total of 28 species are included in the IUCN Red List, including 18 animal species and 10 bird species; a total of 30 species are include in the CITES Appendix, including 17 animal species, 8 bird species, 3 species of amphibians and reptiles and 2 species of butterflies.

Table 5.3-3 Wildlife Fauna Composition in Chipwi Section of Nmaihka River

Category	Family	Genus	Species	Rare and Endangered	IUCN	CITES
Animals	18	32	41	18	18	17(17)
Birds	56	136	318	16	10	8(2)
Amphibians and reptiles	9	24	27	3		3
Butterflies	11	125	216	2		2

Note: (17) indicates that there are 17 species included in the IUCN Red List.

Due to human disturbance and frequent hunting, there are rare large wild animals near the

project area where are mainly monkeys, snakes and other small wild animals.

Table 5.3-4 Preliminary List of Mammals of Chibwe Area, Kachin, Myanmar

SPECIES					EVIDENCE			STATUS	
NO.	**ORDER**	**FAMILY**	**SCIENTIFIC NAME**	**COMMON NAME**	**Body**	**Sign**	**Info.**	**IUCN**	**CITES Appendix**
1	**EULYPOTYPHLA**	Soricidae	*Suncas sp.*	Shrew	√				
2		Talpidae	*Parascaptor leucurus*	White-tailed Mole	√			LC	
3	**PRIMATES**	Lorisidae	*Nycticebus bengalensis*	Slow Loris	√			VU	I
4		Cercopithecidae	*Macaca mulatta*	Rhesus Macaque	√	√	√	LC	II
5			*M. assamensis*	Assamese Macaque	√	√	√	NT	II
6			*M. arctoides*	Stump-tailed Macaque	√		√	VU	II
7			*Trachypithecus shortridgei*	Shortridge's Langur	√		√	EN	I
8		\Hylobatidae	*Hoolock leuconedys*	Eastern Hoolock Gibbon	√	√	√	EN	I
9	**PHOLIDOTA**	Manidae	*Manis pentadactyla*	Chinese Pangolin	√	√	√	EN	II
10			*M. Jacanica*	Sunda Pangolin		√	√	EN	II
11	**CARNIVORA**	Ursidae	*Selenarctos thibetanus*	Asian Black Bear	√	√	√	VU	I
12			*Helarctos malayanus*	Sun Bear	√	√	√	VU	I
13		Mustelidae	*Martes flavigula*	Yellow-throated Marten	√			LC	
14			*Melogale personata*	Ferret Badger	√			DD	
15		Viverridae	*Viverra zibetha*	Large Indian Civet	√	√	√	NT	
16			*Viverricula indica*	Small Indian Civet	√	√	√	LC	
17			*Paradoxurus hermaphroditus*	Common Palm Civet	√			LC	
18			*Paguma larvata*	Masked Palm Civet	√	√	√	LC	
19		Felidae	*Catopuma temminckii*	Asian Golden Cat	√			NT	I
20			*Prionailurus bengalensis*	Leopard Cat	√	√	√	LC	II
21			*P. viverrina*	Fishing Cat	√	√		EN	II
22			*Neofelis nebulosa*	Clouded Leopard	√	√	√	VU	I
23	**ARTIODACTYLA**	Suidae	*Sus scrofa*	Wild Boar	√	√	√	LC	
24		Moschidae	*Moschus*	Forest Musk			√	EN	II

			berezovskii	Deer					
25		Cervidae	*Muntiacus vaginalis*	Red Muntjac	√	√	√	LC	
26			*M. feae*	Fea's Muntjac	√	√	√	DD	
27			*Rusa unicolor*	Sambar	√	√	√	VU	
28		Bovidae	*Bos gaurus*	Gaur	√	√	√	VU	I
29			*Budorcas taxicolor*	Takin	√	√	√	VU	II
30			*Capricornis milneedwardsii*	Chinese Serow	√	√	√	NT	I
31			*C. rubidus*	Red Serow	√	√	√	NT	I
32	**RODENTIA**	Sciuridae	*Callosciurus quinquestriatus*	Strip-bellied Squirrel	√			NT	
33			*Tamiops maclellandi*	HimalayanStriped Squirrel	√			LC	
34			*T. swinhoei*	Swinhoe's Striped Squirrel	√			LC	
35			*Dremomys rufigenis*	Red-cheecked Squirrel	√			LC	
36			*D. pernyi*	Pernyi'sLong-nosedSquirrel	√			LC	
37		Pteromyidae	*Petauris philippensis*	Indian Giant Flying Squirrel	√	√		LC	
38			*P. sybilla*	Small Orange-back Flying Squirrel	√				
39		Spalacidae	*Rhizomys pruinosus*	Hoary Bamboo Rat	√	√	√	LC	
40		Hystricidae	*Atherurus macrourus*	Brush-tailed Porcupine	√	√	√	LC	
41			*Hystrix brachyura*	Malayan Porcupine	√	√	√	LC	

Mammals

Amphibians and reptiles

Birds and Butterflies

(2) Type of terrestrial animal habitat

1) Type of terrestrial mammal habitat

a. Seasonal rainforest

Under direct influence of warm and wet flows brought by southwest monsoon of Indian Ocean, the seasonal rain forests is widely distributed on the valley bottom. As a climax vegetation community in northern mountains, it is distributed in mountains from both sides of rivers and streams to the altitude of 600 to 800m. Myitsone is located in the transition area between northern mountains and middle plains, where the terrain is flat, river and valley are wide, low hills are dominant and there is a large area of such habitats. Based on niche differentiation, wild mammals distributed in seasonal rainforests of Myitsone can be classified into the following habitat types.

Canopy habitat type: such wild animals rely on canopy of tall trees and spent most of the life on it. Some endangered primate species distributed in Myitsone are typical under the type.

Ground or semi-ground habitat type: such wild animals spend most of the life on the ground in the forests. In addition, some are good at climbing trees for foraging or hunting, for nesting in a tree or for resting in a tree. They have alternating activities on the ground and trees.

Fossorial type: such animals adapt to underground life. Most species under pholidota and rodentia have a habit of dwelling in caves, but they also can forage on the ground and rest in tree holes. For the reason, they also belong to self-fossorial type.

Valley semiaquatic type: otters and fishing cats mainly live in forests on both sides of the valley. They depend on water and their food sources include fishes, arthropods and mollusks in the water. In addition, they also live on forest ground near the water to conduct rest, marriage and other acts. Some species have no foraging in the water, but they like to conduct waterside activities, including artiodactyla red deer, Indian bison and so on.

b. Mountain forests

Mountain forests are generally distributed between 800m and 200m of altitude. Based on ecology habit, wild animals in the habitat could be classified into four distribution types. Several primates under tree-dwelling type all can live in the habitat.

c. Wetlands and rivers

Few animals rely on wetland ecosystems and fewer ones live in the investigation area. Only red deer and Indian bison often live in wetlands. Other small animals may live in the habitat, but most of them don't rely on such single habitat patch.

2) Type of bird habitat

a. Rivers and waters

River ecological system presents a uniform phenonemon of distributing like strips in verticial direction. Verticial alternation of species doesn't evenly and continuously change. Special species occur again in the whole rivers like Phalacrocorax carbo; Birds acting in this district are mostly those that have special morpholigical structures suitable to ecological environments under rapid rivers, for example, several kinds of dovetails act in NmaiKhaRiver at the confluence of two rivers.

Goose and duck species are mainly distributed in lower stream of confluences between two rivers, and sparsely distributed in upper stream. Larus ichthyaetus and Larus brunnicephalus often act in rivers. Ciconiiformes species and Anhinga melanogaster prefer habiting on tranquil and smooth river surface. Alcedo atthis and Megaceryle lugubris often habit in twigs or stone edges nearby rivers. Charadrius dubius like habiting in river beaches and pebble beaches. Rhyacornis fuliginosus prefer living in regions along the banks of rivers with a large amount of loose stones.

b. Wetlands

Wetland is transitional zone between lands and waters and equipped with rich resources related to land and aquatic animal and plants. Amaurornis phoenicurus often hunt for foods in streams and rivers on banks of this watershed, farmlands and wetlands. Birds under Ardeidae mostly habit in wetlands and forest areas nearby waters. Birds under Motacillidae frequently occur in wetlands of foramlands and along banks of rivers. Shorebirds often hunt for food in wetland environment along rivers. Dovetails mainly choose wet environment of streams storing water as its habitate.

c. Ecological environment of shrub grasslands

Shrub grassland refers to a plant community where mesophytic or xerophytic mesophytic perenniall herbaceous plants are taken as dominant species with a sparse distribution of shrubs. Shrub grassland is mainly distributed on both banks along rivers and nearby villages and farmlands. Campephagidae, Emberizidae and Sylviidaeunder Passeriformes often choose shrub grasslands as their habitating environment, mainly living in middle and lower part of open forests on mountain feeet and shrubs; Birds under Ccuculiformes often habitate on top of high shrub forests.

d. Villages - farmlands ecological system

Land resources from Myitkyina extending to Myitsone sections are relatively distributed evenly and suitable for settled agricultures, villages often develop toward even distribution; hills and mountainous areas cover a large area in north of Myitsone, and villages mostly are centralized valleys, mountain feet and edges of mountain feet. Birds depending on this ecological system mainly include crow, Passer montanus, Psittacula finschii and birds under Sturnidae.

e. Mountainous secondary forests

Secondary forests refer to those that are naturally formed after virgin forests lose original forest environments due to unreasonable cutting, deforestation, fire disaster and shifting cultivation activities and are replaced by various secondary communities. Mountainous secondary forests

in evaluated area are mostly yound and middle-aged forests, often taking broad-leaved species as dominant species. Birds under Falconiformes often choose mountainous secondary forests as their habitats, frequently seen in mountains, plains, mountain feet and hilly lands.

3) Type of reptile habitat

a. River and riverbank zone

The zone includes the areas which are located near Nmaihka River and its banks and largely affected by river water. Reptiles include testudinata, sauria and serpentiformes. Reptile species are less in the zone. There are more species with high adaptive capacity and it is easier to find them.

b. Residential area, farmland and trunk road zone

It mainly includes residential areas, farmlands, orchards, vegetable plots, grasslands, highroad and other areas subject to relatively large human disturbances. There are more species and number of reptiles mainly including saurian and snakes. Due to relatively large human disturbances, species and number of reptiles have a larger change.

c. Small tributary, creek and spring zone

The zone mainly includes streams, creeks and springs, where reptiles are more in the species and number. Except the saurian in residential area, most reptiles can be found in the zone.

d. Hillside and forest zone

The zone is higher, far away from rivers and covered with dense trees and shrubs. Main reptiles include saurian, testudinata and serpentiformes. With the better hiding conditions, they can not easily be found.

4) Type of amphibian habitat

a. River and riverbank zone

The zone includes the areas which are located near Nmaihka River and its banks and largely affected by river water. Amphibian species are less in the zone. Most of the species are highly adaptive and larger in the number. It is easier to find animal population of above 10,000.

b. Residential area, farmland and trunk road zone

It mainly includes residential areas, farmlands, orchards, vegetable plots, grasslands, highroad and other areas subject to relatively large human disturbances. There is a few of amphibian species largely affected by human disturbances. For the reason, species and number of amphibians follow a large change.

c. Small tributary, creek and spring zone

The zone mainly includes streams, creeks and springs, where amphibian distribution is the most concentrated. It is far more than any other zone in the species and number of amphibians. Almost all amphibians in Myitsone area could be found in the zone.

d. Hillside and forest zone

The zone is far away from water and covered with dense trees and shrubs. With the better hiding conditions, they can not easily be found.

5.3.3 Aquatic organisms

Investigation of Nmaihka River obtained 26 fish species under three orders and four families, including eighteen species under two families of cypriniformes, seven species under one family of siluriformes and one species under one family of anguilliformes.

Fishes above Chipwi section of Nmaihka River mainly include schizothorax, pareuchiloglani, glyptothorax and pseudecheneis adaptive to rapids habitat. Fewer fish species are adaptive to

slow flows. The river section below Chipwi is in the transition zone between cannon river and plain river and its water follows characteristics of cannon river and plain river, where aquatic organisms are rich and fish species also follow characteristics of upstream and downstream species.

With low utilization of fishery resources, single fishing method and simple operating tool, Chipwi section has no professional fishermen. Common fishing species include schizothorax meridionalis, mahasher and garra qiaojiensis.

Chipwi River is the largest tributary of Nmaihka River on the left bank. In accordance with analysis of habitat, schizothorax, pareuchiloglanis, glyptothorax and pseudecheneis of fishes may be available in Chipwi River.

(1) Life history of fish

1) Reproduction habits

Based on the collected records about relevant fish habits and analysis with related species, a vast majority of species in the surveyed regions are fishes laying sticky, sinking types of eggs. For these species, their reproductive migratory distances are normally short and reproduction naturally completes in habitats. For prespawing migration, they generally move upward along the trunk for a short distance to lay eggs on flowing shoals with different bottom sediments or enter nearby mountain streams and lay eggs along them. Schizothorax, pareuchiloglani and catfishes mostly lay eggs in water environment of trunk and tributaries.

2) Feeding habits

According to the major food composition for fishes, fish feeding habits in surveyed regions are mainly divided into four categories: periphytic algae feeding habit, benthic invertebrate feeding habit, omnivorous feeding habit and piscivore feeding habit.

① Fishes which mainly feed on periphytic algae. These kinds of fish generally have wide oral fissure, sharp horny in front edge of mandibular, and adapt to the way of feeding algae growing on stones by scraping, e.g., Labeoninae, Schizothoracinae and Cobitidae.

② Fish which mainly feed on benthic invertebrate, e.g. some species under Sisoridae, Schizothoracinae and Siluridae. Their mouths often have well-developed tentacles or hypertrophic lips used to absorb food. Regarding the intaken food, except only a small part of food are Chironomidae larvae and Oligochaetes growing in deep pools and tranquil flow sections, a majority of food are larvae or nymphs under Trichoptera, Plecoptera, and Ephemeroptera growing between gravels in rapid flows and stone cracks in rivers. The proportion of this type of fish species is comparatively large.

③ Omnivorous fish. They both feed on benthonic animals, aquatic insects, and residues and seeds of algae and plants. For example, small fishes like Osteobrama belangeri, Amblypharyngodon atkinsonii, Rasbora, Barbinae.

④ Piscivore fish. They are fierce and mainly prey on other small fishes. For example, Bagarius yarrelli , Channa aurolineata, Wallago attu, Raiamas guttatus.

Overally speaking, feeding habits of fishes have close connection with biological basis of baits in this region, showing that fishes specifies composition has a high relevancy with flowing environmental features in sections of Myitsone section.

3) Migration habits

① Diadromous fishes. Combining the field survey and literature findings, the results show that no fish species laying eggs anadromously are distributed in Nmaihka river section. But based on the market survey made to Machanbaw, Anguilla bengalensis and Anguilla nebulosa have

typical catadromous and reproductive characteristics. The spawning sites are in the deep-sea waters of Indian Ocean, and the laval migrate into fresh water hunting for baits and fattening.

② Potamodromous fishes. This type of fish usually refers to those that complete entire life cycle in freshwater, but the feeding grounds and spawning grounds are relatively far from each other. Thus during different life stages, they should have regular migration. For fish species living in the rivers, its larval fish have a weak ability to defend streams, and are often carried and dispersed with water, flowing into downstream for hunting for baits and fattening, which constructs a significant adaptability for the proliferation and growth of species. However, fishes of different spawning types have a quite different migration distance. As for the fish living in open water area and laying pelagic eggs, for example, Four Chinese Carps and Coreiusheterodon, Coreius Guichenoti and other species, the fertilized eggs often drift hundreds of kilometers away with the water. But for the species which lay sticky sinking eggs along coastal waters, since they stay at early developmental stages in slow or static water, the spreading distance is relatively short. During this survey, no pelagic eggs are collected.

③ Fresh water sedentary fishes. These fish species are usually wildly distributed in freshwater area. They are commonly small in size and lay sticky sinking eggs along coastal waters. Ecological environment range of completing their life cycle is relatively small, thus they can complete total life cycle in partial sections of still or slow waters.

④ Amphidromous fishes. This type of fish has the characteristic of adapting a wide range of salinity, consequently distribute wildly in coastal waters, esuaries and freshwater. But analysis from their breeding habits, there is no need for them to migrate between fresh and salt water to complete their life cycles in all aspects.

4) Habitat selection

Chipwi River is a mountain stream type of river. Its water level can sharply rise after rainstorms and then quickly fall. Bedrock or gravel is distributed on the bottom. Chipwi River is shallow and low in the content of suspended matters so the people can see the bottom. Due to small flow, water transportation is at a lower level, so the river bottom is relatively stable. There are more deposition of rotted terrestrial plant leafs in stone gaps where aquatic hold plants, zoobenthos and periphytic algae breed. Due to the lower water temperature, dissolved oxygen is often saturated. Small fish species adaptive to rapids are dominant, such as small species of cobitidae and barbinae.

(2) Major economic fish species and distribution

In accordance with the Investigation and Evaluation of Aquatic Organisms for Upper Ayeyawady, fishes of large sample size in the investigation of economic fish resources include Bangana pierrei, mahasher, Bangana delvdevi, barbodes hexagonolepis, schizothorax meridionalis, garra qiaojiensis and neolissochilus stracheyi. In addition, there is also a certain number of Indian glassy fishes, amblypharyngodon atkinsonii, tor tambroides and Myanmar crossocheilus latius.

Economic fishes in Chipwi section of Nmaihka River manly include neolissochilus stracheyi, schizothorax meridionalis, mahasher and garra qiaojiensis. Fish sample properption in total samples, length range and weight range are shown in Table 5.3-3. As shown from the table, schizothorax meridionalis fishes are potentially important fishing targets with the weight of above 1000g; mahasher and garra qiaojiensis fishes are relatively small but more, so they have a certain economic value.

The additional terrestrial flora and fauna and aquatic study were done in August, 2016. This study cover the power plant area (3km radius), 16km long Chipwi Nge river section between

dam and river mouth of Nmaikha (Maykha River). The additional terrestrial ecology and aquatic report is presented in Appendix II.

Table 5.3-4 Length and Weight Range of Major Economic Fish Species

	Sample size	Proportion	Length Range (mm)	Weight Range (g)
Mahasher	72	6.62%	90-265	11-347.8
Schizothorax meridionalis	31	2.85%	82-425	8.3-1312.7
Garra qiaojiensis	31	2.85%	123-209	39.7-208
Neolissochilus stracheyi	28	2.58%	103-550	18.1-4000

5.4 Social environment

5.4.1 Socio economy

(1) Administrative division

Kachin State is an autonomous state of Kachin in the northeast of Myanmar. It borders on NujiangLisuAutonomousPrefecture and Dehong Dai and JingpoAutonomousPrefecture in YunnanProvince and adjacent to Changdu of Tibet Autonomous Region on the north. KachinState covers an area of 89,000 km^2 accounting for 13% of total Myanmar area, including three counties of Myitkyina, Bhamo and Putao and 18 Town cities.

(2) Population

With the total population of about 1.42 million and the population density of 15.9 persons km^2, Kachin State is at the lowest level in Myanmar. In plains such as Bhamo and Mogong towns, the population density is 40 to 45 persons / km^2. Capital of KachinState, Myitkyina, has a population of about 200,000. The population sex ratio in Kachin is female 60% : male 40%.

(3) Nation

In the Kachin State, there are primary Kachin and its 11 branches (Jinghpaw, Lachik, Dalaung, Lauwaw, Guari, Lisu, Rawang, Hkahku, Duleng, Atsi and Zaiwa) as well as Burman, Shan and other ethnic groups, hundreds of thousands of overseas Chinese and immigrants from India, Pakistan, Bangladesh and other countries. Most Kachin people live in the orth of kachin State. Burman, Shan and their branches mostly live along railways in Mandalay and Myitkyina. Some people of Shan and its branches also live in Ayeyawady River basin and PutaoBasin. A few Tibetan people live in the northernmost Kachin State.

Official languge of KachinState is Burmese, but many people can speak English and Chinese. Local ethnic minorities have their own languages. Both Kachin and Shan use their own languages and characters.

(4) Agriculture

In Kachin State, rice is an important crop, accounting for 75% of total planted area. Other crops are widely planted in Myanmar. Fishery is distributed in rivers and lakes. Farm cattle, yellow cattle, pigs and chickens are raised.

Agriculture is an economic pillar of KachinState and main crops include rice, sorghum, maize, sugar cane and rape. The total planted area is about 2308km^2, including farmland area of about 1417km^2, drylands 405km^2, flood land of 202km^2, garden area of 121km^2 and mountain land of 162km^2. Rich is an important crop mainly planted in plains and mountain lands, accounting for 75% of total planted area. Protected forestland area is about 5670km^2 in Mohnyin, Myitkyina, Bhamo, Shwegu and other towns. Forest products include teak, hardwood and other

forest products. They are another main source of income.

(5) Industry

The most important industry in KachinState includes sugar refinery in NanmudiTown, small rice mills and timber processing plants. Hand-weaving industry is widespread throughout the whole state.

In addition, jade and teak are also main sources of income. Jades are distributed in Hanba, Longqin and other places while teak is distributed in Bhamo and Myitkyina.

(6) Electric power

Small portion of the southern region is covered by main grid and most areas are powered by isolated grids. There are several small (micro)-type hydroelectric power plants, electricity supply is subject to serious shortage. Total generation is about 3.04 million kW • h. Electric lighting is available only in 15 towns and 15 villages. With small power supply and coverage of isolated grids, power supply cannot be guaranteed. For the reason, almost all enterprises and merchants have their own small diesel generators.

(7) Employment

As shown from International Labor Statistics Yearbook (2003) issued by the ILO, registered unemployed population reached 0.382 million, 0.398 million and 0.434 million respectively in 2000, 2001 and 2002. In accordance with statistics in 2003, the employment population is 26.36 million, including 16.29 million males accounting for 61.8% and 10.07 million females accounting for 38.2%, and the unemployment rate is 4.02%. Agricultural production accounts for 64.09% of total employment population, processing and manufacturing, mining, electricity, energy, construction and other industries account for 8.42%, service industries (including transportation, telecommunications, administration, tourism and other service industries) account for 10.12% and the business accounts for 9.75%.

5.4.2 Religious belief and ethnic culture

(1) Religious belief

In Kachin State, there are primary Buddhism and Christianity as well as Islam and Hinduism. Buddhism believers account for 57.8% and Christianity believers account for 36.4%. 614 Christian churches, 20 Islam churches, 48 Hinduism churches and many Buddhist pagodas are distributed in Kachin State.

Buddhism has a broad and profound impact on aspects of social life in Myanmar. Current Myanmar society still has a strong Buddhist color. Almost all Buddhist families have shrines. Worshiping is an important life content. The believers chant sutras in the morning and at night. Schools and institutions set up temples or shrines. A number of people worship in famous Buddhist temples or pagodas in their rest days.

Buddhist temples have a great influence on Myanmar education. In the past, people worshiped and receive an education in Buddhist temples in villages or towns. Buddhist temples take classics for education textbook to provide religious education and language education in parallel. They still have a certain influence and take an important position on cultural education in villages and towns.

(2) Ethnic culture

Primary Kachin people mostly live in high mountains of 1500 to 2000m. To prevent fires, their houses are not connected. Most houses are thatched cottages divided into two layers of which the upper is for people and the lower is for livestock and poultry. All houses are rectangular with a gable roof.

There are more than 20 traditional festivals in Myanmar, most of which are related to Buddhism. Main traditional festivals include Songkran, Buddha Bathing Festival, Summer Festival, Hanukkah, Festival of Lights and Festival of Worship. There are also some festivals of ethnic minorities.

Manau Festival is the biggest and the most solemn traditional collective event of Kachin people. Thefestival is held once a year but it also could be hold timely based on needs. Permanent Manau altar was built in Myitkyina, Capital of Kachin State, in 1958. A state-wide Manau festival event is held in Myitkyina once every four or five years. For villages and tribes, Manau Festival is held once every year. During the Manau Festival, All Kachin people will wear festival coats to gather in a specified space for dancing and singing aloud with drum beats.

A number of Kachin people can speak English and Chinese. Most of local ethnic minorities have their own languages. Kachin and Shan use their own languages and characters.

5.4.3 Land use

Agriculture (farming) is the most important industry of Myanmar but also the basis of the Myanmar economy. Based on agricultural land resources per capita, Myanmar is one of the richest Asian countries and takes the first position in Southeast Asia. As shown from statistics from 2000 to 2001, there are 10.4 million hectares of arable lands and 650,000 hectares of fallow lands, which amount to 11.05 million hectares with 0.2 hectares per capita; 8.46 million acres of arable wastelands with 0.16 hectares per capita.

Farming is the most important industry ofKachin State but also the economic basis of the KachinState. KachinState covers a land area of 89,000 km^2, including plains of 38.66% and mountains of 61.34%. Total planted area is about 568,000 acres, including 351,000 acres of farmlands, 99,000 acres of dry lands, 49,000 acres of flood lands and 30,000 acres of garden lands.

5.4.4 Landscape and tourism

KachinState is rich in tourism resources. Bhamo and Myitkyina are major tourist cities in Myanmar. Bhamo Pajue Mountains, Senge Benlan church and Myitkyina Wanling Pagoda are local famous attractions.

According to the survey analysis, construction of Chipwi Nge Hydropower Station does not involves local landscape and tourism resources.

5.4.5 Population health

Most Kachin areas are hot and humid so as to facilitate breeding of disease vectors and animals as well as pathogenic microorganisms. There are mainly insect-borne, food-borne and water-borne diseases.

Insect-borne diseases are the major diseases in Myanmar, mainly including malaria, Japanese encephalitis and Leishmaniasis. Spinal Chikungunya fever, dengue, filariasis, plague and typhus (forest) also occur. Malaria risk prevails in the area below an altitude of 1000 meters. It occurs in Kachin State from March to December.

Main food-borne and water-borne diseases include cholera, dysentery, fasciolopsis buski, colon fluke, hepatitis, melioidosis and typhoid. Measles, diphtheria, influenza, poliomyelitis and other diseases also often occur.

Medical conditions are poor in Kachin State where there are six hospitals of more than 100 beds, 21 hospitals of below 50 beds as well as small town hospitals and village clinics. A narcotics hospital is built respectively in Bhamo and Myitkyina. Economic backwardness and inadequate investment in health care costs seriously hamper the development of medical and

health services and improvement of people health status.

5.4.6 Traffic

The land transportation of KachinState is rather poor, with only one railway.Myitkyina city is an important transport hub in northern Myanmar. It is located in the northern end of Myanmar's North-South Railway, at a full distance of 542 km from Mandalay in the south, and a full distance of 1163 km from Yangon. The full distance of the highway from Myitkyina to Putao in the north is 365 km, from Myitkyina to Bhamo in the south, 187 km, from Myitkyina to Ledo of India in the west, 458 km. The distance of the Myitkyina-Jiamai section of the Myanmar-India Highway is about 200 km, and this section can be available for transport all the year round while the other sections can barely available for jeeps in dry seasons. Myitkyina city and China's Yunnan province have close contacts at border areas, and the main highways include Tengchong-Myitkyina Highway, Myitkyina-Chipwi-Panwa Highway, and Myitkyina-Chipwi-Pianma Highway.

The main navigable river for inland water transport is the Ayeyawady River. Myitkyina is the starting point of the Ayeyawady River shipping, at a full distance of 169 km from Myitkyina to Bhamo, with the width of river of 400m to 800m, and small ships can be navigable in flood period. The voyage distance from Bhamo to Mandalay is 510km, with the width of river of 800m to 1500m, ships below 400 t can be navigable all the year round.

Myitkyina Airport is an important dual-use airport in northern Myanmar, with asphalt runways, equipment of communication navigation and night navigation. There are also airports at Bhamo and Putao. Normally, there are two flights per week from Yangon to Myitkina and Putao.

5.4.7 Education

There were 156 colleges and universities in 2007, with a highly uneven distribution. Educational opportunities in Myanmar are limited outside the main cities of Yangon and Mandalay. It is somewhat an obvious problem in KachinState. According to the 2002-2003 statistics, there were 1183 primary schools, 86 junior high schools and 41 senior high schools in KachinState.

5.4.8 Mineral

Kachin Jades are produced in Pagan, Hanba, Duomo, Longqin and other places. In ManxiTown, Bhamo County is Nanshanka gem site. Hugong Basin produces a small amount of amber, gold can be washed in rivers. Salt wells are distributed in GamaiTown and Hugong Basin.

5.4.9 Women

(1) Basic conditions of women

Sex ratio of population in Myanmar is 98.83: 100 and females are more than males. Kachin population is about 1,420,000, including about 850,000 women accounting for 60%. In traditional history, Burmese women enjoyed a high social and economic status and were equal to men in all key areas such as education, health, employment as well as social and political activities. 1947 and 1974 Myanmar Constitution reiterates the principle of gender equality and

some legal policies also begin to concern maternity leave treatment of women and increases medical services for pregnant women. It is internationally recognized that the government takes responsibility to eliminate injustice and discrimination against women. Myanmar has formally accepted this view. It signed the Convention Elimination of Discrimination against Women (CEDAW) in 1979.

(2) Status of women

Political rights of Myanmar's military government are controlled by males. Women are prohibited to join the army so that they are less involved in government affairs and impossibly take a high post. In the national voting assembly, women take a very small proportion of seats.

The status of women in the family is guaranteed basic and domestic violence is less. Within marriage, the husband is considered to be in the first position in the family. He takes obligations for his wife and children. The wife bears most of the housework, including child care and disposition of household finances. In case of divorce, father will take guardianship for boys while mother will take guardianship for girls. But children have the right to make their own decisions. As shown from CEDAW report, the mother generally takes care of all children. The male and female in the marriage are co-owner of the property. The spouse can own 1/3 of the other's property before marriage and 1/2 of property accumulated or increased after marriage, including the property given in the wedding and that obtained by common labor after marriage.

Myanmar laws support the economic status independence of women. They have equal rights to obtain lands and other properties. In bank loan application and signature of other contracts, women are equal to men. But women cannot obtain the same reward with men engaged in the same work. Myanmar Women's Affairs Coalition (MWAF) implemented microfinance for women to provide 8,608 women with Burmese Kyat 724 million of loans. In accordance with the CEDAW report, Myanmar Maternal and Child Welfare Association also gave a similar opportunity to provide more than 45,000 women with Burmese Kyat 180 million of loans to do small business or livestock farming.

(3) Organization of women

Independent women's rights organizations had not been allowed in Myanmar by 2007. Only some women organizations under government management serve as political speech right organizations of women.

Union of Myanmar Women's Commission (MNCWA) was founded in 1996. It is organized by the Secretary-General of the State Peace and Development Council to provide policy advices.

Union of Myanmar Women's Affairs (MWAF 2003) set up branches in all states to concern education, health, economy, culture, environment, violence against women, human trafficking, girls, women status rebuilding, national races affairs and legal affairs.

Myanmar Women and Children Welfare Association (MMCWA) was founded in 1991. It is a government organization mainly comprising enthusiastic volunteers to facilitate improvement of life and health conditions of women and children. The organization is distributed in 324 towns with 11,233 branches and more than 20 million volunteers. It focuses on health and education of women and children as well as loan assistance to poor women; it set up 91 prenatal and postnatal care centers for pregnant women; it also set up 1,344 preschool daycare centers.


(4) Right of women

Myanmar government failed to invest sufficient funds for health care so that individuals had to bear the medical expenses. More and more poor women cannot get the better medical services due to inability to pay for medical expenses.

5.4.10 Indigenous people

Chipwi Nge Hydropower Station mainly involves remote and inaccessible areas. Most indigenous people are Kachin and Shan.

In the KachinState are Primary Kachin and 11 branches (Jinghpaw, Lachik, Dalaung, Lauwaw, Guari, Lisu, Rawang, Hkahku, Duleng, Atsi and Zaiwa) as well as Burmese, Shan and other ethnic groups. Most Kachin people live in the orth of kachin State. Burman, Shan and their branches mostly live along railways in Mandalay and Myitkyina. Some people of Shan and its branches also live in Ayeyawady River basin and PutaoBasin. A few Tibetan people live in the northernmost KachinState.

Kachin is the sixth largest ethnic group in Myanmar, with a population of about 1.3 million, accounting for 2.5% of the total population. It is mongoloid and similar to Burmese in human characteristics. Kachin have their own language as a branch of Sino-Tibetan Tibeto-Burmese Jingpo language. Their economic life is mountain agriculture-based. Their cattle, pigs and chickens are raised in courtyards. They also are engaged in hunting and fishing activities in the slack season. Weaving of bamboo articles is a traditional handicraft of Kachin. In addition to stoneware and iron, bamboo articles are widely used for Kachin production and living tools. And even bamboo tubes are used for cooking.

Shan is the second largest ethnic group in Burma, with a population of about 4.2 million, accounting for 8.5% of Myanmar's total population. Shan people are scattered to live in KachinState. Shan language is a Zhung-Shan-Dai branch of Sino-Tibetan Zhuang-Dong group. It is similar to Burmese in the character appearance. Due to long-term close contacts and exchanges in the history, Shan people are affected by Burmese in the mode of production and religious habits. Their economic life is agriculture-based and a few people also operate handicraft business or small businesses. Small handicraft industry can produce farm tools, household items, decorations, cloth, cooking utensils as well as mats, satchel, paper and dyed threads. Shan women's economic independence is strong. In production, men are responsible for plowing and ditch while women responsible for sowing and transplanting; in commerce, men transport cloth and grocery while women sell vegetables, fruits and snacks in the village bazaar. In the handicraft, the men repair houses and make furniture while women spin cotton

and weave cloth.

The additional socio-economic study was done in August 2016 and the report is presented in Appendix III.

5.4.11 Overview of project area

In the influencing area of Chipwi Nge Hydropower Station are main crops such as rice, wheat, corn, peanut, sesame, cotton, beans, sugar cane and so on; main fruits such as mango, pineapple, lemon, orange and coconut; main economic woods such as teak, green fruit trees, bamboo and so on.

In the project area, villagers generally live near riverside highways or rivers and mostly are concentrated in natural villages subject to different sizes. Each village has a specified head responsible for message transmitting. There is no clear boundary between villages.

Between the project area and the external are waterways and highways for communication. Due to large channel slope in the waterways, streams are fast-flowing so as to cause navigational hazards. There are a number of gold diggers on both bank of the river and ships in the river mostly provide services for the gold diggers. There are two highways to connect the project area with the external, namely Myitkyina – Chipwi highway on the left bank of Nmaihka Riverand Injangyang-Chipwi highway on the right bank of Nmaihka River. Their roadbeds can reach the maximum width of 5 to 6m and minimum width of 3 to 4m. Both highways are extended along the mountain form and they are poorly linear. They have an uneven clay bound macadam pavement which becomes muddy in summer and often suffers slough to beak the traffic.

In the project area, some villages are located along the above highways, some are connected with the above highways via branches to realize external transport and some have no highway but rely on waterways for external transport.

Infrastructure conditions are poor in the project area. There is no grid in the reservoir area and a few villagers generate power by using small diesel generators. Drinking water is generally drawn from stream ditches by gravity flow. Some villages build a reservoir in a high position and lead water to surroundings of households via pipelines. The pipelines are equipped with a tap to provide water for surrounding villagers. Some villages have water wells for villagers to carry water. There is no special facilities such as telecommunications and cable television in the reservoir.

In the project area, public facilities mainly include temples, churches, schools, hospitals and so on. Most villages provide Buddhist temples and God or Christ churches. They generally coexist. Some villages provide primary schools where kindergarten and grades of 1 to 4 are set up. Students need to learn in Myitkyina after graduation. A few villages are equipped with small hospitals.

5.5 Status of environmental quality

Entrusted by CPIYN, the Environmental Monitoring Station in Tengchong County, Yunnan Province of China monitored the water quality in sections of the dam site and power plant of Nmaihka River in October 2014. The results of surface water quality monitoring are shown in Table 5.5-1.

Table 5.5-1 Results of Surface Water Quality Monitoring in Project Area

Water Quality Index	Section Name		Environmental quality standards	Evaluation result	Standard limits of CPCB （Central Pollution Control Board of India）
	Dam site	Power plant site	Environmental quality standards for surface water of China GB3838-2002（Ⅲ）		
pH	7.49	7.28	6~9	Ⅲ	5.5-9.0
BOD	2	3	≤4	Ⅲ	30.0
COD	6	7	≤20	Ⅲ	250
TSS	18	20	—	—	100
Oil	0.04	0.04	≤0.05	Ⅲ	10.0
Phenol	0.002	0.002	≤0.005	Ⅲ	1.0
Cyanide	0.004	0.004	≤0.2	Ⅲ	0.2
TN	0.227	0.365	≤1.0	Ⅲ	50.0
TP	0.027	0.026	≤0.2	Ⅲ	5.0
Arsenic	0.007	0.007	≤0.05	Ⅲ	0.2
Chrome	0.009	0.013	≤0.05	Ⅲ	2.0
Mercury	0.0001	0.0001	≤0.0001	Ⅲ	0.01
Zinc	0.05	0.05	≤1.0	Ⅲ	5.0

Because the surface water quality standards has not been collected from Myanmar, we refer to China "surface water environment quality standard" (GB3838-2002) for the evaluation of surface water. ClassⅢ is mainly suitable forlevel 2of centralized drinking water protection zones, which is mainly suitable for drinking water, fish and shrimp wintering grounds, migration routes, aquaculture zones, swimming area, etc.

As shown from Table 5.5-1, all water quality indexes are within the limit of China "surface water environment quality standard" (GB3838-2002) class Ⅲ. According to the monitoring results, the water quality of both sites is quite good and can meet " Environmental quality standards for surface water "(China, GB3838-2002) .

From Table 5.5-1, we can find that the limits of china surface water environment quality standard are much lower than CPCB which come from BANCA. For some index's limits, such as BOD, COD, Oil, etc, CPCB is some kind of wastewater discharge standard rather than water environment quality standard.

According to the investigation, there is no medium and large -sized mining enterprise or industrial pollution source near Chipwi River. Ambient air quality and sound quality are better in the area.

5.6 Main environmental problems

(1) Serious ecological damage

Wood is a main income source of northern Myanmar and KachinState. Continuing deforestation causes serious damage to forest resources and sharp decline of forest coverage.In addition, local residents are accustomed to migration type shifting cultivation and obtain slope farmland by burning and rotation of crops, which directly causes damage to vegetation in large area and

even leads to forest fires. To obtain a livelihood, some residents have to engage in wildlife hunting and trading activities so that wildlife suffers a huge threat and rare or endangered animals become reduced sharply. Deforestation, slash-and-burn cultivation, wildlife trading and other human activities cause a large impact on ecology in the area so that ecological degradation in local area becomes serious.

Logging

Slash-and-burn Cultivation

(2) Economic development and people's livelihood to be improved

Myitsone area is remote and its infrastructures need to be developed. Due to limitation of capital and other conditions, local resources and related industries cannot develop properly. In particular, abundant water resources are not exploited. Due to scattered residence of local population, economic and cultural exchanges are less and regional economic development is very restricted. Most people's living standards need to be improved.

Infrastructure conditions need to be improved.


PEOPLE's living standards need to be improved

5.7 Environment trends analysis of project zero

This section aims to analyze change trend of regional natural environment, ecological environment and social environment of the project area following established economic and social development goals under the premise of no construction of Chipwi Nge Hydropower Station, that is, analyze change trend of environment and development in the appraisal area under the premise of project zero.

5.7.1 Natural environment

(1) Hydrological regime

In case of taking project zero, the hydrological regime will not be changed significantly in the project area. Water level, flow, velocity, direction and other hydraulic elements will maintain the status in time and space. Runoff is almost consistent with rainfall in annual change. Uneven annual distribution still exists and declines gradually from the upstream to the downstream. The water level changes with flow rate. In summer, runoff reduction causes river water level drop and river surface narrowing; in rainy season, water level rises to widen the river surface.

Under the influence of rainfall and climate, sediment yield in the basin increases from upstream to downstream. Under the premise that human activities, population distribution and ground vegetation coverage has little change, sediment yield changes slightly and follows the trend of increasing from upstream to downstream.

(2) Water environment

Under current conditions, both sides of Chipwi River are sparsely populated and have no large industrial and mining enterprises. For the reason, there are few pollutants into the river and current water quality is relatively good.

In case of taking the Project Zero, farming will grow with economic and social development in the project area but surface source pollutants will increase to some extent. Due to limited local level of technological and economic development, traditions and mountainous terrain conditions, farming mode and planted area change at a low level. Even if surface source pollutants increase, the change will still be relatively small. The population and domestic wastewater discharge in the project area will increase, but the pollutants into the river will remain at a low level due to scattered population. Industrial development in the project area will almost maintain the status quo and industrial pollution sources will not increase. It can be clearly seen that, economic and social development contribution to pollutants is at a lower level and increase of river pollutants will not change water quality of the river.

5.7.2 Ecological environment

(1) Vegetation change trend

Due to intense human activities over the past few decades, most tropical rainforests have been destroyed. Savanna bamboo forest, tropical monsoon forest and evergreen broad-leaved forest dominated by kapok, male bamboo, duabanga grandiflora, kapur and balau have been significantly secondary in the vegetation.

In case of taking the Project Zero, firewood and house building materials for local people's livelihood will have to rely on deforestation if no stable power supply is available. In order to obtain family incomes, some residents will have to engage in timber harvesting and trading so as to cause damage to forest resources. High mountains and deep valleys are more while flat ground is less in the project area. Local residents will continue to obtain farmlands by burning and rotation so as to directly cause damage to vegetation in large area. These human activities will lead to further reduction of forest vegetation area in the appraisal area and enhance degradation of vegetation succession. Main vegetation types generally will not change in the project area.

(2) Trend of terrestrial animals

With high forest coverage, inaccessibility and small population density, habitats suitable for terrestrial animals are widely distributed in the project area. In case of taking the Project Zero, mobility of the population will increase with economic and social development to generate some interferences to the habitats so that some animals will migrate to high altitudes. But the influence is at a low level. Animal species diversity will continue to maintain a high level and local environmental conditions will be still suitable for terrestrial animals to thrive.

In addition, due to lack of large-scale industrial enterprises, modern agriculture, mature services and other living means, some residents will have to engage in wildlife hunting for obtaining family incomes by trading of wild animal fur, bones and meat so that wild animals suffer a huge threat, which will result in reduction of rare and endangered animals and affect biodiversity.

(3) Trend of fish resources

In case of taking Project Zero, fishermen will fish mainly in Nmaihka River and generate littler interference to Chipwi River. As long as water and sediment conditions have no large change in the basin and habitats of fishes are not changed significantly, fish resources of Chipwi River will continue to remain in a natural state and there will be no disappearance of species and significant decline of resources.

(4) Trend of ecological environment quality

In case of taking the Project Zero, deforestation, slash-and-burn cultivation, wildlife trade and other human activities will increase with economic and social development in the basin. Their interferences on ecological environment also will increase and local ecological environment will be further degraded. Due to limitation of local economic and technological development and social environment, the intensity of human activity will be limited to improve. The ecological environment in the area will continue to follow typical characteristics of forest ecological system and the overall ecological environment quality will be in a better state.

5.7.3 Social environment

Due to limitation of national economy foundation and other instable factors, economic and technological develop is slow, living standard is at a low level, science ,culture and hygiene, road transportation, water conservancy facilities and other infrastructures are weak and residents still retain more primitive lifestyle of slash-and-burn cultivation. In addition, due to historical reason, local residents are distributed in the project area of Chipwi Nge Hydropower

Station by ethnic community. All ethnic groups retain their own culture and customs and have less economic and cultural exchanges between them.

In case of taking the Project Zero, if no comprehensive planning is carried out for the Chipwi River basin, local residents will continue to remain their own the original production and lifestyle so that it will be difficult to fundamentally change the above economic backwardness and slow social development.

5.7.4 Comprehensive analysis

In summary, if the project area of Chipwi Nge Hydropower Station fails to change existing economic development mode, eliminate the production and lifestyle of logging, slash-burn cultivation, hunting and gold washing or strengthen environmental protection and management, ecological environment of local area will further be degraded, local residents will continue to live in poverty and it will be difficult to fundamentally change slow economic and social development in a short term.

6 Environmental Impact Assessment (EIA)

6.1 Hydrological regime

Normal pool level of Chipwi Nge Hydropower Station is 740m. The capacity of reservoir below normal pool level is about 789,000 m^3. The reservoir has the ability for daily regulation and it is a channel reservoir. The reservoir covers an area of about 0.10km^2 and its backwater length is about 0.75km.

After the reservoir retains water, flow rate will decline and the water level at dam site will be about 30m above natural channel so that water surface area and water width will increase. Due to small reservoir capacity, the increase will be at a low level. With daily regulation capacity, the reservoir is rapid in water exchange. Its water level changes between 735m and 740m with an amplitude of 5m.

Chipwi Nge Hydropower Station is a low-dam diversion hydropower station. Annual average flow rate at the dam site is 40.1m^3/s while power generation takes about 27m^3/s. After the project is completed, a water reduction section of about 15.7km long will be generated between the dam site and estuary. In accordance with site survey, scattered settlements are distributed on both sides of the section from the dam to estuary. The settlements have a large height difference and distance from Chipwi River. Local residents take living water mainly from nearby streams or springs rather than Chipwi River. The water reduction section has no requirements for irrigation and water supply. To maintain basic ecological requirements for the river and meet construction power loads of Myitsone and Chipwi power plants, the power plant shall discharge some ecological flows. There are more branch gullies in the downstream of the dam and the water connecting amount is larger, discharged flow of Chipwi Nge Hydropower Station will take 10% of minimum monthly average flow in the dry season, namely 0.53m^3/s. Proposed discharged ecological flow of the dam is 0.53m^3/s.

Day-by-day comparison of downstream natural flow and discharged flow in high flow year, normal year and low flow year is shown in Figure 6-1 to 6-3. Downstream flow changes in different hydrographic years are shown in Table 6.1-1. From May to October, the natural flow is large. Diversion power generation has little impact on downstream flow and downstream water level changes slightly. From November to next April, natural reservoir inflow declines and diversion power generation significantly reduces downstream flow. The downstream flow is discharged ecological flow, namely 0.53m^3/s and downstream water level falls. With abouchement of streams from many downstream branch gullies, flow of water reduction section will gradually increase so that the downstream flow and water level will gradually reduce difference from natural conditions.

As shown from the investigation, the nearest two branch gullies are about 1.6km in the downstream of the dam, respectively with a catchment area of 10.0km^2 and 5.45km^2. According to estimates, their annual average flows are respectively 0.73m^3 / s and 0.4m^3 / s. Plus discharged flow of 0.53m^3/s, average flow 1.6km in the downstream can reach 1.66m^3/s. Annual average flow of confluence between the dam site and estuary is about 13.9m^3/s. Plus discharged ecological flow, the flow at the estuary of Chipwi River can reach 14.4m^3/s, accounting for 26.7% of annual average flow at the estuary of Chipwi River.

Table 6.1-1 Dam Site Flows in Hydrologic Years before and after Project Completion
Unit: m^3/s

Month	25%			50%			75%		
	Natural Flow	Water Diversion Discharge	Discharged Flow	Natural Flow	Water Diversion Discharge	Discharged Flow	Natural Flow	Water Diversion Discharge	Discharged Flow
1	14.38	13.85	0.53	10.28	9.75	0.53	9.76	9.23	0.53
2	11.82	11.29	0.53	10.29	9.76	0.53	7.74	7.21	0.53
3	9.19	8.66	0.53	11.51	10.98	0.53	4.92	4.39	0.53
4	7.43	6.90	0.53	17.37	12.09	5.29	3.88	3.35	0.53
5	9.41	8.29	1.12	14.85	14.08	0.78	36.55	18.71	17.84
6	86.21	26.23	59.98	92.38	26.69	65.68	85.56	26.15	59.41
7	112.81	27.18	85.63	118.61	27.18	91.42	102.40	27.18	75.21
8	112.22	27.18	85.03	84.50	27.18	57.32	58.33	27.18	31.15
9	60.65	27.18	33.47	49.68	27.03	22.65	59.61	27.18	32.43
10	64.04	27.18	36.86	25.93	23.11	2.82	29.55	24.68	4.87
11	29.47	25.98	3.49	21.25	16.96	4.29	15.64	15.11	0.53
12	15.83	15.30	0.53	14.35	13.54	0.81	8.84	8.31	0.53

The powerhouse is located in the main stream of Nmaihka River. Chipwi Nge Hydropower Station draws water from Chipwi River as a tributary of Nmaihka River to main stream of Nmaihka River. Designed diversion flow is 26.46 m^3/s, accounting for only 1.2% of annual average flow of Nmaihka River at the powerhouse. It has little impact on hydrological regime of Nmaihka River waterways above the powerhouse.

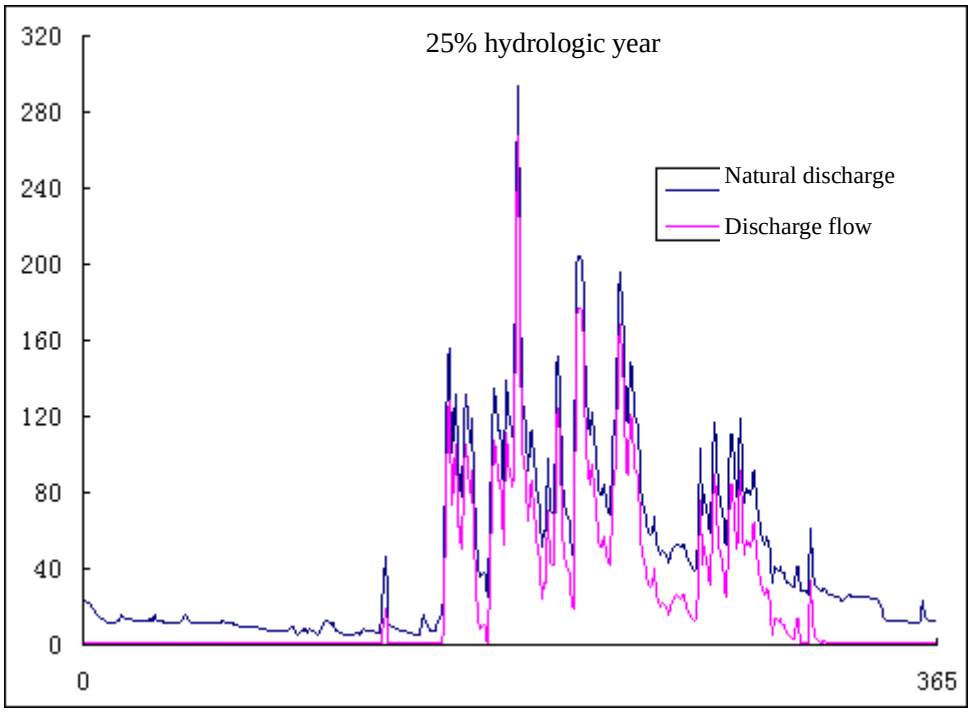


Figure 6-1 Day-by-day Comparison of Downstream Natural Flow and Discharged Flow in High Flow Year (P = 25%)

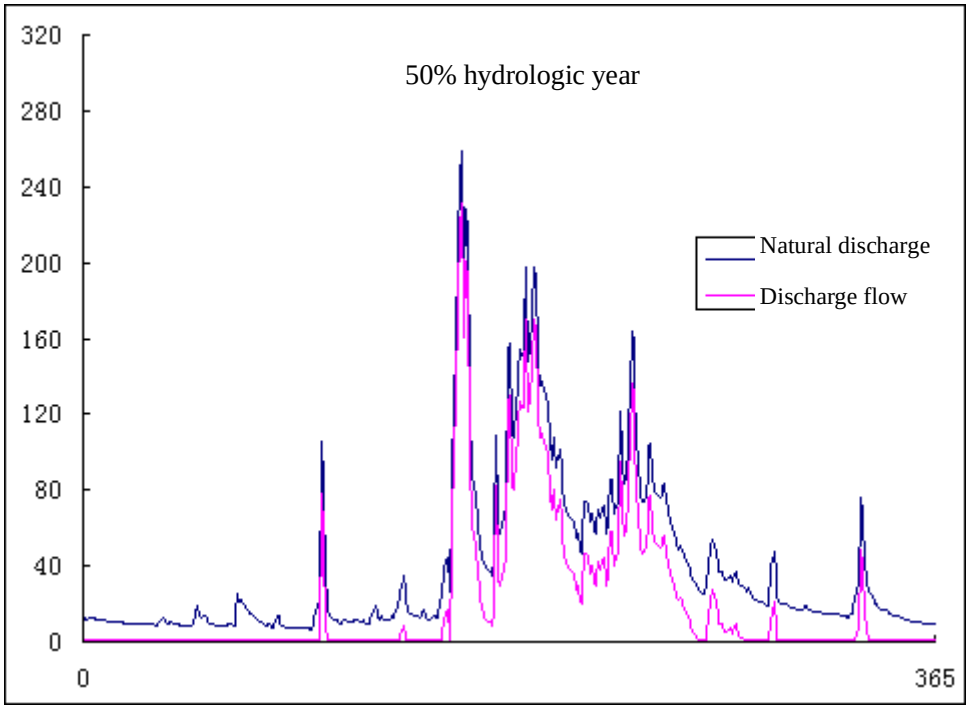


Figure 6-2 Day-by-day Comparison of Downstream Natural Flow and Discharged Flow in Normal Year (P = 50%)

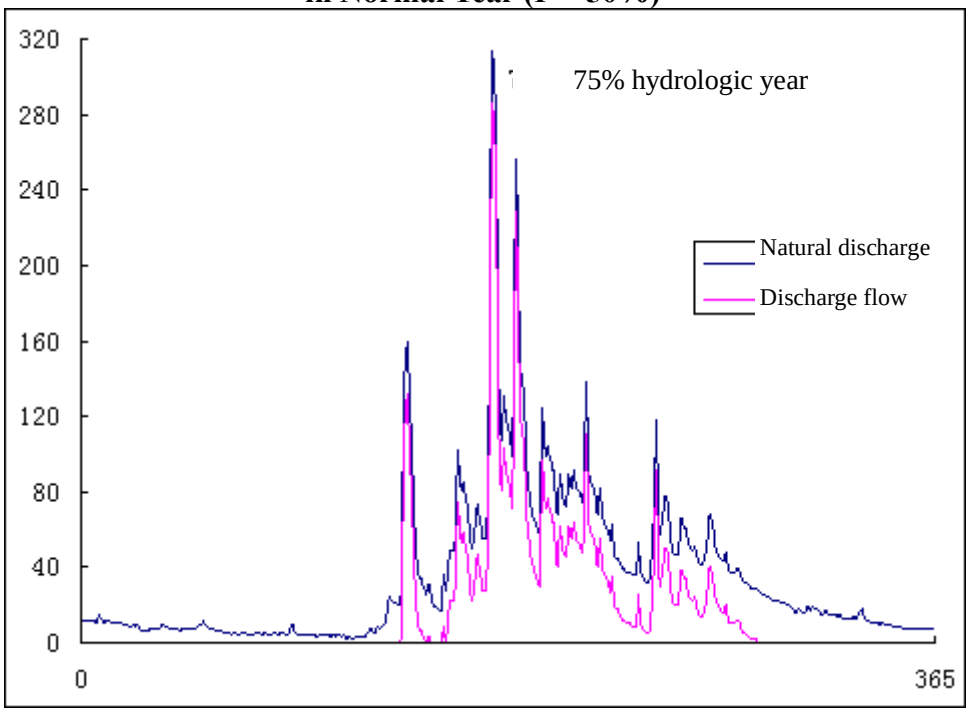


Figure 6-3 Day-by-day Comparison of Downstream Natural Flow and Discharged Flow in Low Flow Year (P = 75%)

6.2 Water Environment

6.2.1 Influence on water quality

(1) Construction period

In accordance with analysis on engineering characteristics of Chipwi Nge Hydropower Station, influences of the project construction on water quality are mainly caused by discharge of construction wastewater and domestic sewage.

Influences on water quality of Chipwi River during the construction mainly include alkaline wastewater generated from concrete mixing, rinsing and curing, oily wastewater generated from construction machinery maintenance, foundation pit drainage, domestic sewage of construction personnel and so on. In the project, aggregate processing system adopts dry process and production process of three-stage crushing and three-stage screening to eliminate rinsing wastewater.

Concrete mixing stations are arranged respectively in a position about 300m in the downstream of the dam site on the right side, on the flat land in the upstream of powerhouse on the left bank and at No.1 to No.5 construction adits of diversion tunnel. Total amount of concrete pouring is 78,000 m^3. Concrete curing and rinsing wastewater reaches suspended solids concentration of about 5000mg / L and pH value of about 11. For similar water conservancy and hydropower projects, curing of 1m^3 concrete generates about 0.35m^3 alkaline wastewater. It can be estimated accordingly that total alkaline wastewater is 62,300 m^3 and rinsing wastewater per shift of concrete drum and tank is about 6m^3. If alkaline wastewater is discharge randomly, it will cause destruction of the surrounding soil environment and affect water quality in the construction section.

The project is mechanized construction-based. Construction machineries draw power from fuels. About 140 construction machineries need to be rinsed regularly. The rinsing will generate a certain amount of oily wastewater. Based on average rinsing water of 0.6m^3 per machinery, all machineries will consume about 84.0m^3 of water once. Wastewater from machinery vehicle repair and rinsing water discharge has a high content of suspended matters and oil, including suspended matters of 500 to 1000mg/l and oil of about 10 ~ 30mg / l. If oily wastewater is discharged into water randomly, an oil film will cover the water to reduce dissolved oxygen reoxygenation rate and affect water quality in the construction section.

Cofferdam will be built to generate a foundation pit when hydraulic structure for Chipwi Nge Hydropower Station is built. Cofferdam seepage, rain and construction water are often discharged from the foundation pit. In accordance with monitoring data of other water conservancy and hydropower projects, common water of foundation pit is subject to suspended matter concentration of about 2000mg / L and pH value of 11 to 12. If foundation pit wastewater is directly discharged without treatment, it will affect water quality in the construction section.

There will be 860 persons at the peak of project construction and expected domestic sewage discharge is 99.6m^3/d. COD, BOD5, SS and total nitrogen are more in the construction and domestic water. If domestic wastewater is directly discharged without treatment, it will affect water quality in the construction section.

Due to small project construction scale, the wastewater output is less. In addition, pollutant composition is simple. The wastewater will not cause adverse influences on water quality of Chipwi River after appropriate measures are taken and the influence will be temporary. The influence will disappear immediately after the construction comes to an end.

(2) Operation period

No industrial and domestic pollution is in the reservoir of Chipwi Nge Hydropower Station, so there will be almost no wastewater to enter the reservoir.

In the initial stage of impoundment for Chipwi Nge Hydropower Station, dissolution of nutrients in submerged lands may increase content of nitrogen and phosphorus in the water so as to facilitate enrichment of nitrogen, phosphorus and other nutrient elements. Chipwi Nge

Hydropower Station is a daily regulation one with frequent water exchange. It is expected that the impoundment will have little impact on eutrophication of water in the reservoir.

After the power plant is completed, it will reach normal pool level of 740m and backwater length of about 0.75km, the water level will be higher than that before dam construction to widen the water surface. Water volume in the backwater area will increase to enhance diluting effects, thus improving overall water quality in the reservoir. Reduction of discharged flow in the section from the dam site and estuary will affect dilution and self-purification capacity of the water.

In summary, construction and operation of Chipwi Nge Hydropower Station will not affect significantly water quality in the river.

6.2.2 Influence on water temperature

Chipwi Nge Hydropower Station has a daily regulation function and runoff reservoir capacity method is used for calculation to show a>20, indicating the reservoir is a mixed one. Water temperature in the reservoir will not be layered. Project construction and operation have no effect on reservoir water temperature.

6.3 Aquatic organisms

Chipwi River for Chipwi Nge Hydropower Station is a fast-flowing mountain stream with average hydraulic slope of 5% to 6%. Schizothorax, pareuchiloglanis, glyptothorax and pseudecheneis of fishes suitable for rapid stream habitats are likely to inhabit in Chipwi River.

After the reservoir filling, flow of river reach in the reservoir will decline so that water environment will be favorable to growth and breeding of aquatic organisms suitable for slow flow habitats. Fishes of Nmaihka river system are mainly the species suitable for rapids habitat. They will migrate to the upstream or rapids environment of Nmaihka River. Chipwi Nge Hydropower Station is subject to low-dam diversion development with a reservoir backwater length of about 0.75km. The project construction has little impact on schizothorax, pareuchiloglani, glyptothorax and pseudecheneis adaptive to rapids habitat.

After the power plant is completed, water flow of about 15.7km long river reach from the downstream to the powerhouse will decline sharply to reduce plankton and benthos. Fish resources in the river reach also will reduce. Fishes in the river reach are widely distributed in the Nmaihka River basin. The power plant construction only reduces their scope of habitats and the reduction is very small. Reduction of water flow in the water reduction river reach has a limited influence on fishes.

Dam construction will divide the complete river ecology system into two parts, the upstream and the downstream, to cause fragmentation of river habitat which will affect exchange between aquatic organisms. Fishes in the Chipwi River are widely distributed in the river system of Nmaihka River. In addition, reservoir for Chipwi Nge Hydropower Station has a backwater river reach of 0.75km long and downstream water reduction reach of about 15.7km. influencing reach is shorter, so the project construction will almost not play a significant impact on fish resources in the river system of Nmaihka River.

6.4 Terrestrial organisms

6.4.1Terrestrial plants

(1) Ecological integrity

The power plant is subject to diversion power generation. Its permanent land and reservoir inundation cover an area of 17.3hm^2, including only 12.2hm^2 for damage or inundation. The influence on local vegetation is small and that on regional ecology system productivity is

acceptable. Temporary construction land occupation will reduce vegetation area to lower biological productivity in the appraisal area, but the change is very small. In addition, vegetation restoration measures will be taken after the completion of construction, which can improve biological productivity. Project construction and operation will almost not change general heterogenization of vegetation patches and the influence on restoration stability and impedance stability of ecological systems in the project area will be very small.

(2) Terrestrial ecosystems

Due to reservoir inundation of Chipwi Nge Hydropower Station as well as construction of dam, powerhouse, construction road, diversion tunnel and construction adit, 12.2hm^2 of surface vegetation will be damaged, including 0.5hm^2 of orchard, 6.5hm^2 of economic forest, 0.7hm^2 of timber forest, 2.7hm^2 of grass land and 1.2hm^2 of shrub forest.

Pivotal project construction, construction site layout, stockyard excavation, slag yard field filling and other construction activities will directly damage original surface vegetation. Existing vegetation in the construction area will be completely changed to manmade structures. Plants in the project constriction area are seriously affected by human activities, mainly including vegetation of secondary forests and plants such as local common arbors, shrubs and weeds. Construction activities will not cause disappearance of species and substantial drop of the quantity. For the vegetation in the project area, damaged area will take a small proportion and the influence is at a lower level.

With gradual completion of all works, implementation of soil and water conservation, greening and landscaping measures as well as rapid vegetation growth and strong restoration under high summer temperature and rainfall in the construction area, all damaged vegetations except permanent buildings will be gradually restored. Productivity of terrestrial plants in the construction area will be restored manually to original level.

6.4.2 Terrestrial animals

Reservoir for Chipwi Nge Hydropower Station is small and its area will increase by only 0.08km^2 after filling. It will almost not affect reptiles and mammals inhabiting around the reservoir.

Due to disturbance of human activities, there is a small number of wild animals in the project area, which are mainly small ones such as snakes, rodents and birds. Direct influence of the project construction on reptiles, birds and animals is that focused activities and construction of construction personnel will drive these animals to leave the construction site and take secondary forests and shrubs as the habitats. There are habitats for small animals to habitat or migrate in the edge of the construction area. Therefore, the direct influence on these wild animals will be slight.

Disturbance to living environment of animals and even hunting in the project construction will reduce animals. But main animals in the construction area are frogs, common lizards, small birds and small mammals and have a small number. For the reason, activities of construction personnel will have little influence on wild animals in the area. But wildlife purchasing of construction personnel or management personnel will increase wildlife trading in the project area. It can improve intensity and frequency of hunters for hunting so as to reduce wild animals in the project area.

6.5 Soil erosion

New soil erosion may be caused by foundation excavation of dam, powerhouse, diversion tunnel and stockyard, construction road building, leveling of construction enterprises and office & living site and slag.

In accordance with soil erosion status in the project area and engineering design data, construction of Chipwi Nge Hydropower Station will disturb 61.74hm^2 of surface and produce 65,100 m^3 of slag. Analysis and prediction show that the project construction may cause total soil erosion of about 16262t, including new amount of about 9241t.

Slope excavation for construction of dam, powerhouse and other buildings will change original landform and damage original surface vegetation so as to cause surface exposure, change original water movement form and reduce erosion resistance of surface soils. Steep slopes generated by excavation will reduce stability of natural slopes. If they are not reasonably protected, gravity erosion will be caused to affect safety of main engineering facilities. In addition to adverse impact on the project construction, the soil erosion also will increase channel sediments.

If no effective protection measure is timely taken during excavation of stockyard, large soil erosion hazards will be caused to affect ecological environment in the occupied range and surrounding area.

Construction enterprise site leveling and construction road building are subject to a large work amount, which will damage a large area of vegetation and increase soil erosion. If no effective protection measure is taken, land productivity and ecological environment in local sections will be affected to some extent.

Therefore, effective soil and water conservation measures shall be taken during the construction to prevent soil erosion in the construction area.

6.6 Acoustic environment

Noises in the construction area are caused mainly by excavation, drilling, blasting, concrete mixing, transportation and other activities. There are more excavation machineries to generate continuous noises at the level of 85dB to 115dB. Blasting will generate instantaneous noises at 130dB to 140dB. Concrete pouring will generate continuous noises at 90dB to 110dB. Aggregate processing will generate continuous noises of above 80dB. Processing and repair of auxiliary enterprises will generate intermittent noises at 80dB to 110dB, but they are concentrated in the processing and repair plant. Vehicle transport will generate traffic noises with line source at the level of 70dB to 90dB. In terms of project location, the construction area is located in an open valley which is sparsely populated. Construction personnel will be affected, so necessary protection measures shall be taken.

6.7 Atmospheric environment

There is no large atmospheric pollution source such as factories and mines near Chipwi Nge Hydropower Station, so the construction area have fresh air and good air quality.

Main air pollution sources during the construction period include fuel machinery exhaust, dusts caused by earthrock excavation, blasting, concrete mixing and aggregate crushing and screening as well as road dusts caused by vehicle transport. Main pollutants include TSP, SO2, etc.. The above construction activities will affect ambient air quality in local area, but the influence is temporary. It will disappear immediately after the construction is completed. In addition, the above construction activities will affect site construction personnel, so necessary protection measures must be taken for them.

6.8 Solid waste

Sold wastes generated during the construction of Chipwi Nge Hydropower Station include waste slag and domestic garbage of construction personnel. Total slag of 665,100 m^3 will be generated in the construction. 830 construction personnel will be involved at the peak of construction for Chipwi Nge Hydropower Station. Based on the construction period of 29

months, garbage of 1kg /person/ day and specific gravity of 0.8t/m^3, all construction personnel will generate about 653m^3 of domestic garbage during the construction.

If no measure is taken, soil erosion will be caused in case of storms so as to affect water quality of Ayeyawady River and surrounding ecological environment. More construction personnel will be involved at the peak of construction. If domestic garbage is stacked randomly, it will pollute air, affect the appearance and breed mosquitoes and a lot of rodents under some conditions to increase transmission of diseases in the construction area. Therefore, solid wastes generated in the construction shall be properly handled.

6.9 Environmental geology

The reservoir is subject to small length, simple geological conditions and lack of fault. The reservoir basin is located in weakly permeable granitic gneiss rocks, so the reservoir is sealed properly without leakage; rocky slopes are distributed on both side of the reservoir to prevent immersion.

There are gullies on both sides of the dam site, including two gullies on the right side and eight small gullies on the left side. Surface of Slopes on both sides of Chipwi River and its gullies consists of soil layer and completely and highly weathered layer. It is prone to downward collapse, slip and solifluction under rain effects. Its coverage towards gullies and Chipwi River will easily cause mudslides. The mudslides will affect reservoir sedimentation and dam safety. Mudslide gullies about 100m in the upstream of water inlet are on the diagonally opposite of No.2 dangerous rockmass. The gullies affect No.2 dangerous rockmass and water inlet.

The No.2 dangerous rock mass is located on the left bank, with a distance of 155m to the upper dam axis. With a distribution elevation of 728m ~ 764m, the rock mass is approximately 55m long, 15m wide and 15m ~ 30m high. It is estimated that the volume is 8000m^3. The rock mass is made of diorite-granite gneiss. The No.2 dangerous rock mass is formed due to influences of three groups of fissures. At present, the rock mass is in stable state, but most of it will be submerged in water after reservoir impoundment.

Water inlet slope is nearly vertical to gneissosity direction. The excavation will generate a slope of about 50m high. There are more slope fractures and they are weathered to different extent, so the decompression is serious. The upper loose layer is thick locally and poor locally in the stability. Exits and entrances of tunnels, groove section and fault zone are subject to impact of surface decomposition and structure. Rocks are fractured and poorly stable.

Powerhouse excavation will generate artificial slopes of 12m to 50.5m high. They will be mainly distributed in the upstream, rear and downstream of the powerhouse. The upper slope is loose layer of 11.6m to 18.9m thick and it is prone to sliding after excavation. The lower rock slope has four groups of fractures most of which are opened and some are filled with a small amount of silty clay and gravel in poor properties. Fracture combination divides the slope into blocks by cutting. The slope will be subject to stability problem after excavation.

6.10 Impact on Local and Regional Climate

The concern regarding the impacts of dam and reservoir projects on local climate is microclimate changes. The significance of this changes is related to the surface area and volume of the reservoir and to the prevailing climate condition in the area. The phenomenon is generally storing energy of the reservoir from solar radiation received during summer in the upper water body and dissipating this resulting in increases in humidity and increased average winter temperatures and less hot conditions in summer. The effect of colder air from the slopes meeting the relatively warmer reservoir water surface might also result in a tendency to mist and fog occurrence especially in winter.

The Chipwi Nge Hydropower project will have a very small reservoir with 0.08 km^2 after filling, so it will not lead to a significant change in the climate of the area or the region.

6.11 Greenhouse Gas Emissions from Chipwi Nge Reservoir

Carbon dioxide (CO_2) and methane (CH_4) cause global warming and thus are commonly denoted as greenhouse gases (GHG). Despite generating electricity without the use of fossil fuel, also reservoir-fed hydropower plants (having reservoirs of large volume and area) may be significant sources of greenhouse gas (GHG) emission. Both gases are emitted form reservoirs due to decay of inundated vegetation, soils and organic sediment formed by aquatic biomass and particulate or dissolved organic carbon inflow the catchment. Thus, hydropower plants have their own global warming potential (GWP).

In particular; shallow, tropical reservoirs with high volumes of residual organic compounds in the flooded reservoir, intensive aquatic primary production and high influx of organic material by their tributaries are of concern in this respect. Chipwi Nge reservoir area however, is very small and degraded forest and orchard, has soil layer and highly weathered layer and low influx of organic material. Furthermore, the climate of the project area of Chipwi Nge Hydropower Project is not favourable for contribution to the greenhouse gas emissions. As a result, Chipwi Nge Hydropower Project will not contribute to the climate change.

7 Social Impact Assessment (SIA)

7.1 Social economy

Chipwi Nge Hydropower Station is designed to provide installed capacity of 99MW and annual average power generation of 609 million kW • h. Its original development task is to provide construction power for development of Myitsone and Chipwi hydropower stations in Ayeyawady River. Due to change of external conditions, the development task is adjusted to power supply for ChipwiTown and Myitkyina City. Social and economic impacts of Chipwi Nge Hydropower Station construction are as follows:

(1) To increase tax revenue and promote the comprehensive development of economy and society

Construction of Chipwi Nge Hydropower Station will bring new opportunities for regional economy development to inject fresh momentum into local financial income. New financial income sources are closely related to power generation and associated business of the power plant to promote comprehensive development of local economy. Under new financial supports, infrastructures in the area will have new investment opportunities such as road improvement, health care facility increase, education investment increase and cultural construction investment increase, which can directly enhance sustainable development capacity of local economy. Increase in local tax revenue will help solve fund lack in local economic and social development projects to promote coordination of regional economic and social development.

(2) To promote development of local related industries

Construction of Chipwi Nge Hydropower Station will certainly drive development of local related industries. Huge consumption of building materials for power plant construction can promote development of building materials production and processing in surrounding areas, drive development of logistics and increase trades in surrounding areas. A large number of living materials for power plant construction can promote production and trading of local agricultural and sideline products. After the power plant is completed, sufficient power supply will promote coordinated development of electric power related industries to provide energy guarantee for development of new industrialization.

(3) To increase employment opportunities for labor force

830 construction personnel will be involved at the peak of construction for Chipwi Nge Hydropower Station. The construction unit will actively encourage and absorb local residents to participate in engineering construction and provide services for construction, thus increasing revenues and improving living standard. First, a number of construction personnel will be hired locally; second, a huge number of construction personnel need corresponding logistics supports, which will promote development of local planting, breeding, logistics and other industries to create more employment opportunities for local labors; moreover, the power plant will need long-term operation and maintenance after completion, so more operation and management personnel will be hired locally. Thus it can be seen that power plant construction will bring a rare opportunity to local residents for poverty alleviation.

In summary, construction of Chipwi Nge Hydropower Station will inject fresh growth momentum into local financial revenue. Investment of project development funds can bring a number of employment opportunities to help local residents for poverty alleviation, promote development of building materials, transportation, services and other industries to change the status of simple industrial structure and weak industrial foundation, provide reliable energy guarantee for economic development of Kachin State and become the driving force for comprehensive economic revitalization and development to change economic and social backwardness in Kachin State. In a word, construction of Chipwi Nge Hydropower Station will

actively promote economic and social development of the basin and even KachinState.

7.2 Religious and ethnic culture

(1) Impact on religion

Construction of Chipwi Nge Hydropower Station doesn't involve local religious facilities. The construction will promote further development of economy and society in the area, progress of educational and health services, timely dissemination of scientific and technical knowledge via film, radio, television and network and protection for people's lives, which will change ideas of local residents.

(2) Impact on ethnic structure and culture

Construction of Chipwi Nge Hydropower Station doesn't involve migration, so it will not affect geographical space composite structure of minority cultures. But external cultures may affect local minority cultures to some extent. The construction will involve the larger ethnic groups such as Kachin, Burman and Shan with a long history of culture. External culture impact on these minorities is limited.

(3) Impact on ethnic relations

Construction of Chipwi Nge Hydropower Station can positively affect local ethnic relations. Local residents mainly include Kachin and other minorities under slow economic development. The project construction will help promote local economic development and social progress, improve production and living standards of local residents and enhance further solidarity and cooperation between peoples; help solve difficulties and problems in the development of local ethnic relations.

7.3 Indigenous people

World Bank's Indigenous People (OP / BP 4.10) is designed to achieve the mission of poverty alleviation and sustainable development by ensuring project development completely complies with dignity, rights, economy and culture of minorities.

Features and culture of indigenous people have been closely related to their lands and natural resources on which they depend for survival. Construction of Chipwi Nge Hydropower Station may bring different risks and influences to the minorities, including loss of national identity, culture and traditional livelihoods as well as disease intrusion. As a social group significantly different from social mainstream groups, the indigenous people (minorities) are generally the most marginalized and vulnerable group. Their economic, social and legal status usually limit the ability to protect interests and rights of their own lands, territories and other productive resources or participate in development projects to obtain benefits.

The indigenous people (minorities) play a vital role in the sustainable development. The international community has increased attention to protect their rights and interests. Therefore, construction of Chipwi Nge Hydropower Station shall pay widespread concern and attention to adverse impact on indigenous people, fully respect dignity, rights, economy and culture of local minorities and take feasible measures to protect interests of the indigenous people to achieve poverty alleviation and sustainable development.

7.4 Women and other vulnerable groups

Due to civil war in the construction area, economic situation is more severe. To increase family incomes, women have to bear more economic pressure and go out to work. But women have a lower employment rate than men. It is very difficult to go out looking for work.

Construction of Chipwi Nge Hydropower Station can provide more employment opportunities for local residents, especially women, poor people and other vulnerable groups. Demand of

construction personnel and technical personnel for food and living goods will promote development of local tertiary industry to provide employment opportunities for women and other vulnerable groups under life stress, thus improving employment; in addition, it will increase financial revenues of government so that more funds will be invested into construction of health and education to positively improve culture level and health of women and other vulnerable groups.

7.5 Land use

The reservoir will have a water area of 9.7hm^2 and submerged land area of 8.1hm^2, including 0.1hm^2 of orchard, 2.5hm^2 of economic forest, 0.6hm^2 of timber forest, 1.6hm^2 of grass land, 0.1hm^2 of shrub forest and 3.2hm^2 of other lands. Dam site construction will permanently occupy a land area of 4.8hm^2, including 0.6hm^2 of paddy field, 0.4hm^2 of orchard, 1.9hm^2 of economic forest, 0.1hm^2 of timber forest, 0.4hm^2 of grass land, 1.1hm^2 of shrub forest and 0.3hm^2 of other lands.

With a small scale, Chipwi Nge Hydropower Station will have a small area for reservoir inundation and permanent land occupancy. Therefore, the impact on land use and agriculture production is very small.

7.6 Water resources utilization

7.6.1 Impact on use of water resources

Water resources are rich in Myanmar. Ayeyawady, Chindwin River and Salween River run through Myanmar from south to north. Total theoretical potential hydropower resources are about 70000MW and technical available hydroenergy resources are about 60000MW. Due to lack of funds, electricity market restriction and other reasons, utilization rate is only about 2%. Development of rich water resources in the upstream of Ayeyawady River can change resource advantage into economic advantage to promote social and economic development.

The upper reaches of Ayeyawady River are located in the northernmost of Kachin State in the north of Myanmar, where there is no national gird of Myanmar to cause serious lack of power supply so that government departments and some of the residents under the better economic conditions (mainly including self-employed persons of shops and hotels) install small diesel generators for power generation. Chipwi Nge Hydropower Station is designed to provide installed capacity of 99MW and annual average power generation of 609 million kW • h. The power plant can improve utilization of water resources in Ayeyawady River, supply sufficient power to Chipwi Town and Myitkyina City and promote development of water resources in Ayeyawady River.

7.6.2 Impact on downstream water use

After Chipwi Nge Hydropower Station is completed, a water reduction reach of 15.7km long will occur between the dam site and estuary.

As shown from the investigation, the nearest two branch gullies are about 1.6km in the downstream of the dam, respectively with a catchment area of 10.0km^2 and 5.45km^2. According to estimates, their annual average flows are respectively 0.73m^3 / s and 0.4m^3 / s. Plus discharged flow of 0.53m^3/s, average flow 1.6km in the downstream can reach 1.66m^3/s.

In accordance with site survey, scattered settlements are distributed on both sides of the reach from the dam to estuary. The settlements have a large height difference and distance from Chipwi River. Local residents take living water mainly from nearby streams or springs rather than Chipwi River. The water reduction reach has no requirements for irrigation and water supply.

In summary, Chipwi Nge Hydropower Station will not cause cutoff between the dam site and

estuary or largely affect production and living water in the downstream after completion.

7.7 Infrastructure

(1) Transportation

The Myitsone reservoir area is connected with the external via waterways and highways. Due to large channel slope in the waterways, streams are fast-flowing so as to cause navigational hazards. Capsizing accidents often occur. There are two highways to connect the project area with the external, namely Myitkyina – Chipwi highway on the left bank of Nmaihka River and Injangyang-Chipwi highway on the right bank of Nmaihka River. Their roadbeds can reach the maximum width of 5 to 6m and minimum width of 3 to 4m. Both highways are extended along the mountain form and they are poorly linear. They have an uneven clay bound macadam pavement which becomes muddy in summer and often suffers slough to beak the traffic.

In the project area, villagers generally live near riverside highways or rivers and mostly are concentrated in natural villages subject to different sizes. Some villages are located along the above highways, some are connected with the above highways via branches to realize external transport and some have no highway.

Due to demand for materials transportation, the investor will upgrade roads in northern Myanmar and significantly improve transport facilities in the construction area to facilitate travel of local people and provide convenience to local investment and economic development.

There was no cement pavement in ChipwiCity and PangwaCity before construction of Chipwi Nge Hydropower Station. From 2009 to 2011, the project owner invested to build cement roads in ChipwiCity and PangwaCity, reconstruct bridges and road facilities to upgrade Myitsone - Myitkyina Highway and conduct repair or upgrade for multiple highways such as Myitsone - Laza, Myitkyina – Kambaiti and Panwa – Chipwi with a mileage of about 390km.

Therefore, construction of Chipwi Nge Hydropower Station and hydroelectric projects in the upper reaches of Ayeyawady will significantly improve traffic conditions for communication between the residents in the upper reaches and the external to promote economic exchanges and cultural exchanges between the reservoir residents and the external.

Upstream highways Upstream waterways

Before upgrading of roads in Chipwi City **After upgrading of roads in ChipwiCity**

Before upgrading of roads in Panwa City **After upgrading of roads in Panwa City**

(2) Medical treatment and education

Some villages provide primary schools where kindergarten and grades of 1 to 4 are set up. Students need to learn in Myitkyina after graduation. A few villages are equipped with small hospitals. Many villages have no schools, hospitals and other medical, cultural and educational institutions. Medical and cultural education level is relatively low. Construction of Chipwi Nge Hydropower Station will promote economic and social development in Chipwi. Medical treatment, culture and education infrastructure in the project area also will be improved. Therefore, construction of Chipwi Nge Hydropower Station will be favorable to construction of infrastructures for medical treatment and cultural education.

7.8 Population health

In accordance with epidemic situation of infectious diseases in the construction area, main infectious diseases are classified into insect-borne, food-borne and water-borne diseases, generally including malaria, cholera, dysentery, bfasciolopsis buski, fluke colon, hepatitis, typhoid and so on.

During the construction, construction personnel are dense. The construction area is sparsely populated with poor health conditions and humid subtropical environment, which provide conditions for breeding of mosquitoes and flies. If no attention is paid to food hygiene and sanitation for living areas, the possibility of infecting malaria, dengue fever, cholera and other diseases will be improved. Preventive quarantine shall be strengthened during the construction to prevent disease outbreaks.

7.9 Personnel training

International mature hydropower development and operational management experience will be

introduced for construction of Chipwi Nge Hydropower Station, which will lay talent foundation for development of power industry development in Myanmar and improve the ability for independent construction, operation and management of power plant and grid. First, cooperation with local enterprises will train hydropower construction and management personnel for Myanmar. Second, local talents will be introduced for management and technical work during the operation of power plant after completion.

Relying on hydroelectric development in the upper reaches of Ayeyawady River, electric power talents will be trained for Myanmar in batches and stages. It is planned to train 60 personnel in the first stage and 20 hydropower operation and management personnel in the first batch have completed trainings. From September to December in 2011, three-month theoretical and practical trainings were conducted for 20 Myanmar personnel in China's universities with rich teacher resources and large hydro basin development companies with mature experience. In March 2013, 14 Myanmar employees sent by Myanmar Ministry of Electric Power completed theoretical and practical training for operation and maintenance before working for operation and maintenance of Chipwi Nge Hydropower Station. They have begun to work for operation and maintenance for the power plant.

The first batch of 20 Myanmar students receiving theoretical trainings in China

Myanmar staff training for operation and maintenance of Chipwi Nge Hydropower Station

Myanmar staff of Chipwi Nge Hydropower Station working after passing the trainings

On-site practical training

Additional Socio-economic data of Chipwi Nge town, Social Impact Assessmnet and Public Participation and Public Consultation activities are presented in Appendix-III Social Impact Assessment Report.

8 Environmental risk assessment

8.1 Environmental risk identification

Environmental risks refer to hazards caused by emergent accidents to the environment (or health). Chipwi Nge Hydropower Station belongs to a medium Grade III hydropower project offering electric power to power stations of Myitsone and Chipwi. In project construction and operation, various development activities such as project construction and reservoir operation may directly or indirectly create new environmental risks or increase the existing environmental risks in the area and the surrounding areas. Engineering environmental risks are identified as Table 8.1-1. Identification results show: in the process of project construction, explosive magazine and oil depot may encounter explosion accidents due to emergent accidents, thus polluting the air and water environments, generating environmental risks, and possibly leading to water supply risks at the downstream construction area, belonging to new risks; in addition, reservoir filling may cause geological disaster risks; emergent pollution accidents of oil depot may generate the risk of water pollution, thus changing the habitats of aquatic animals. These risks are highly possible due to reservoir filling.

Table 8.1-1 Identification of Risk Factors Affecting the Environment of Chipwi Nge Hydropower Station

Engineering role	Risk source or direct factor	Risk type					
		Environmental geology	Water environment	Ecology	Air	Water supply	Pubic health
Engineering construction	Explosive magazine				√		√
	Oil depot		√	√	√	√	√
Reservoir filling	Water pressure	√					
	Pollution discharge		√	√		√	
	Habitat change			√			

8.2 Environmental risk analysis

Risk analysis of project construction is to probe into significant environmental accidents due to natural or artificial reasons in project construction or operation, thus leading to the maximum hazards to the environment, and also the corresponding measures adopted to tackle such risks.

8.2.1 Accident risk analysis of oil depot and explosive magazine

According to the construction organization design of Chipwi Nge Hydropower Station, two oil depots and one explosive magazine shall be provided during the period of hub project construction.

(1) Oil depot accident risk analysis

Reasons for accidents of oil depots and filling stations are: ① Storage tank, pipe valve and pump break down due to poor maintenance, thus leading to oil/gas leakage and further fire and even explosion; ② fire and inflammation caused by static electricity and thunder; ③ operators of oil depots and filling stations make mistakes in work, thus leading to overflowing of crude oil, and further giving rise to fire and inflammation accidents when in contact with source of ignition.

According to the overall layout of project construction, the dam area and the plant area are provided with an oil depot separately, located at the edge of the construction site.

Although oil depots and filling stations are far away from nearby residents and office camp, the explosion of oil depots could still have unfavorable impact on life and property safeties of the owner's personnel in the camp; the fire and inflammation of oil tanks may affect the

environment at the downwind direction; crude oil leakage caused by oil tank explosion can have serious impact on the water quality at the downstream of Nmaihka River and underground water.

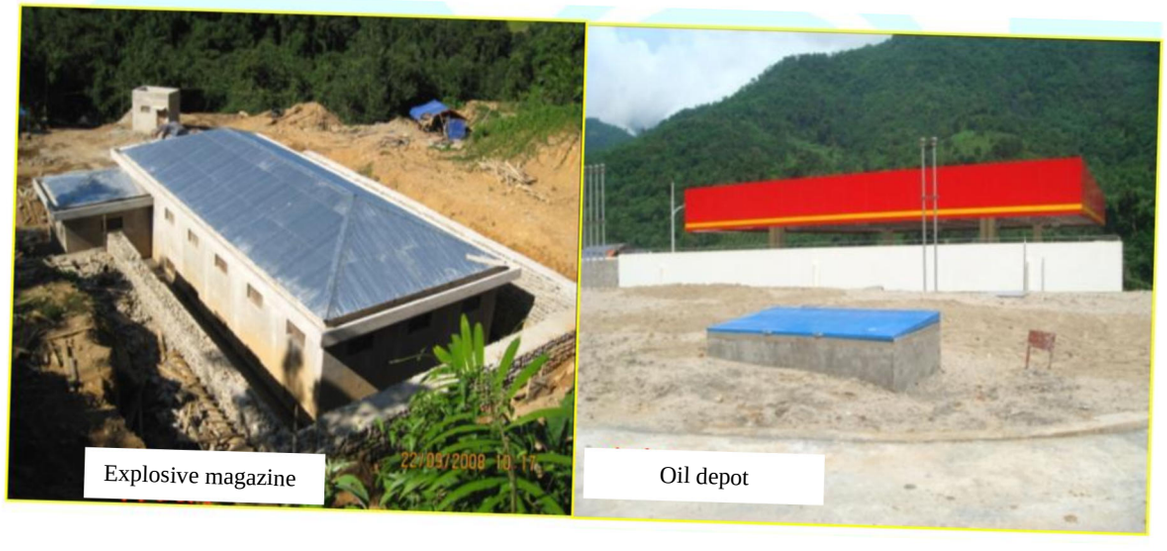
In terms of the construction of the existing hydropower projects, oil tanks and filling stations rarely encounter any accidents, and hydropower construction management is strict. Therefore, oil tanks and filling stations of the project stand the little possibility of explosion and leakage during the construction period, but it is still required to reinforce management and formulate the corresponding emergency measures and plans.

(2) Explosion magazine accident risk analysis

Reasons for explosion magazine accidents are: ① management personnel violate stipulations, smoking or creating the source of ignition, thus igniting explosive or triggering detonator; ② explosive explosion caused by electric spark due to static effect or thunder.

According to the construction organization design, the plant area is provided with an explosive magazine, which covers an area of 1,000m^2. The explosive magazine is far away from other construction sites, so its construction has little threat to construction personnel.

In explosive magazine design, safety measures include: various firefighting facilities; lightning-protection facilities and various static-proof facilities in the magazine; setting the safety protection distance of various structures in the magazine according to related design criteria; setting accident alarm system; formulating rigorous operating regulations. The explosive magazine is the key of safety and firefighting management in the whole project construction, and should be managed strictly and designed with precise measures against accidents. According to past hydropower project construction, the possibility of explosion is small. The explosive magazine is fenced with walls, and the vegetation in the scope is cleaned off, so fires caused by accidents may have little impact.


Explosive magazine

Oil depot

8.2.2 Reservoir-induced earthquake risk analysis

Chipwi Nge Hydropower Station is located at the Qinghai-Tibet reactive orogenic belt, and close to it include Chipwi fault extending along Nmaihka River and Chipwi-Tengchong east-west fault. Chipwi fault has been inactive for 1.18 million years, and there is no active fault within 5km around the site. The construction site is located in the area with stable structure. Ground motion peak acceleration exceeding 10% probability in 50 years is 0.20g, and the corresponding seismic basic intensity is VIII.

The reservoir area is of simple geological conditions and undeveloped fault structure. Reservoir

basins are located in granitic gneiss with weak water permeability, so the closure is excellent, and there is no leakage; the two banks of the reservoir are mainly rock slopes. Before water filling, there is no super-large, huge sliding mass, collapse aggregate and dangerous rock with poor stability in the dry reservoir. There are sparsely-distributed dangerous rocks at the head and some sections of the reservoir, which do not cause reservoir immersion.

To sum up, the reservoir area of Chipwi NgeHydropower Station are of good geological conditions, and the risk of reservoir-induced geological disaster is low.

8.3 Environmental risk prevention measures

8.3.1 Measures against environmental risk of oil depots

(1) Formulate the rigorous oil depot safety management system, and standardize oil transportation, storage and use.

(2) Oil depots are provided with telephones connected with local firefighting department for immediate contact. There are special firefighting lines in oil depots, and the duty room of fire pump is equipped with a number of special answering telephones (at least one for oil depot and station separately). Divisions of oil depots are equipped with primary alarms, which can give an alarm in time in the case of fires. Oil depots are also provided with several explosion-proof wireless walkie-talkies for production and firefighting instruction. Oil tanks are surrounded by fire banks, and reinforced with waterproof material to control the vegetation on fire banks. Accident oil sumps are offered to collect leaking oil, and deliver it to special department for disposal. If penetrating through fire banks and fencing walls, pipes should be protected with sleeves and filled with inflammable material.

(3) Operators in oil depots should wear anti-static working clothes and conductive working shoes. Oil tanks are equipped with lightning-protection grounding measures; oil pipeline on the ground or in trenches should be equipped with lightning-protection and anti-static measures; oil delivery station, pump shed or house and other structures in distributed in oil depots should be designed with lightning-protection measures. Source of ignition in oil depots should be controlled strictly. Smoke and fire are forbidden in oil depots, and source of ignition likely to lead to fire should be checked periodically, such as wire; in oil loading and unloading and vehicle refueling, related personnel should make patrol inspection so as to eliminate smoking.

(4) Fire pump house is provided with fire pump and fixed low-expansion foam fire extinguishing system, a sub-grounded fire pool that can provide enough water for extinguishing one fire, and also a fire water collection pool to reduce oil-containing water’s hazard to nearby water and soil. Collected fire water is transported to the outside for disposal.

(5) Oil depots should be provided with some oil spilling control emergency equipment and appliances, including explosion-proof oil pump and oil vessel, trench separator, special tools and equipment for emergent repair, and special instrument and equipment for detecting oil spilling.

8.3.2 Explosive magazine environmental risk prevention measures

This environmental assessment has the following requirements on environmental risk prevention measures:

(1) The stock of a single explosive magazine should meet requirements of criteria.

(2) Among warehouses are the corresponding earth embankment for protection so as to offer protective barrier for both two structures; explosive magazine is built with gate and fencing wall, and the distance between fencing wall and each warehouse is above 15m. Lookout posts are provided in explosive magazine; duty room is arranged at a suitable position 250m away from warehouse.

(3) Explosive magazine and detonator magazine are provided with outdoor fire hydrants, and fire pools are arranged on the slope outside the magazines. Its water pressure and quantity should meet requirements of criteria.

(4) There is no electric equipment in warehouses according to criteria; cables in warehouses are buried, and outside power lines are laid overhead.

(5) Independent lightning rod tower is adopted to protect warehouses against lightning stroke. All metal parts in warehouses should go through equipotential iterative earthing so as to prevent warehouses from generating static electricity.

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8.4 Risk accident emergency plan

On the premise of adopting risk prevention measures, directed at emergent environmental risks (mainly pollution risk in the project), the project owner should set up the risk accident emergency headquarters with local government, scientific research institute, and project undertaker to uniformly implement the risk accident emergency plan so as to minimize hazards and environmental losses caused by risk accidents. The major duties and responsibilities of the risk accident emergency headquarters are: formulating environmental risk accident emergency plan, coordinating the implementation of risk emergency plan, releasing information to the public, and starting emergency monitoring, emergency procedure, and emergency plan drill. The following is the emergency plan for environmental risks of oil depots and explosive magazines:

(1) Emergency plan areas

Emergency plan areas include: ① oil tank area; ② explosive magazine area; ③ environmental protection goal area, mainly surrounding settlements and water areas; and ④ geological disaster-stricken areas.

Emergency events include fire, explosion, oil spilling, debris flow, landslide etc.

(2) Framework and personnel of emergency organization

1) Emergency leadership

Emergency chief leadership organization is the emergency public event emergency commission of the local government. As the coordinating command institution, it is responsible for the treatment of emergent public events.

2) Site command

The emergency leadership organization designates the site director. As for fire and explosion, fire chief usually assumes the post of site director, instructing the whole process of emergency reactions; the chief of safety section is responsible for instructing actions against oil spilling.

3) Emergent rescue personnel

Emergent rescue personnel is composed of: ① dangerous source control team; ② the wounded-rescue team; ③ medical aid team; ④ firefighting team; ⑤ safety evacuation team; ⑥ safety warning team; ⑦ material supply team; ⑧environment monitoring team; ⑨ expert consultation team; ⑩ comprehensive coordinating team; and ⑪ aftermath treatment team.

4) Alarm and communication ways

① Alarm way: set the special alarm telephone in the construction close-off management area, fire alarm in the construction area, and local fire reporting telephone.

② Emergent communications: emergent leadership organization contacts site directors through walkie talkie and telephones.

5) Emergency protection measures

Dangerous source control team and firefighting team should investigate accident scene and obtain evidence, make analysis on accident type, generation time, pollution source, major pollutants, and affecting scope, form preliminary opinions, and make feedback to site directors and emergency leadership organization.

Safety warning team should set warning sign in accident area, and prohibit irrelevant personnel from entering. All teams should coordinate with each other, control dangerous sources in time, cut off spreading means, and control fireproof and explosion-proof areas, dispose of pollution sources, and avoid the dispersal of pollution. Material supply team should offer various materials and equipment needed.

6) Plans for personnel evacuation and withdrawal

Trapped personnel in areas stricken by disasters are searched and rescued by the safety evacuation team; irrelevant personnel in the warning area are evacuated by the construction unit with the assistance of the safety evacuation team.

7) Close the emergency rescue and recovery measures

After the entire emergency response and rescue work is completed, that the scene of the incident under control, event condition has been eliminated and sources of leakage or release has been reduced to less than the prescribed limits. Approved by the leading group,the on-site command can announced the lifting of the state of emergency, and release information.

8) Emergency Training Program

In order to ensure the effectiveness and operability of contingency plans, Training Program must be pre-planned for personnel involved in training and equipment, equipment maintenance, so that each individual can do to participate in contingency operations master.

Conduct a regular emergency drills to found the weak link through exercises, and modify, improve emergency plans.

9) Public education and information

Publicity and education should be devoleped for the residents of the nearby area wherethe accidents might happen.Therelevant information should bereleasedin time.

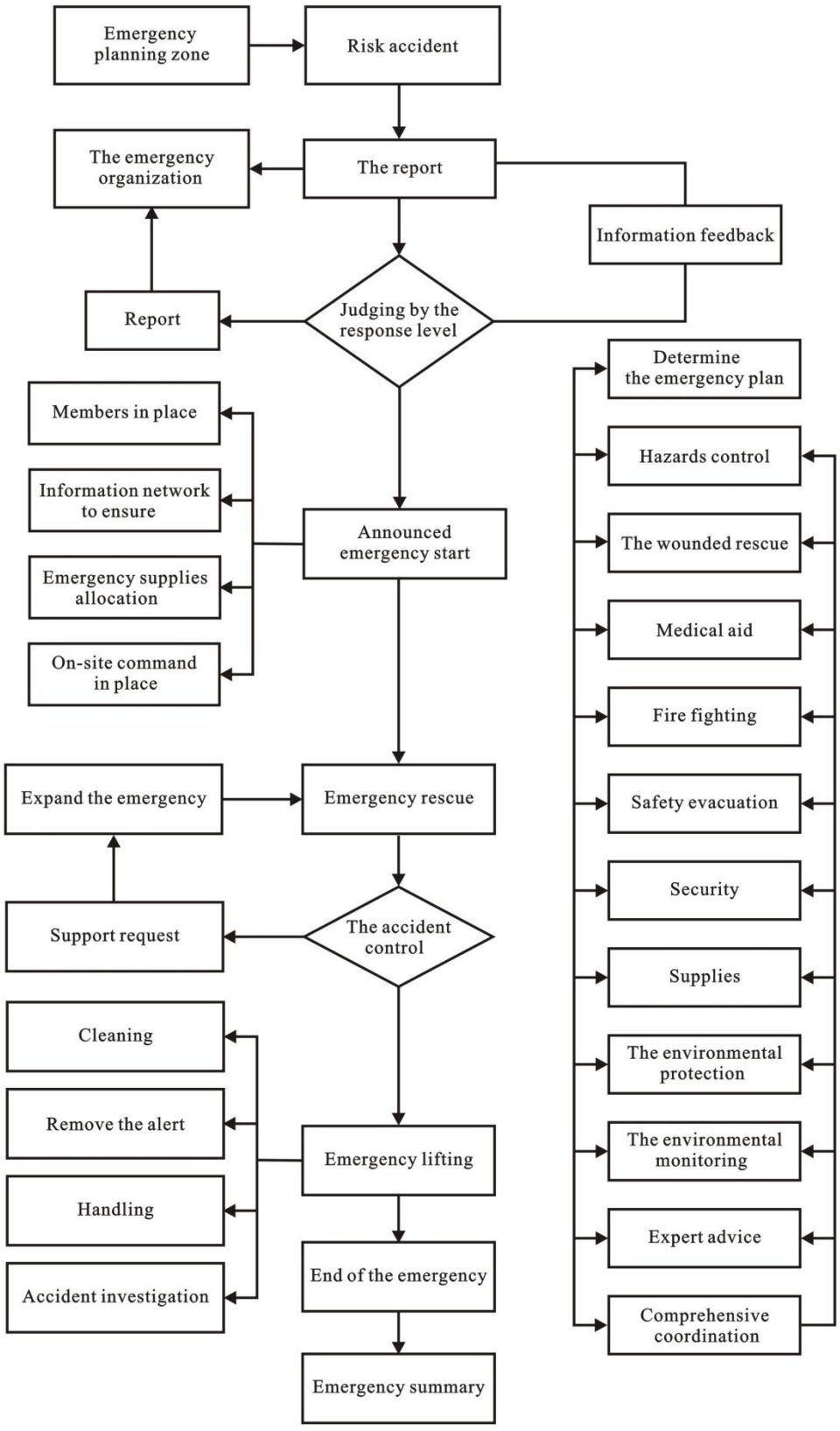


Chart 8.4-1 Emergency procedures

9 Environmental impact economic benefit and loss analysis

The purpose of environmental impact economic benefit and loss analysis of hydropower development in the upper reaches of Ayeyawady River is to, based on principles of environmental economics, analyze environmental benefit and loss of hydropower development with the expense ~ benefit analysis method on the premise of the sustainable development of hydropower development and ecological environment, social environment and economy & society.

9.1 Environmental economic benefit

9.1.1 Economic benefit

9.1.1.1 Direct economic benefit

According to the *Feasibility Study Report of Chipwi Nge Hydropower Station*, the original task of Chipwi Nge Hydropower Station is to offer power to two hydropower stations of Myitsone and Chipwi. Due to changes of external conditions, Chipwi Nge Hydropower Station is designed to offer electricity to ChipwiTown and MyitkyinaCity after the consultation between the party of Myanmar and CPIYN

Installed capacity of Chipwi Nge Hydropower Station is 99MW, and annual power output 599 million kW·h. In normal cases, Myanmar can obtain gain on foreign exchange of RMB 2.4 billion Yuan, approximately about USD 400 million dollars, within the franchised period of Chipwi Nge Hydropower Station; after the end of the franchised period, assets of over RMB 1 billion Yuan will be delivered to the government of Myanmar for continuous operation free of charge.

9.1.1.2 Driving economic growth

From the perspective of expenditure, consumption, investment and import & export are the major strengths driving the growth of national economy. Investment can boost consumption and lend an impetus to import & export trade through demand effect and supply effect. Demand effect of investment refers to the demand for production materials and labor commodities due to investment activities. For instance, the construction of hydropower station may create demands for building materials, equipment and laborers. Supply effect of investment refers to the fact that investment can inject new production factors into the social reproduction process, and further form new capital. The concrete manifestation is the increase of the supply of production materials (such as machine and plant). Therefore, investment can remarkably facilitate economic growth of a country or a region.

Our company establishes measurement model to analyze investment's facilitation to economic growth according to 152 countries/regions' (China's Hong Kong and Taiwan are listed separately) GDP and fixed asset investment data in above 10 years from 1960-2011 in Global Economic Prospects database. According to regression analysis results, the range of investment multiplier in the 152 countries/regions is [1.128， 8.959]. The value of investment multiplier is related to factors such as the country/region's consumption inclination, investment efficiency and import/export status. Investment multipliers of most of countries in the world are ranged between 3 and 6.

Total investment in Chipwi Nge Hydropower Station hits RMB 1 billion Yuan, and is able to generate GDP of RMB 1.128 billion Yuan (calculated by investment multiplier 1.128) for Kachin State, or GDP of RMB 8.959 billion Yuan (calculated by investment multiplier 8.959) at most. If estimated in the light of the status of most countries in the world, Chipwi NgeHydropower Station can generate GDP of RMB 3-6 billion for the drainage base of

KachinState.

9.1.1.3 Promoting the adjustment and optimization of industrial structure

Kachin's industry is yet to be developed. Industrial structure is dominated by farm crops processing and handicraft industry, there are currently only some rice mills, saw mills, sugar mills and cigarette factories, etc., among which the pillar industry is the sugar mill located at NanmudiTown, and handloom industry is wide spread. There are only a few small power plants in Kachin State, with a gross electric generating capacity of about 3.04 million kW•h, and 15 towns and 15 villages have already been using electricity for lighting. The commerce of cities such as Myitkyina and Bhamo began to grow in recent years.

This shows that economic development of KachinState is still in the initial stage. According to the theory of regional economic development stage, Kachin State should actively accumulate capital, energetically develop modern industries, and optimize industrial structure so as to jump to the higher economic development stage. In the economic development planning brought forth by the government of Myanmar in 2011, the economic development goal has been shifted from "be based on agriculture and comprehensively develop the economy of other factors" into "further develop agriculture, establish a modern industrial country, and comprehensively develop the economy of other sectors."The construction of Chipwi Nge Hydropower Station (construction power plant) will effectively facilitate the adjustment and optimization of industrial structure of KachinState.

9.1.1.4 Promoting the development of related industries

(1) The development of the electric power industry

Chipwi Nge Hydropower Station can guarantee power supply for the development of the heavy industry, modern industry and hi-tech industry of KachinState and Myanmar. Electric power output of Myanmar was 5.85 billion kw·h (World Date Bank： world Development Indicators &Global Development Finance Database) in 2010. According to the preliminary forecast, the maximum load of power demand will be about 3,634MW in 2020, and power demand about 17.8 billion kW·h. After put into operation, Chipwi Nge Hydropower Station can supply power of about 48 million kW·h to KachinState each year free of charge, thus greatly facilitating the industrial development of the region.

(2) Development of the building material industry

Building materials for hydropower project and supporting facilities can, in terms of source, fall into natural materials and artificial materials. Natural materials include soil, aggregate, and timber; artificial materials include limestone, cement, metal, geosynthetics, and high-molecular polymer. The construction of Chipwi Nge Hydropower Station requires supplying large quantities of building materials, and major material demands include 812,700m^3 earthwork, 178,000m^3 concrete and 42,000t reinforcement. During the construction period, it is also required to exploit natural building materials, and process artificial materials such as concrete and reinforcement. The huge demand will necessarily impel the development of the local building material industry.

(3) Development of the building industry

Since traffic conditions in the project area are poor, the construction of the hydropower station requires building or expanding special external traffic roads. For instance, Chipwi ~ Panwa road and Tengchong ~ Waxiao ~ Chipwi road, for the poor condition, have to be expanded according to the need of the project; meanwhile, roads in the construction area have to be built, including a river-crossing bridge and seven major construction roads. Therefore, the construction of

Chipwi Nge Hydropower Station has the large building demand, and can directly facilitate the development of the local building industry.

(4) Development of the transportation industry

The construction of Chipwi Nge Hydropower Station will call for a large amount of materials, including building material, food, and articles for daily use. Some materials can be purchased in KachinState directly and then transported to the construction site. Some materials have to be purchased from other regions of Myanmar. And some building materials such as cement and reinforcement have to be imported from South China, and transported to the construction area. Therefore, the project will have the large transportation demand.

(5) Development of the tourism industry

Three basic factors should be available for the development of the tourism industry: firstly, varied tourism resources for the attraction of tourists; secondly, convenient traffic for the travel of tourists; lastly, living service facilities for the enjoyment and rest of tourists.

The development degree in the project area is low. Natural and elegant scenery is the local treasonable landscape resource. Chipwi Nge Hydropower Station will effectively improve local waterway and road conditions, thus offering favorable conditions for the development of tourism resources in the project area. In addition, the construction of the hydropower station will greatly impel the development of the local economy, facilitate the construction of regional service infrastructures, and offer the strong support for local tourism development.

(6) Development of the life service industry

During the peak construction period, Chipwi Nge Hydropower Station will need about 830 laborers. Such a large number of laborers will have a considerable demand for clothes, food and recreation. Therefore, project construction will also promote the development of local living service industries like catering, accommodation and recreation besides tourism.

9.1.1.5 Increasing fiscal revenue

The construction and operation of Chipwi Nge Hydropower Station will bring about considerable tax revenue for local public finance of KachinState.

In terms of direct effect, taxes related to the construction and operation of hydropower projects include corporate income tax, value-added tax, and operating tax. If equipment and building materials are imported, enterprises should also pay tariffs. In addition, according to tax policies of different countries, others taxes should also be paid, such as urban construction tax, education surcharge, and resource tax. For hydropower development in Myanmar, major taxes involved are income tax, business tax and tariff. Therefore, Myanmar can obtain big economic benefits in terms of income tax, business tax and tariff from the construction and operation ofChipwi Nge Hydropower Station.

Secondly, in terms of indirect effect, we can find out through analysis in the previous two sections that Chipwi Nge Hydropower Station will facilitate economic growth of the region, and also the development of related industries such as building material, tourism, service, and transportation. Furthermore, regional economic growth and the development of related industries can increase local and national fiscal revenues. Therefore, the project may have the remarkable indirect effect on the increase of fiscal revenues.

Meanwhile, the increase of Myanmar central fiscal revenue and Kachin local fiscal revenue can correspondingly lift expenditures in economic construction, which specifically covers agriculture& farming, fuel & energy, mining, manufacturing & building, traffic & communications. From 2003 to 2005, economic construction expenditure accounted for 32.88%, 30.54% and 34.33% of the central financial expenditure of Myanmar (International Monetary

Fund *Government Finance Statistics Yearbook 2008*). This means that about 1/3 of fiscal revenue from Chipwi Nge Hydropower Station will be used for economic construction, and economic construction will further lend an impetus to local economic development, thus forming the virtuous cycle.

9.1.2 Social benefit

9.1.2.1 Employment

The hydropower project's promotion to employment falls into direct impact and indirect impact. First of all, the development and construction of the project involves a number of value chains such as design, consultation, construction, equipment production, environmental service and finance, thus creating a large number of job opportunities. Data released by National Hydropower Association reveal that the United States' hydropower installed capacity is 100,000MW (including pumped storage), which creates 300,000 jobs. Installed capacity of each MW can generate 3 jobs on average. According to research results of Denmark Navigant, a famous consultation firm in the world, the United States still has 400,000MW hydropower development potential (including inland and offshore) presently. It is estimated that the hydropower industry of the United States will create 700,000 jobs in 2025.

During the peak construction period, Chipwi Nge Hydropower Station will need 830 workers. Estimated by data of the United States, total installed capacity of Chipwi Nge Hydropower Station is 99MW. From construction to operation, the project will produce 300 job opportunities.

According to the above analysis, the construction of Chipwi Nge Hydropower Station will lend an impetus to the development of industries like building material, building, transportation, tourism, living service and agriculture. The development of the industries can also create more jobs. Therefore, the project construction can promote local employment.

9.1.2.2 Living level

(1) Resident income

In 2010, Myanmar's national income per capita was 437,000Kyats, equivalent to USD 539 dollars. According to the latest income grouping standard released by the World Bank in 2008, Myanmar belongs to a low-income country since its national income per capita is lower than USD 975 dollars. The development of Chipwi Nge Hydropower Station will directly increase resident incomes of KachinState through increasing job opportunities, facilitating the development of related industries and boosting economic growth.

(2) Infrastructure facilities

New and expanded roads will be superior to original ones in terms of grade and quality; the new river-crossing bridge can connect roads at the two banks of Chipwi River. Therefore, Chipwi Nge Hydropower Station will remarkably improve local traffic facility conditions and offer convenience for the travel of local residents.

In addition, the construction of Chipwi Nge Hydropower Station will increase fiscal revenue of Kachin government. Compared with financial expenditures of Myanmar government (Table 9.1-1), about 20% of the increased fiscal revenue will be used for infrastructures, thus further improving infrastructure conditions of KachinState.

Table 9.1-1 Proportion of expenditures for improving residents' living to central finance of Myanmar from 2003 to 2005

Year	Education	Medical treatment	Social guarantee	Housing and community facilities	Traffic	Entertainment, culture and religion
2003	12.1%	3.2%	1.3%	1.3%	20.2%	0.7%
2004	13.3%	3.5%	1.3%	1.1%	17.2%	0.8%
2005	6.8%	2.1%	0.8%	0.6%	20.0%	0.4%

Data source: IMF, Government Finance Statistics Yearbook, 2008

(3) Education and medical treatment

The construction of Chipwi Nge Hydropower Station will increase fiscal revenue of Kachin government. Compared with financial expenditures of Myanmar government (Table 5.2-1), about 10% of the increased fiscal revenue will be used for education and medical treatment, thus further improving education and medical treatment conditions of Kachin State.

(4) Living way

In 2009, per capita household electricity consumption of Myanmar is 104kWh, far lower than the world's average level of 2803 kWh; in 2009, two out of 1,000 people in Myanmar use Internet while the world's average level is 300. In normal cases, after its completion, Chipwi Nge Hydropower Station can offer 48 million kW•h to Myanmar free of charge ever year, and is able to effectively lift local residents' incomes and facilitate power consumption of Kachin residents. Meanwhile, fiscal revenue from the project can further improve local power grid and communications network, conducive to local people shifting to modern living ways.

9.1.2.3 Technology diffusion

After 100 years of development, Chinese hydropower, through absorption, conversion and independent innovation, has possessed the world's many advanced technologies, healthy management system, and scientific operating concepts.

Through Sino-Myanmar cooperation, developing Chipwi Nge Hydropower Station can form the effective technology diffusion, cultivating hydropower design, construction and management talents for Myanmar, and gradually introducing environmental impact assessment system, owner system, supervision system, and bidding system into the country. Meanwhile, Myanmar can find out and track the latest hydropower operation and dispatching concept and practical experience, and this is of referential significance for hydropower development in other drainage basins of Myanmarin the future, and will also facilitate the sustainable development of hydropower in the whole Myanmar.

9.1.3 Environmental benefit

Chipwi Nge Hydropower Station is a clean, renewable energy project. Compared with coal-fired plants, its environmental benefit during the operating period is mainly manifested in:

(1) Reducing the consumption of coal resources

Coal is the mixture formed mainly with various complicated macromolecule organic compounds and also inorganic mineral substances. Presently, modern chemical technologies are employed to extract 130 kinds of by-products and a variety of rare valuable elements, which are indispensable substances for people's life and economic construction. At present, coal resources are poorly utilized, and most of coal is burned off simply.

Due to the backward exploitation technology, ecological damage caused by the exploitation of coal resource is also a serious problem. Saving coal resource and slowing down the exploitation of coal resource is of great significance for the sustainable utilization of coal resource and the protection of ecological environment in the coal mine area.

Annual average power output of Chipwi Nge Hydropower Station is 599 million kW•h, so it is estimated that economic value of reduced coal resource consumption each year can reach RMB 268 million Yuan.

(2) Reducing the emission of greenhouse gases such as CO_2

Taking thermal power as the alternative scheme will generate a great amount of greenhouse gases such as CO_2, thus leading to greenhouse effect. Serious greenhouse will give rise to grave results such as sea level rise, climate disaster, land drought, desertization area increase, pest and disease damage increase, and change of ecological system.

If thermal power combustion coal for the production of 1KWH generates 0.997kgCO_2, the implementation of Chipwi Nge Hydropower Station can reduce CO_2 emission by 607,200 tons each year. If the price for carbon emission per ton is RMB 100 Yuan, annual economic value of the reduced carbon emission from Chipwi Nge Hydropower Station is estimated to be RMB 60.72 million Yuan.

(3) Other benefits

SO_2 emission is one of the important reasons for the mounting acid rain harm. Acid rain pollution will lead to remarkable economic loss to ecological environment and buildings. SO_2 emitted from coal-fired power plants in the form of elevated sources is the major reason for acid rain. According to estimation, replacing thermal power with hydropower can reduce SO_2 emission by 18,400 tons and NO_2 emission by 9,000 tons. Therefore, the project can effectively slow down the increase of SO_2 and NO_2 emissions due to the increasingly higher demand for electric power, and further relieve acid rain harm caused. Due to the shortage of local energy and short supply of electric power, residents continuously chop down forests to maintain their lives. After the operation of Chipwi Nge Hydropower Station, residents can use electricity rather than woods in their daily living, thus greatly reducing the area of forest chopping and protecting forest vegetation.

According to the above analysis results, Chipwi Nge Hydropower Station's overall environmental benefit of taking thermal power as the alternative scheme is about RMB 329 million Yuan (excluding some environmental benefit that can not be monetized.)

9.2 Loss on environmental impact

Environmental protection of Chipwi Nge Hydropower Station will cost RMB 20.8445 million Yuan, covering water and soil conservation, water environment protection, terrestrial organism protection, aquatic organism protection, atmospheric environment protection, acoustic environment protection, domestic rubbish disposal, people's health protection, and environmental monitoring.

To sum up, environmental economic loss of Chipwi Nge Hydropower Station is about RMB 20.8445 million Yuan.

9.3 Cost-benefit analysis on environmental impact

Cost-benefit analysis method will be used to analyze the environmental economic cost and benefit. The economic benefit ofChipwi Nge Hydropower Station (construction power plant) is significant, with notable social benefits and environmental benefit of reducing CO2 emission. The cost for environmental impact loss and for measures to avoid potential economic loss, to recover and compensate adverse environmental impact is smaller.Chipwi Nge Hydropower Station (construction power plant) can generate significant economic benefit, and its social benefit and environmental benefit are much larger than environmental impact loss.

10 Public participation

10.1 Characteristics of Chipwi Nge Hydropower Station

Chipwi Nge Hydropower Station (construction power plant) is a diversion type hydropower station, the main hub consists of dam, diversion system, diversion buildings and powerhouse. The dam and power station intakes are located on Chipwi River, the dam is a concrete gravity dam, with dam intakes, and the diversion line is in a form of folded line. The tunnel has an internal diameter of 4.0m. The powerhouse and tailrace is located at the left bank of Nmaihka River, the powerhouse is a open plant which axis forms an angle of 30 ° with the axis of the penstock. Chipwi Nge Hydropower Station has a normal water level of 740m, the total length of backwater: 0.75km, regulating capacity is 281,000 m^3, with a daily regulation capacity. The power station has an installed capacity of 99MW, a guaranteed output of 25.9MW (P = 90%), and an annual average generating capacity of 599 million kW • h.

The project covers both permanent and temporary areas. The permanent area includes two parts, namely reservoir inundation and construction occupation, covering a total area of 17.3 hm^2, of which reservoir inundation covers an area of 9.7 hm^2, and construction occupation covers an area of 7.6 hm^2 (construction occupation at dam site covers an area of 4.8 hm^2; and construction occupation at powerhouse covers an area of 2.8 hm^2). The temporary areas are covered by construction accesses, production and living, excavation site, spoil yard and other associated facilities, covering a total area of 56.39 hm^2.

As it involves only a small amount of garden plot and woodland within the scope, and no any residences are involved, resettlement will not be necessary.

10.2 Public participation

Various forms of public participation are involved in planning, design, engineering and construction of Chipwi Nge Hydropower Station, mainly including four forms as following:

(1) Forum

In order to make the local governments of Myanmar and local people fully understand the planning, design, engineering and construction of Chipwi Nge Hydropower Station, the assessors and other relevant parties have organized forums to the public for many times, introducing the situations of the project, including the basic characteristics of the project, the potential adverse effects and the favorable effects of the construction, as well as strategies and measures to be taken.

(2) Technical seminar

CPIYN and CDC have held meetings and seminars for many times during the planning, design, engineering and construction of Chipwi Nge Hydropower Station, organizing relevant experts, environmental assessors and social assessors to discuss the environmental and social issues related to the construction of Chipwi Nge Hydropower Station.

(3) Communication and exchange during compensations for land coverings

The scope of Chipwi Nge Hydropower Station only involves a small amount of garden plots and woodlands, and no any residences are involved, so resettlement will not be necessary. In the process of physical compensations, the designers and assessors fully respect the opinions of local people and actively satisfy their needs to avoid damages to their interests.

征地赔偿协议

赔偿事由：

现电源电站业主管地区域（包括通往 4# 、5#洞公路所占用土地）、原地表附着物 CPI 为橘树 60 株，茅屋一间，2008 年征用时未对农户作最终赔偿，随着时间的推移此事已成遗留问题，2011 年 7 月 3 日 DHPI 驻其培代表觉信奉（音译）发出信函要求赔偿 。

经多次与农户及 DHPI 相关人员进行协商，农户以及 DHPI、其培市政府都要求按现在的赔偿标准进行赔偿 。因此现将赔偿事项列出如下：

1、橘树 60 株，每株 MB35000 元，计 MB2100000 元；

2、茅屋一间赔偿 MB500000 元；

3、总计赔偿缅币 2600000 元，按现行缅币与人民币的兑换率折合人民币为 23636 元 。

以上赔偿，经双方协商达成一致意见，此协议双方签字生效，一次性结清，农户接受赔偿后不得再以任何理由要求其他赔偿 。

协议双方签字

项目部代表：
年 月 日

DHPI 代表：
年 月 日

农户：
年 月 日

Mung Zin Do
Township Offices
General Administration Department

(4) Others

We actively participate in all activities organized by local governments and public organizations during the planning, design, engineering and construction of Chipwi Nge Hydropower Station, and take effective measures to award the local communities, so that positive results are obtained.

10.3 Conclusion

The designers, assessors and contractors have adopted a variety of public participation approaches during the planning, design, engineering and construction of Chipwi Nge Hydropower Station, to fully respect the interests and needs of local people and fully listen, feedback, solve and implement the aspirations of local people. In addition, through extensive publicity and communication, we get more understanding and supports for development and construction of Chipwi Nge Hydropower Station.

11 Environmental management plan (EMP)

11.1 Mitigation measures and implementation for environmental impacts

11.1.1 Mitigation measures for environmental impacts

11.1.1.1 Water environment protection measures

(1) Alkaline wastewater

According to construction management plan, two concrete mixing plants, of which each is built up respectively in the dam site and the plant construction site. Concrete mixing system wastewater comes from flushing operations of concrete mixing drums and material bins, featured as high content of suspended solids up to 5000 mg/L, the pH value is around 11, and the flushing wastewater is about 6m^3 from each shift.

Alkaline wastewater treatment processes: two alkaline wastewater treatment ponds, operating interchangeably, will be located respectively at two concrete mixing systems, and the flushing wastewater will be drained to the ponds after the works of one shift for settlement till the closing of the next shift, and the settlement time shall not be less than 6 hours, and sulfuric acid will be dosed to neutralize, then discharge or reuse after found qualified. The process is as shown in Figure 11.1-1.

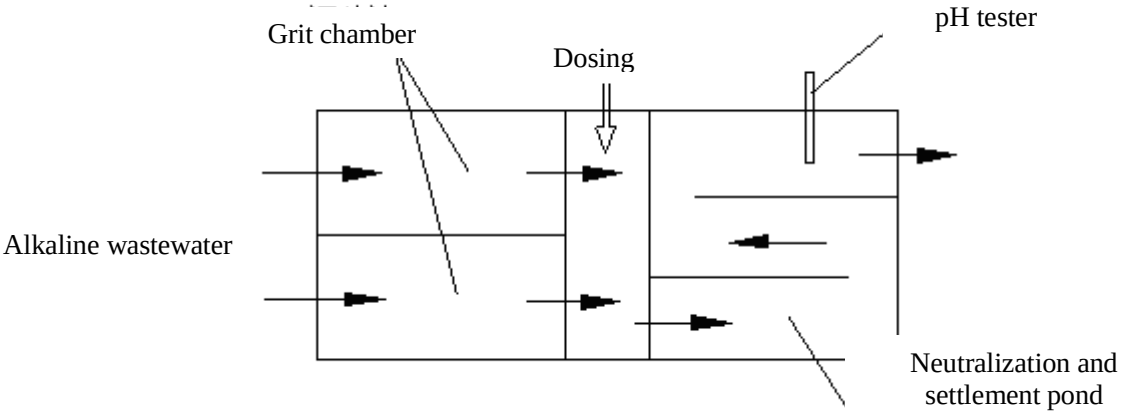


Figure 11.1-1 Flow diagram of alkaline wastewater treatment processes

Design parameters: design wastewater treatment flow 6 m^3/time

The main structural size: the ditch has a rectangular cross-section, with a size of 0.2m × 0.2m (width × height); and the size of grease trap is 4.0m × 1.8m × 1.2m (length × width × height).

Workload estimates: the major workloads of alkaline wastewater treatment ponds are estimated as Table 11.1-1.

Table 11.1-1 Estimates of major workloads of alkaline wastewater treatment ponds Unit: m^3

Item	Excavation	Filling	Concrete
Single grit chamber	21.1	9.5	4.4
Total of four grit chambers	84.4	38.0	17.6

2) Oily wastewater

There are two machine parking lots in this project, one is located at the right bank, upstream of the dam site where is about 150m away from the dam site, and another one is located at the flat area of left bank, upstream of the powerhouse, and each of the parking lot can generate oily wastewater from flushing operations up to 42.0m^3/d.

Oily wastewater treatment processes: a simple wastewater collection system will be installed at the machine parking lot, and the oily wastewater will be collected through the ditch and treated with the grease trap prior to discharging or reusing after found qualified. The process in the grit grease trap is as shown in Figure 11.1-2.

Design parameters: the total flushing duration is assumed as 3 hours, then the design wastewater treatment flow is 14.0m^3/h, wastewater residence time is 10min, flow rate ≤ 6mm/s and sludge discharge cycle is 7 days.

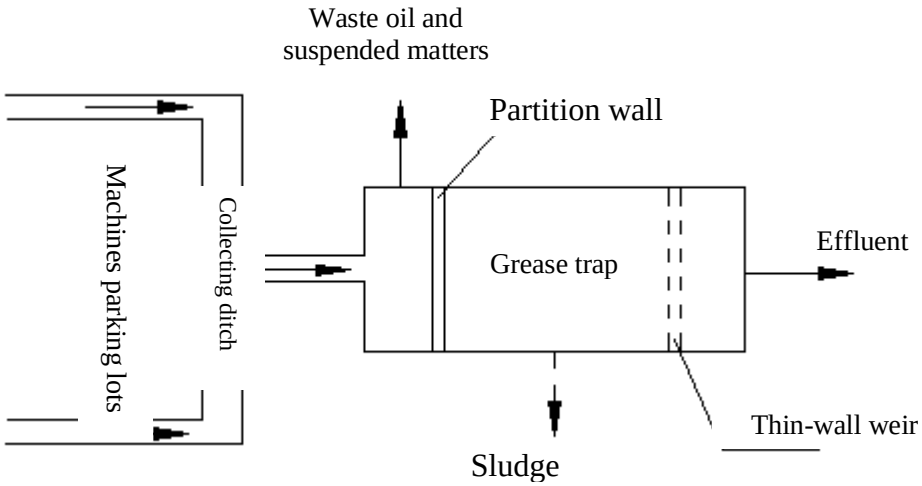


Figure 11.1-2 Diagram of process of oily wastewater treatment

The main structural size: the ditch has a rectangular cross-section, with a size of 0.2m × 0.2m (width × height); and the size of grease trap is 3.3m×0.7m×1.2m (length × width × height).

Workload estimates: the major workloads of alkaline wastewater treatment ponds are estimated as Table 11.1-1.

Table 11.1-2 Estimates of major workloads of oily wastewater treatment ponds Unit: m^3

Item	Excavation	Filling	Concrete
Single grease trap	11.5	6.8	2.5
Total of two grease traps	23.6	13.8	5.2

3) Domestic sewage

There are two construction camps at the project, one is located at the right bank, downstream of the dam site where is about 300m away from the dam site, and another one is located at the flat area of left bank, upstream of the powerhouse, with 480 and 350 construction workers respectively.

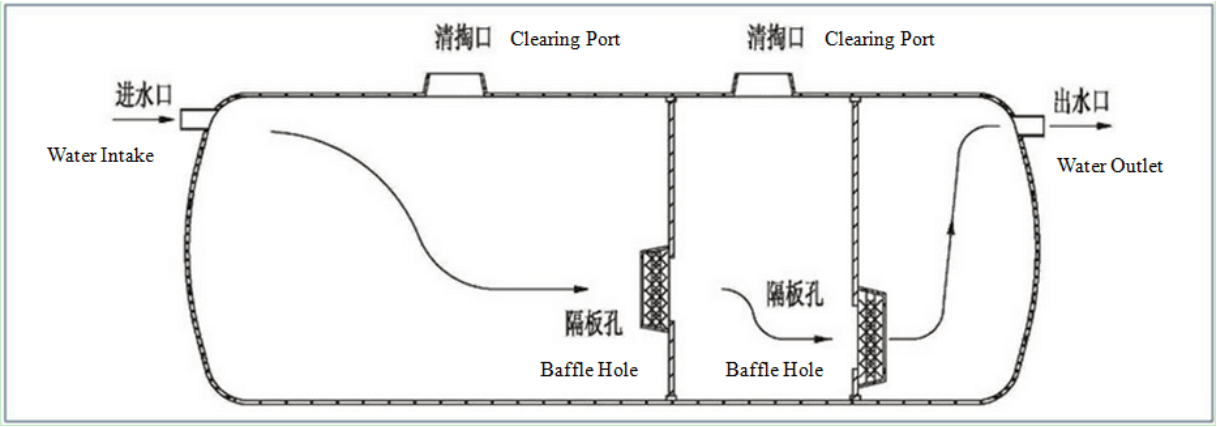
Septic tanks will be used as the planning, and the design sewage quantity is 150 L/person • day, with a cleaning cycle of 90 days. The design excludes the considerations of traffic or ground water, the tank cover overburden depth is 0.7m, and if the overburden depth is greater than 0.7m, then the tank body will be reinforced. One septic tank consists of three divisions, and the wall is made of cement, mortar and bricks, the bottom is made of 15mm thick C25 concrete on 10cm thick gravel bedding course. The precast concrete structures are made of C25 reinforced concrete, and the protective cover is 10mm thick for reinforcement. The precast concrete components shall be made of C25 reinforced concrete, and the protective cover is 10mm thick for reinforcement. The backfilling shall not be carried out until the tank cover is in place.

The plant construction camp can be used as owner's camp in closing stages. The domestic sewage treatment facilities initially used for construction periods can be used to treat the

domestic sewage generated by the workers of the power plant. The treated sewage can be reused, such as used for greening purposes in the plant or living areas.

Table 11.1-3 Parameters of septic tank at the construction site

NO. of construction camp	Design headcount	Actual headcount	Effective volume m^3
Dam site	480	196	6
Plant	350	140	4



11.1.1.2 Ecological and environmental protection measures

(1) Protection objectives

Protect the integrity of regional ecosystems; protect the vegetation at the construction area; restore the vegetation due to damages caused by reservoir inundation and construction activities as much as possible, so that the vegetation coverage area can be maintained or better; protect the wildlife habitats and avoid interferences caused by construction activities; maintain the aquatic biodiversity in the reservoir and downstream river sections, and protect the fish resources from being damaged due to construction activities; prevent and control the additional soil erosion due to construction activities; make a rational use of water and land resources; improve the land productivity; and protect the ecological environment.

(2) Ecological environment protection measures

1) Ecological protection and prevention measures

Focus on advocacy, education and personnel training works. By taking a series of measures to promote education and training, to raise the public awareness to terrestrial organisms, especially to the various functions and benefits of terrestrial organisms, so that strengthen the public awareness of the significance of protection of the terrestrial organisms and transitions of concepts to establish a good atmosphere conducive to the protection.

Raise awareness of construction workers to protection, and it is prohibited to hunt wild animals. Education and training will be carried out for the workers prior to construction activities, to inform them that it is prohibited to hunt wild animals and it is necessary to protect them as far as possible if we encounter them during construction activities; the construction workers are prohibited to buy wild animals from local hunters; eliminate consumptions of wild animals and their products or other activities impacting on local wild animals.

Try to work beyond the margins of secondary ecosystems or habitats, and minimize the

disturbances and destructions to the ground surfaces and vegetation in order to maintain the integrity of the natural ecosystems at the construction area. The hub construction, especially the road construction shall be carried out with deep excavation or high filling avoided, so as to minimize the construction disturbances and mitigate damages to natural ecosystems and vegetation.

Install animal protection warning signs in the construction area, and there are 10 signs will be installed, including two signs respectively at the dam site and the plant, one sign respectively at six adits. The construction workers are prohibited to hunt in the mountains or forests, and they are also prohibited to hunt frogs, snakes, birds or other wild animals; if wild animals and their habitats are discovered during construction activities, then evasive actions shall be taken.

Make a reasonable arrangement for the operation time of construction machines to try to avoid disturbances to the animals; and the highly noisy construction activities, such as blasting, shall be avoided in the breeding seasons of animals.

Reduce the impacts caused by construction on local vegetation to a minimum degree, while strengthen public education and fire prevention measures and establish construction area fire prevention and fire alarm systems to prevent and avoid the damages caused by fire to the vegetation.

2) Restoration and compensation measures for ecological impacts

In addition to land and water conservation measures, the on-site restoration, greening and landscaping will be carried out as ecological environment construction. The vegetation surrounding the main structures, construction camps, spoil yards, excavation sites and two sides of the roads shall be restored, to maintain the vegetation coverage against construction activities and ensure the original ecological functions of the area.

Specific to the impacts on the ecological environment caused by the water reduction river section as long as 15.7km from the dam to the river mouth, a discharging ecological flow of 0.53m^3/s has been taken into account in the design. The discharging opening of the ecological flow is located at the #5 dam section where is close to the right side of the sluicing and sand discharging opening, it is in a horizontal arrangement, with an internal diameter D = 20cm and a center elevation= 720.0m, the centerline is 1.5m away from the right side wall of the sluicing and sand discharging opening. The outlet is located at the downstream opening of the right side wall of the sluicing and sand discharging opening, maintenance butterfly valves and working butterfly valves are located near the outlets, the discharging flow can be adjusted according to the changes in the upstream heads, and the discharged water flows directly into the river bed through the outlets.

Specific to the flooded plants, the methods including transplanting for saplings and nursing for big trees will be adopted, to move them to the positions above the reservoir inundation line where close to their original habitats for protection .

Further investigate the terrestrial organisms on a regular and irregular basis, and pay attentions to and master the changes in populations of rare and endangered species and their adaptive behaviors after the hydropower developments. Carry out appropriate monitoring of dynamics of populations and species according to the habitat characteristics and distributions of mammals, birds, amphibians and reptiles.

11.1.1.3 Water and land conservation measures

According to the layout, functions, construction technologies and construction features of Chipwi Nge Hydropower Station, five water and land conservation zones are determined: prevention and treatment zone for main structures; prevention and treatment zone for roads; prevention and treatment zone for construction, production and living activities; prevention and

treatment zone for excavation site; and prevention and treatment zone for spoil yard.

(1) Prevention and treatment zone for main structures

The main structures include reservoir inundation area, dam, water lines and powerhouse.

The length of the reservoir inundation zone is short in this project, and the river valley is 60m ~ 90m wide. The two banks are featured as steep, with a slope ≥ 35°. No landslides are found in the surface investigation, and the mountains at two sides are basically in a steady state, showing heaps of collapsed stone. Most will be flooded after impoundment of the reservoir, and the impacts are fewer on the reservoir. After the completion of this project, no additional prevention and control measures are needed for the reservoir banks.

In the dam construction process, greatest water and soil erosion occurs at the excavation processes of earthworks and rockworks, and some serious impacts will be caused on the water and soil erosion at the project site during formation of new slopes due to excavation of dam shoulders. It is difficult to configure new slope protective measures due to limitations of dam construction site, so relevant cautions and requirements will be proposed to the excavation processes, and it is required that the workers shall strengthen construction safety and standardized operation to prevent serious water and soil erosion caused by operational factors; after completion of the project, in order to protect the safety of the project, new slope protection measures, featured as good water and soil conservation effects, will be designed for the main structures. Therefore it is not necessary to configure new water and soil conservation measures after the completion of the project.

Except for open-cut operations for the diversion tunnel faces, the remaining shall be excavated in a concealed manner. During excavation of tunnel faces and tunnel bodies, appropriate support and drainage measures are taken into account in the construction management plan, to guarantee the safety of the project while brings good water and soil conservation effects. Therefore it is not necessary to configure new water and soil conservation measures for the diversion tunnels.

Powerhouse is located at a slope in left bank of Nmaihka River where 9km away from Chipwi City, the plant drainage issues have been taken into account in the main structural design, and there are drainage ditches available around the plant; new slopes are formed due to hillside excavation behind the plant, and some measures are taken into account for the main structures to ensure the project safety, the slope cutting is carried out from top to bottom according to different slope ratio according to different rock conditions, and concrete shot protection is adopted for the slope surfaces, and a 2m wide berm is available every 15m height difference vertically to ensure the stability of the slopes formed with excavation.

On the basis of body construction design, greening will be carried out on the platforms formed after construction of dams as the soil and water conservation design, and the greening area is about 0.5 hm^2 as the preliminary estimates, with white clover planted, the sowing density is 50kg/hm^2 and the sowing amount is 25kg.

(2) Prevention and treatment zone for roads

According to the distribution of the construction roads, the construction roads include accesses to the river, dam, cofferdam, foundation pit and all adits, covering a total length of 29.1km.

Most of construction roads are built up on the slope, with 50% excavation and 50% filling. The water and soil conservation measures include: excavate to form ditches and arrange appropriate slope protection measures at the side to be excavated; protect the road slopes at the side to be filled; and build up masonry retaining wall at the toe of the filling side.

The ditches are masonry works in a rectangular cross-section, with a bottom width of 0.3m, a

depth of 0.3m and a masonry thickness of 0.3m. The ditch is 29.1km long, with a soil excavation quantity of 15714 m^3 and a masonry quantity of 13095 m^3. The filled road slopes will be protected with turfs and sowed with white clover, of which the sowing density is 50 kg/hm^2, sowing area is about 14.55 hm^2 and sowing quantity is 727.5kg. The filled slope toes are protected with masonry retaining walls in trapezoidal cross-sections, with a top width of 0.5m and an average height of 1.0m above the ground, the slope ratio is 1:0.2, depth is 0.5m, construction length is 29.1km, and the masonry quantity is 33465 m^3.

(3) Prevention and treatment zone for construction, production and living activities

The construction, production and living area contains living facilities and production facilities, covering a total area of 2.9hm^2. The living facilities include construction camp and office housing; and production facilities include concrete mixing system, a variety of materials processing facilities, material warehouses, material excavation sites and machines parking and maintenance spaces.

In the construction period, temporary drainage ditches will be formed by mean of excavation within the site, with a density of 300m/hm^2 and in a trapezoidal cross-section, the bottom width is 0.3m, depth is 0.3m and slope ratio is 1:1. The length of the drainage ditch is about 870m and excavation quantity is 156.6m^3. After the completion of the project, the construction, production and living area shall be leveled which involves a total area of 2.9hm^2. The vegetation will be recovered after site leveling, it is planned to plant 7250 camphor, with white clover sowed under the trees in a density of 50kg/hm^2, and the sowing quantity is 145kg.

(4) Prevention and treatment zone for excavation site

The excavation sites include soil excavation site, rock excavation site and gravel excavation site.

1) Soil excavation site

Soil excavation site is located at right bank of the Chipwi River and upstream of the dam site, and it consists of secondary terraces and residual slopes, covering a total area of 2.1hm^2.

Soil and water conservation measures at the soil excavation site: topsoil stripping protection, on-site drainage, and on-site restoration measures after the completion of the project.

According to the results of the geological survey, the soil excavation site is covered with 0.5m thick dark gray silty clay, consisting of a lot of plant roots and can not meet the construction needs. Therefore it is useless and shall be removed, and the topsoil clearing quantity is about 10,500 m^3. It is planned to store the topsoil at the corners of the excavation site after clearance, and then used as the backfilling soil covering for the excavation site after the completion of the project. The average stacking height is assumed as 2m, and the topsoil stockpiling area is 0.525hm^2. After the removal of the topsoil, a slope shall be formed with a ratio of 1:2 around it, and the surface and slopes shall be sowed with grass seeds for temporary protection. The grass will be white clover according to the natural conditions of the project site, with a sowing density of 50kg/hm^2 and a sowing quantity of 28kg.

During excavation of soil, temporary soil ditches will be formed around the operation position by means of excavation, and it is in a trapezoidal cross-section, with a bottom width of 0.3m, a depth of 0.3m, and a slope ratio of 1:1. The excavation length is about 365m and excavation quantity is 65.7m^3.

After the project is completed, the excavation site will be leveled and the topsoil stripped will be backfilled as the covering.

2) Rock excavation site

The rock excavation site for dam site is located at the right bank of Chipwi River, and it is a

hill body at north of the highway about 1km away from the downstream of the dam site. The terrain is steep, with a slope of about 50° ~ 70°, and vegetation is covering some surfaces. There are collapsed rocks distributed as thick as 1m to 3m along the highway. The outcropping rock shows black, grey, white and medium coarse-grained hornblende granite gneiss, featured as fresh and covering an area of 0.6 hm^2.

The rock excavation site for plant site is located at 800m away from the left bank, upstream of Nmaihka River, the south boundary is the ditch of debris flow, and a gully passes under the rock excavation site. The rock excavation site mainly consists of slope north to the debris flow, and the slope top elevation is about 500m, with the surface mainly covered by vegetation, and the mixture of clay and rock as thick as 5m can be found formed by debris flow near the bottom of the gully. The gully bottom elevation is about 245m, outcropping rock as long as 200m can be found along the gully bottom, the rock is hornblende granite gneiss featured as fresh, the mineable thickness is great and covering an area of 0.25 hm^2.

At the rock excavation site, the water and soil conservation measures include: stripping topsoil protection; drainage measures around the site; excavation platform restoration after completion; and vertical protective measures for the excavation surface.

The topsoil stripping quantity is about 4300 m^3at the rock excavation site, and the soil is temporarily stored at the spoil yard (then will be returned to the rock excavation site as the covering). The average stacking height is 2m, with a stacking area of 0.21hm^2 and sowed with white clover as the protection. A slope of 1:2 is formed around it. The sowing density is 50kg/hm^2 and sowing quantity is 10.5kg.

After the excavation of rocks, it is necessary to form intercepting ditches and drainage ditches on the top and at two sides. The ditches shall be made of masonry works, in a rectangular cross-section, 0.3m wide and 0.3m deep, and the masonry thickness is 0.3m. The total length of the ditches will be 908m, with an earthwork and rockwork excavation quantity of 490 m^3 and a masonry quantity of 409 m^3. After the excavation operations, the site will be leveled, including leveling the excavation platform and vertical protection measures for the excavation surface. The excavation platform will be re-covered by the topsoil stripped, with azaleas planted, covering an area of about 0.6hm^2, the spacing between two lines will be 2m × 2m, and 1500 seedlings will be planted. White clover will be sowed in a density of 50kg/hm^2, and the sowing quantity is 38.64kg.

During the rock excavation operations, a berm will be formed every 10m ~ 15m, and it is planned to build up vertical protective measures on the berms after the excavation operations. Precast reinforced concrete grids will be located in an interval of 3m for containing nutrient soil, in a size of 0.5m × 0.5 m × 0.6m (length × width × height), and 150 grids will be available for planting ivy, of which each grid contains three seedlings.

3) Sand and gravel excavation site

The sand and gravel excavation site is located at the junction of mouth of Chipwi River and left bank of Nmaihka River. The length of excavation site is about 250m along Chipwi River, bordering a low pebble floodplain and distributed along Nmaihka River for about 200m.

The excavation site is flat and about 10m higher than Nmaihka River, mostly containing medium-fine sand with low clay content, the mineable thickness is about 6m, and pebble as thick as 4m is under it. The sand and gravel excavation site covers an area of about 3.08hm^2.

The sand and gravel excavation site is located at the floodplain. It is necessary to remove the useless layers during the excavation operations, and the useful layers will be excavated and conveyed with excavators. The water and soil conservation measures for the sand and gravel excavation site mainly include protection of useless layers and restoration of the site after

excavation operations. The total volume of useless layers to be removed will be about 15,000 m^3, and stacked at the corners and then used as site restoration after the completion of the project. Woven bags will be used as the retaining measures for useless layers. The useless layers contain large particles which can not meet the basic needs of plant growth, so plant protection measures will not be available on them. The useless layer stacking area is about 0.75hm^2, and the retaining measures show a trapezoidal cross-section, with a top width of 0.5m, a height of 1m and a slope ratio of 1:1. The retaining length is 450m and the masonry quantity is 675m^3 needed by the retaining measures.

(5) Spoil yard

The water and soil conservation measures include retaining measures, drainage measures, and protective measures at the tops and slopes of the debris after dumping operations.

Before the beginning of the dumping operations, masonry retaining walls will be built up around the spoil yard, and masonry ditches in a rectangular cross-section will be built up beyond the retaining walls. The dumping debris contain large particles which can not meet the basic needs of plant growth, so after the dumping operations, it is only necessary to level and compact the debris, and form a slope of 1:3, without any planting measures in place.

11.1.1.4 Population health protection

(1) Protection objectives

Protect the health of construction workers; strengthen the formation of the health and epidemic prevention system in the stage of construction; prevent the breeding of vectors related to impoundment and construction activities; ensure that the incidence of infectious diseases is not higher than the current level.

(2) Protection measures

1) Environmental health management

Kill leeches, mosquitoes, rats and flies on a monthly basis in the living area in order to reduce the vectors of infectious diseases. Before the arrival of construction workers in the construction worker camps, carry out a cleaning campaign at where densely populated at the construction worker camps and construction sites while remove weeds, garbage and solid wastes. Strengthen the environmental health management at the places including drinking water sources, public catering locations, spoil yards and public toilets in the construction stage. Carry out health inspections on a regular basis. In addition to daily cleaning, overall cleaning will be carried out at least once per month, and the living garbage shall be collected with garbage bins, and then sorted for treatments.

2) Health and epidemic prevention

Construction workers must undergo quarantine prior to arrival, and the patients must be treated in isolation to cut off the transmissions upon the discovery of new infectious diseases. The malaria prevention drugs such as quinine will be distributed to the workers who are found healthy after the quarantine. According to the construction schedule arrangements, one sampling inspection will be carried out respectively prior to commencement, at peak construction periods and prior to project completion, and the headcount involved in the inspection shall account for 1/3 of total headcount of workers at the peak construction periods. The diseases involved in quarantine include dengue fever, malaria, cholera, hepatitis and other infectious diseases, and these diseases must be treated in a timely manner upon found. Provide preventive medication, vaccination and other preventive measures on a regular basis to the construction workers. Pay attentions to mosquito extermination works at the construction area to prevent the occurrence of dengue fever, and if symptoms of dengue fever are found,

treatments shall be in place as soon as possible.

Strengthen supervision and management of food hygiene; pay attentions to drinking water safety for construction workers; and disinfect the living water on a regular basis.

The persons shall be identified responsible for health and epidemic prevention, and epidemic reporting systems and emergency measures shall be established in all construction departments. Medicines and equipment shall be readily available for treatment of common infectious diseases, and if an outbreak is detected, the measures such as treatment, isolation and observation shall be taken specific to the infectious sources, and preventive and protective measures shall be adopted for the vulnerable populations.

3) Public health facilities

Full-time health personnel will be appointed to take responsibilities of the general treatments of diseases and accidents; carry out inspection of epidemic prevention on a regular basis; and publicize and introduce relevant health and epidemic prevention knowledge to the construction workers.

Strengthen supervision and management of food hygiene, and pay attentions to drinking water safety for construction workers.

Improve the hygiene conditions at the construction area; do a good job at treatment of domestic wastes and human & livestock manure at the construction area; build up toilets and place trash bins at the construction worker camp and densely populated positions.

A public toilet, with a building area of $50m^2$, will be available respectively at the dam site and the construction worker camp. There are five partitions in each toilet, of which four for men's toilet and one for women's toilet, the spacing between two partitions is 0.9m and the height of each partition is 1.0m. Appropriate tap flush system shall be available in each toilet. The roof height is 3.5m. Good ventilation and lighting will be maintained and night lighting measures shall be available. The floor shall be hardened and easy to clean. The septic tanks shall meet the standards. The temporary toilets shall be removed and disinfected after the completion of the project. The septic tanks can be used continuously to treat the domestic sewage from the power station during its operation.

Trash bins will be available in the construction and living area to collect domestic wastes. A trash bin will be corresponding to 120kg waste, so there will be a total of 9 trash bins at the dam site and construction worker camp.

4) Labor protection for construction workers

Provide dust prevention supplies, such as dust masks to the workers who work in highly dusty environment according to relevant national labor protection laws.

Clarify the labor protection provisions related to noise prevention in the bidding contract, and the contractor shall provide anti-noise earplugs, anti-noise earmuffs, anti-noise helmets and other protective equipment to the construction workers who are under great noise impacts.

The concrete mixer operators, bulldozer drivers, excavator drivers and factory workers shall work in shifts.

5) Security protection of construction workers

According to the introductions provided by local residents and on-site personnel, python, wild boar and other wild animals often appear in the shrubs and grass which may cause threats to the physical safety of the construction workers, so it is necessary to provide publicity and education related to security to the construction workers, and relevant provisions shall be available at the ecological protection warning signs to draw attentions of construction workers to their personal security.

11.1.1.5 Atmospheric environmental protection

(1) Dust reduction and control for excavation and blasting

The bidding contract shall stipulate that the contractors must use the construction machines and transport tools with good emission working conditions. Wet operations are preferred for chiseling, drilling and blasting, and the construction machines with dust collection devices shall be used to reduce the amount of dust generated by construction. During open-air blasting, straw bags shall be used to cover the blasting surface to reduce dust generated by blasting.

Provide dust prevention supplies, such as dust masks to the workers who work in highly dusty environment according to relevant national labor protection laws.

(2) Dust reduction and control for aggregate system and concrete system

Improve the performance monitoring of the dust reduction effects of the concrete mixing system, and if the effects are not satisfactory, bag filters or other high efficient filters can be used. Low dust wet breaking processes shall be used for the aggregate, moistening the surroundings to reduce dusts and minimize dust pollution.

Use construction machines and transport tools with good conditions. In the handling and transport processes, the cement and other materials shall be transported within tanks in a sealed manner to maintain good sealing conditions and avoid dust contamination during transport.

(3) Fuel gas reduction and control

Strengthen the management of large construction machines and vehicles; machines and equipment will be equipped with corresponding smoke and dust removal devices; and transport vehicles will be equipped with exhaust purifiers. Carry out inspection and maintenance in a timely manner to ensure that the emissions from construction machines and vehicles meet relevant emission requirements. High quality and low pollution fuels shall be used.

(4) Traffic dust reduction and control

Carry out maintenance and repair on a regular basis, and maintenance works shall be strengthened especially to temporary construction roads paved with soil and gravel to prevent pavement damages or dust. Moisten the roads when it doesn’t rain to reduce dust caused by vehicles.

Carry out greening and landscaping, and plant trees corresponding to soil and water conservation measures at two sides of the roads to reduce dust pollution.

To reduce the impacts of dust caused by construction and transport on local residents, it is planned to employ a sprinkler at the construction site, and it will moisten the positions including excavation sites, blasting sites and two sides of roads at non-rainy days at morning, noon and night repeatedly to reduce the durations and scopes of atmospheric environmental pollution caused by dust.

11.1.1.6 Noise control

(1) Noise source control

The bidding contract shall stipulate that the contractors must use the construction machines and tools with good working conditions and choose the low-noise equipment and processes to reduce the noise level fundamentally. At the same time, they shall strengthen the equipment maintenance and repair to maintain machine lubrication and reduce operating noise level.

Aggregate processing system shall be complete with rubber meshes, plastic plates and damping materials for screening the sand and gravel to reduce noise level.

Damping chassis can be used to reduce the noise level for greatly vibrating machines and equipment, and some flexible soft materials, such as felts and rubber sheets, can also be padded

between machine foundation and other structures to reduce the transmission of vibration and thus play a role in isolation.

Make a reasonable arrangement for the construction time, and avoid open-air blasting and comprehensive processing in factories from 22:00 to 7:00 to reduce the impacts on the surrounding construction workers.

Traffic signs or warning signs shall be installed in the sections where the vehicles pass through the neighborhoods and construction worker camps, to limit the driving speed within the construction area. In addition, the construction vehicle drivers shall be informed to minimize whistling at daytime and no whistling at nighttime to avoid impacts of vehicle noises on surrounding residents and construction workers.

(2) Noise prevention for construction workers

To reduce the impacts of noise on the office staff, the building materials of office and living area shall be featured as strong sound absorption, and noise suppression and isolation, with double-glazed windows installed. At the same time a good job shall be done to green the surroundings of office and living area, including the planting of evergreen trees and hedges; and traffic signs or warning signs shall be available in the office and living area.

For strong noise sources, such as concrete mixing, aggregate crushing and aggregate screening, try to improve the degree of automation and realize remote monitoring and operation, which doesn't only reduce the headcount of workers, but also make the operators far away from the noise sources.

In the construction processes, when construction workers arrive at strong noisy sites for operations, such as chiseling, drilling, excavation and mechanical driving, personal protective equipment shall be completely available. The bidding contract shall clarify the labor protection provisions related to noise prevention for construction workers, and the contractor shall provide anti-noise earplugs, anti-noise earmuffs, anti-noise helmets and other protective equipment to the construction workers who are under great noise impacts.

11.1.1.7 Disposal of solid wastes

(1) Disposal of domestic wastes

Trash bins in different colors will be available in the construction and living area and the owner's camp, and they are used for collecting inorganic and organic wastes. Garbage trucks and cleaners will be available to remove the daily wastes.

The inorganic wastes such as coal ashes and construction wastes shall be dumped respectively at the dam site and the spoil yard near the plant for landfill, and protection, greening and restoration will be available corresponding to soil and water conservation measures for the spoil yard. Remove the wastes from the living camp and construction site on a regular basis, and transport them to designated waste collection stations for landfill as the disposal.

(2) Disposal of construction wastes and production wastes

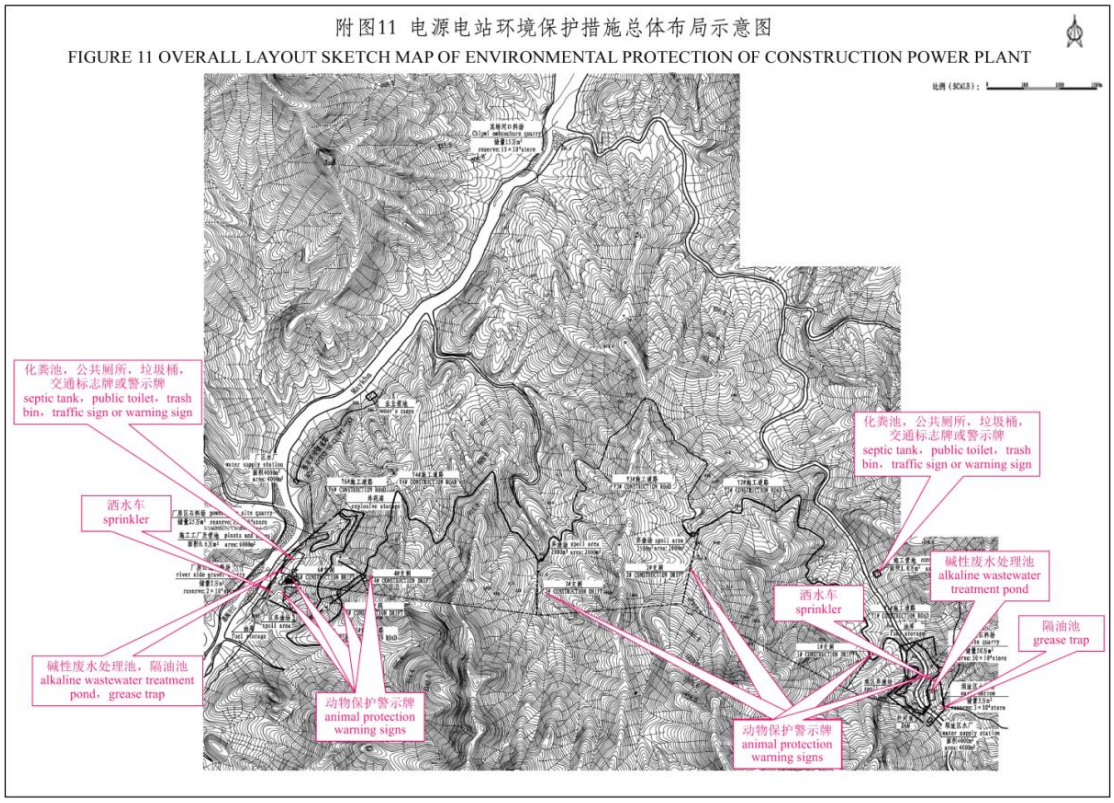
After construction activities, the temporary camps will be removed in a timely manner; and remove or fill the surrounding domestic wastes, temporary toilets and cesspools, and disinfect with carbolic acid and lime.

The contractor shall appoint full-time workers to collect the production wastes, of which the scrap iron, scrap steel, scrap wood and other debris shall be stacked in a specified location, and the stacking shall be in an orderly manner.

During the transport of building materials, the goods shall be well covered to avoid spilling of sand, gravel or soil, and the main roads shall be cleaned on a regular basis.

11.1.1.8 Geological environment protection

Specific to unstable slopes or rocks, appropriate measures have been provided in the design. The #1, #2 and #4 dangerous rocks are treated with the measures including removal, anchoring and shotcrete.



11.1.2 Implementation of environmental impact mitigation measures

11.1.2.1 Water environment

(1) Construction wastes

During construction, the waste water from the diversion tunnel (drilling, concreting and grouting, etc.), concrete mixing system, sand and gravel pond system (washing facilities, etc.) have high clay content and the pollutants are mainly suspended materials without any toxic nature, so it shall be drained after settlement. The construction waste water can reach the design standards after treatments, and the discharge will not cause water pollution.

The electrical and mechanical equipment installations at dam, electrical and mechanical equipment installations at the plant, all parking lots and all the maintenance workshops are located on hardened floors. Used oil collection pools are available to collect the used oil for recycling and reusing, so as to prevent the pollution of the surrounding environment due to emission of used oil.

(2) Domestic sewage

In the construction period, the domestic sewage from living activities, canteens, bath rooms and toilets generally do not contain toxic substances, but the level of organics and total phosphorus and total nitrogen content is high and with poor bacteriological indicators, so septic tanks are built up as the primary disposal mean. Septic tanks are available at the living camps and construction camps, and they are made of brick masonry structures and reinforced concrete covers. The domestic sewage can meet the emission standards after disposals, and the discharge will not cause water pollution.

In the operation period, the facilities including septic tanks, sewage treatment equipment and collecting wells are available in the plant to fulfill the requirements of wastewater treatment of permanent facilities. The effluent, after treatment and found qualified, will be discharged into surrounding gullies through buried pipelines, so it will not cause pollution to surrounding environment.

11.1.2.2 Terrestrial ecosystem

The power station is located in the northern region of Myanmar, where is featured as tropical rainforest climate, with dense vegetation and a large number of animals and plants widely distributed in the construction area, of which most of most of the plants and animals are rare species, so it is very important to protect the terrestrial plants and animals, the jobs done for protection are as follows:

(1) Carry out publicity, education and management for the construction workers to improve their awareness on protection of vegetation and wildlife in the construction area;

(2) The vegetation in the construction area has been trimmed prior to construction, and the flowers, grass and trees are not disturbed beyond the scope permitted;

(3) Rules and regulations are formulated, and the wastes are buried deeply in designated areas. No persons kill, shock or catch the fishes in the river without permissions based on our investigations;

(4) The sites temporarily occupied during construction have been recovered after construction activities.

During the construction of the power station, the vegetation is well protected in the construction area, and no rare animals are killed.

11.1.2.3 Water and soil conservation

(1) Main structural area

The water and soil conservation works in the main structural area include slope protection measures for #1-6 permanent openings, plant, tailrace, dam, reservoir and diversion tunnel. The design slope protection measures don't only guarantee the safety, but also brings good soil and water conservation effects.

There are a number of masonry flower beds in the plant, with flowers and grass as the greening; and ditches and greening are available around the buttress foundation platform at left bank and bottom slope protection platform at right bank in the downstream of the dam. The above measures beautify the environment and effectively avoid water and soil erosion.

(2) Construction road zone

The permanent and temporary roads are treated in Chipwi Nge Hydropower Station, including hardening, gravel paving, ditch forming and culvert lying.

1) Combination of permanent and temporary roads

The combinations of permanent and temporary roads include #1 and #2 maintenance tunnel road, left bank road to the dam, right bank road to the dam, transformed road at right bank of the dam, and the road from the dam management camp to the mixing station.

Specific to the combinations of permanent and temporary roads, retaining walls are built up at road sections with unstable slopes; and the drainage systems consisting of ditches and culverts are available at both sides, which protect the road slopes, subgrade and pavements from rain erosion and thus effectively prevent water and soil erosion.

2) Temporary roads

The temporary roads include #2, #4, #5 and #6 adit road, road from the right bank of dam to the foundation pit, temporary construction road at the dam site, and on-site road within the aggregate system. The protective measures include reasonable slope ratio, masonry retaining wall at road sections with steep slopes, gravel paving, temporary longitudinal ditches and horizontal blind drains to ensure smooth drainage and prevent water and soil erosion.

(3) Construction, production and living area

The water and soil treatment measures in the construction, production and living area mainly cover establishment and removal of all construction and living camps (project office camps and

labor camps at all contract sections), production facilities (mixing systems, aggregate systems, material stockpiles, processing workshops and material warehouses, etc.). The construction of production facilities (mixing systems, aggregate systems, material stockpiles, processing workshops and material warehouses, etc.) has been carried out with minimization of the vegetation damages, guarantee of the smooth flow of surface runoff, and reduction and elimination of slope erosions.

Construction and living camps (project office camps and labor camps at all contract sections) are built up at the locations where are conducive to living and production activities with minimization of occupation of farmland and vegetation, which has effectively reduced damages to the vegetation. The living camps are built up at the locations where are away from wind blowing while facing the sun, close to traffic facilities and water sources. The camps contain public toilets, wastewater purification tanks and septic tanks, and cleaning is carried out on a regular basis to avoid pollution of the environment caused by domestic wastes and wastewater.

After the completion of the project, some labor camps, mixing systems and material stockpiles will be removed according to the relevant requirements, and then the site will be leveled and vegetation will be restored; some labor camps, as required by Myanmar government, are donated to local villagers as schools, houses and other public facilities; and some living and production facilities are transferred to follow-up constructors in view of road construction needs in future.

(4) Spoil yard

There are a lot of working zones in this power station project, so many spoil yards are established. In order to prevent serious water and soil erosion in the spoil yards, protections in different degrees are provided to the spoil yards according to design requirements and other relevant provisions. The completion of protective works is as follows:

1) Drainage of spoil yard

Blind ditches, open channels, drains and incepting ditches are available at all spoil yards according to actual needs to ensure smooth drainage and free of debris such as silt or dead wood.

2) Principles of stockpile

The debris shall be stacked and placed according to the planning and the principle of "retaining first and then confining". After the dumping operations, the top of debris is leveled in order to prevent water and soil erosion. The debris shall be laid in layers and different materials shall be stacked separately, with clear markings to facilitate taking and using of the debris.

3) Protective measures and implementation for the spoil yards

The protective measures include reasonable slope ratio, berms, masonry retaining walls, reinforced gabions and dry masonry works in order to prevent landslides or water and soil erosions. At the same time, blind ditches are available at appropriate positions according to dumping requirements to ensure smooth flow. The slopes of the debris are covered with humus, with grass seeds sprayed, and ivy and other local herbs planted to prevent water and soil erosion due to rainwater flushing.

① Gully spoil yard for # 1 adit

Carry out necessary clearing, leveling and trimming; ditches are formed around the debris; the slope ratio is optimized; berms are formed; and water and soil erosion is avoided. Masonry rocks or reinforced gabions are used to protect the slope toes to ensure stability of the berms and the slope. A layer of fine soil is on the slope and the top, with fragrant eupatorium herb, ivy and banana trees planted, so as to stabilize the water and soil and make the environment green.

② Gully spoil yard for # 2 adit

Carry out necessary clearing, leveling and trimming; ditches are formed around the debris; the slope ratio is optimized; and berms are formed. Masonry rocks or reinforced gabions are used to protect the slope toes to ensure stability of the berms. Finally ivy and other plants easily grow locally are planted on the top and the slope to stabilize the water and soil and make the environment green.

③ Gully spoil yard for # 3 adit

Carry out necessary clearing, leveling and trimming; ditches are formed around the debris; the slope ratio is optimized; and berms are formed. Masonry rocks or reinforced gabions are used to protect the slope toes to ensure stability of the berms and the slope. Finally ivy and other plants easily grow locally are planted on the top and the slope to stabilize the water and soil and make the environment green.

④Spoil yard for # 4 and # 5 adit

Because the spoil yards for # 4 and # 5 adit are located in a deep valley surrounded by dense and strong trees, a natural retaining protection is formed. The site is leveled and ditches are formed on the top and around the debris after completion of works to ensure smooth flow.

⑤Spoil yard for the plant

The spoil yards for the plant include three positions: the spoil yard where Materials Department of 14th Bureau is located , the spoil yard where the camp of 14th Bureau is located, and the spoil yard at the road turning from owner's camp to explosives warehouse.

For the spoil yard where Materials Department of 14th Bureau is located, the debris will be stacked along the right gully to the owner's camp. The stockpile slopes are optimized; berms are available on the slopes; rock heap is available as the slope toe protection; intercepting ditches are available around the edges of the stockpile; blind ditches are formed at the bottom of the stockpile along the original terrain, and there are two layers of geotextile on the top of the blind ditch to prevent the fine particles from entering the blind ditch; and the stockpile slopes have been covered by soil excavated for building up owner's permanent camp, of where because the rain is sufficient and vegetation grows rapidly, there are natural vegetation protections on the slope already.

Concrete retaining wall is adopted as the protection at the slope toe for the spoil yard where the camp of 14th Bureau is located, and concrete ditches are available. The slope surfaces flushed by the rainwater earlier already have been greened with vegetation after backfilling and trimming. Reinforced gabions are adopted as the slope toe protection at the slope toes facing the river, and the slope surfaces are protected with grass sowing and trees planting to reduce water and soil erosion.

For the spoil yard at the road turning from owner's camp to explosives warehouse, there are berms on the slopes; reinforced gabions are adopted as the slope toe protection; intercepting ditches are available around the edges of the stockpile; blind ditches are formed at the bottom of the stockpile along the original terrain, and there are two layers of geotextile on the top of the blind ditch to prevent the fine particles from entering the blind ditch. The slope surfaces have been covered with the soil excavated for building the tailrace, and vegetation grows rapidly, so a natural protection is formed, the stockpile top has been leveled and is protected with grass sowing and trees planting to reduce water and soil erosion while make the spoil yard green.



11.1.2.4 Population health

In the construction processes, occupational health and safety management organizations are established and occupational health and safety management systems are developed in all contract sections. The management at all levels from headquarters to all project management offices have established on-site clinics responsible for epidemic prevention, prevention and control of infectious diseases and drinking water inspection to optimize the protection of the health of workers.

(1) Clinics are available at all contract sections, and a number of medical personnel are ready to provide healthcare and epidemic prevention services. A certain number of epidemic prevention medicines and general emergency medicines are in place in each clinic.

(2) Sufficient trash bins are available at the construction site and the living camp, and construction wastes and domestic wastes will be delivered into the trash bins. The wastes are transported to the garbage stations for landfill deeply and prevent infectious diseases caused by construction wastes or domestic wastes.

(3) Make a unified planning for the layout of living area and production facilities, with flowers and trees planted as the camp greening to create a good production and living environment.

(4) Provide routine physical examinations to construction workers prior to their arrival, and it is prohibited to allow the patients with infectious diseases to enter the construction site. Distribute the drugs against malaria, dengue fever and other infectious diseases to the construction workers on a regular basis, and the living camps are sprayed for disinfection on a regular basis to effectively prevent the occurrence and spread of infectious diseases.

(5) Drinking water purification systems are established in all living camps, and the workers shall not drink the water until the water is purified and found qualified to ensure the safety of living drinking water.

(6) Full-time sanitation staff is available in the construction area and living area, and sanitation

systems are developed. On-site cleaning and wastes removing will be carried out on a regular basis everyday. Strengthen publicity and education, and it is prohibited to dump wastes in the working area, living area and surroundings to ensure the sanitation conditions.

(7) Carry out sanitation inspection and assessment activities, and an environmental sanitation inspection is carried out on a monthly basis to provide awards and punishments according to the performances, so as to improve the enthusiasm of all construction workers to participate in environmental protection.

By vigorously implementing various preventive measures, there are no any occurrences of large-scale infectious diseases or any cases of death due to infectious diseases from the commencement to finishing of the power station project.





11.1.2.5 Atmospheric environment

In the construction process of Chipwi Nge Hydropower Station project, the emissions of dust, waste gases and harmful gases have been controlled effectively, and associated health hazards have been avoided successfully.

(1) The blasting methods are well selected and optimized to minimize the generation of dust, which has reduced the impacts of dust on the surrounding environment and construction personnel.

(2) In addition to masks and other necessary personal protective equipment to reduce dust generated by construction activities, the methods including moistening and ventilation have been adopted to reduce the dust hazards to a minimum degree.

(3) The fine materials and bulk materials, which can lead to dust easily, are well covered with canvas, cloth and other covering materials during transportation, and the driving speed has been well controlled to effectively prevent impacts on the surrounding environment due to flying dust.

(4) A sprinkler is available to moisten the construction roads on a regular basis, and the construction roads are maintained wet to an appropriate degree, so as to prevent impacts on surrounding environment due to traffic dust.

(5) The construction wastes have been disposed by mean of landfill and burning is strictly prohibited, which has ensured the air quality and prevented air pollution due to emissions .

11.1.2.6 Noise control

Production and construction noise level control measures are in place, and the noises don't make any negative impacts on the camp workers, on-site construction workers and surrounding residents. The major measures include:

(1) The machines and equipment are used in the construction process in line with the noise and vibration levels stipulated in the existing national standards, and personal noise reduction equipment shall be in place at the high noise area to reduce the hazards caused by the noises to construction workers.

(2) Temporary production facilities and sites, such as mixing stations, material processing plants and generators are located far away from the living camp, which prevents the disturbances on normal living and working activities by construction noises.

(3) Strengthen the equipment maintenance and repair while maintain mechanical lubrication to achieve the purpose of noise reduction.

(4) Make a reasonable arrangement for the operation time, and try to avoid open-air blasting during rest time, so as to prevent impacts on normal living activities by blasting noises and vibrations.

11.1.2.7 Solid waste disposal

The solid wastes generated in the power station project include debris, construction wastes and domestic wastes. The disposal is completed as follows:

(1) Debris

The debris comes from the construction activities for the dam, plant, adit and diversion channel. The debris will be transported to the designated to spoil yard according to design requirements. There are drainage ditches at the spoil yard, and reinforced gabions are available to protect the slope toe and prevent water and soil erosion.

(2) Construction and domestic wastes

Sufficient trash bins are available at living camp, dam construction area and plant construction

area, and construction wastes and domestic wastes will be delivered into the trash bins. The wastes will be removed from the living camp and construction area on a regular basis, and then transported to the garbage stations for landfill deeply. The medical wastes will be disinfected in a concentrated manner and transported to the garbage stations for landfill deeply to effectively prevent environmental pollution.

11.1.2.8 Geological environment protection

The #1, #2 and #4 dangerous rocks are treated with the measures including removal, anchoring and shotcrete in the power station project.

11.1.3 Implementation evaluation

Based on the comparison and analysis of the actual implementation of environmental protection measures against the design and planning requirements, the main conclusions are:

(1) The implementation of water environment protection measures, ecological environment protection measures, population health protection measures, acoustic environment protection measures and solid waste disposal measures are basically as same as the design and planning requirements.

(2) As to soil and water conservation measures, the implementations at main structural area, construction road area, construction, production and living area and spoil yard are basically as same as the design and planning requirements; but the protective measures for the excavation site are not well implemented.

11.2 Environmental management

As an international or transnational river development project, the realization of "protect during development and develop during protection" in the process of development of the hydropower resources in Myanmar determines the international image of the project investment enterprise, and management is an important part of environmental management of hydropower development and an important link in implementing environmental protection measures. To maximize the social, economic and environmental benefits of Chipwi Nge Hydropower Station, protect the ecological environment of the project area and maintain the international image of investment enterprise, it is very necessary to do a good job at environmental management. The project investment enterprise shall establish a specific environmental management agency which is responsible to complete the tasks of environmental management.

11.2.1 Environmental management department

It is planned to establish an environmental protection department, with 1-2 full-time employees and some part-time employees, which is responsible for unified leadership and organization for environmental protection works in the construction period.

11.2.2 Environmental management tasks during construction

(1) Develop planning and management approaches for environmental protection in construction stage

At the same time of establishment of environmental management departments, environmental protection planning and management approaches are developed according to environmentally sensitive issues involved in management, locations of environmental protection, implementation time and surrounding environmental requirements corresponding to environmental impact assessment reports and specific to the focuses and difficulties, which clarify the management objectives, tasks and focuses, with corresponding management systems and rules determined.

(2) Develop annual environmental protection plans, including environmental investment plans

According to relevant construction schedules and the work focuses detailed in tender documents, a scientific environmental protection plan is developed, which effectively controls the project progress.

(3) Organize tendering for specific environmental protection tasks

Participate in the tender and design review; participate in qualification of bidding companies; help relevant companies to carry out site visit, Q&A and other pre-bidding works; participate in the evaluation of bids.

(4) Take responsibilities for compilation and review of environmental protection clauses detailed in the tender documents and contracts, and ensure that the environmental measures closely related to construction activities have been included into the tender documents and contracts.

According to the environmental impact assessment reports and environmental designs approved already, break down the detailed environmental protection measures to specific tender documents and contracts; review the tender documents and contracts developed already, and provide modification opinions on the environmental protection measures if there are some environmental protection measures are not sound enough.

(5) Supervise the implementation of the contractor's environmental measures

Manage the contracts related to environmental protection during construction, and review the qualifications of the subcontractors. Help to inspect and eliminate the projects and persons involved in illegal subcontracting by the contractor, and stop illegal subcontracting actions. Review the design documents to be submitted by the contractors according to environmental protection contracts; review the construction planning prepared by the contractors on environmental protection works; and inspect the implementation of construction preparations carried out by the contractors.

(6) Supervise and inspect the operation of environmental protection measures related to construction

Coordinate the works of designers, constructors and supervisors, urge the contractors to respect the opinions of designers and realize the design intents; timely organize to study the relevant opinions and comments proposed by the contractors, and ask the designers to reply in writing after consensuses are reached, or confirm in a form of "minutes of meeting"; coordinate to solve the contradictions between designers and contractors, and ask the designers to timely deal with the design problems proposed by the contractors in a timely manner.

(7) Help the constructors to deal with environmental disputes and environmental pollution accidents related to construction activities, and make timely reports to superiors or the relevant administrative departments.

Provide active services for construction activities based on contracts while adhere to the philosophy of fairness and justice, and actively coordinate the relations among all parties, deal with environmental pollution accidents and pollution disputes in a timely manner, and make timely reports to superiors or the relevant administrative departments after investigations and studies.

(8) Organize to implement environmental supervision and environmental monitoring works, and prepare and submit environmental quality reports of the construction area.

1) Review the qualifications of environment supervisors; verify the supervision certificates of the supervisors; and monitor and examine the environmental supervision procedures and quality management.

2) Review the qualifications of the monitoring companies or departments; ask the monitoring

companies or departments to establish quality assurance systems; and supervise the processes including monitoring, sampling, sample storage and transportation.

3) Verify the monitoring reports issued by the monitoring companies or departments, to analyze the reliability of monitoring results and the environmental problems reflected from the monitoring results.

4) Monitor the performances of environmental protection and water conservation measures through appropriate utilization of the monitoring results, and find the prominent environmental problems from the monitoring results, and urge the contractors to develop and implement appropriate solutions.

5) Establish a regular reporting system for monitoring data, and guide and manage the environmental protection works of constructors according to the monitoring data.

6) Organize emergency treatments to pollution accidents according to the monitoring data.

(9) Prepare annual report of the environmental protection works

Participate in the monthly production meeting held by the company to summarize the completion of the environmental protection works in this month and propose the problems existed in environmental protection works, so as to negotiate with the supervisors, designers and contractors for working out solutions, and propose the requirements on the environmental protection works in the next month.

The environmental management agencies can individually hold a special meeting of environmental protection to summon all relevant parties to negotiate the important environmental issues involved in construction to reach consensus and determine the programs to solve the problems after discussions.

Develop monthly, quarterly and annual reports according to the environmental protection plans with considerations of the monthly progress of project. Develop annual report of the environmental protection works according to the problems detailed in the monthly, quarterly and annual reports, the problems occurred, and experiences in dealing with the problems.

(10) Organize to carry out publicity, education and training of environmental protection

By issuing leaflets, setting up billboards and watching video, to provide publicity, education and training of environmental protection to construction workers and supervisors, so as to raise their awareness of environmental protection.

(11) Organize to prepare completion and acceptance report of environmental protection

Participate in and organize the completion and acceptance of the environmental protection works, including acceptance according to the contracts signed and design drawings as well as strict quality control together with consultants and project supervisors. The acceptance documents shall be signed and a completion and acceptance reports shall be developed according to the results. Urge the relevant parties to correct and report to superiors if there are any items found not qualified.

(12) Archive and transfer environmental protection information and results

Archive the environmental protection results achieved in the environmental management works, including management plans; planning; monthly, quarterly and annual reports; annual summaries; supervision data; monitoring data; design contracts; purchase contracts; contractor contracts; correspondences with superiors; correspondences with designers, contractors, local environmental protection authorities; and staff training information.

11.2.3 Environment management tasks in operation periods

(1) Implement environment management measures and develop management practices and

systems in operation periods of the project.

(2) Help the Myanmar authorities to carry out environmental protection works, and participate in ecological protection works and reservoir cleaning works prior to water storage of the reservoir.

(3) Implement environmental monitoring in the operation periods, and analyze the results statistically.

11.2.4 Environmental management system

(1) Environmental quality reporting system

Environmental monitoring is an important tool to access to environmental information and an important basis of implementation of environmental management and environmental protection measures. The power station ecological and environmental monitoring can be contracted by qualified companies or departments by the owner, and they can carry out monitoring for the power station environmental quality according to the monitoring plan.

A project ecological and environmental monitoring system consists of monthly reports, annual reports, periodic environmental quality reports and annual evaluation, and the monitoring results are submitted to the owner to enable them to keep abreast of the project environmental quality conditions and use them as the basis for determining countermeasure for local environment.

(2) Acceptance system

An acceptance system, featured as keeping a same pace with design, construction and operation, shall be observed for the facilities for prevention of pollution and other public hazards. These facilities shall not be put into operation until found compliance with contract requirements and accepted by relevant authorities. Pollution prevention facilities shall not be dismantled or left idle without permissions.

(3) Publicity and training system

The environmental management departments shall often publicize environmental knowledge to enhance environmental awareness through various channels including radio, television, newspapers, billboards and seminars, and make the workers participate in environmental protection works consciously; some expenses shall be included in the budget to award the departments and persons who make great contributions to environmental protection works in this project; and organize to provide training to professional and technical personnel involved in environmental protection to improve their professional quality.

(4) Pollution accident prevention and treatment measures

If some pollution accidents or other unexpected events occur during construction and operation, in addition to measures immediately taken by the departments who cause the accidents, timely notifications shall be provided to the regions and residents facing pollutions, and reports shall be submitted to the environmental management agencies of employer for investigation and treatment. The relevant departments of the owner, after receipt of the notifications of accidents, shall adopt emergency measures to promptly organize to deal with pollution accidents. At the same time, it is necessary to investigate the accidents to find out the causes, departments responsible and persons responsible, and financial penalties can be given to relevant departments and persons.

11.2.5 Implementation of environmental management measures

In the construction and operation period of Chipwi Nge Hydropower Station, the owner and constructor has established relevant organisms according to the environmental management

requirements proposed by the assessor, and assumed the corresponding environmental management tasks.

The construction company of this construction power station is a permanent foreign branch of CPI Yunnan Power Investment Co., Ltd., and it is responsible for realizing the responsibilities of the owner. The construction company organizes the construction of this construction power station under the supervision and control of the supervisor according to the design to form a uniform and complete management system.

The main structural works of the construction power station are included in two contract sections respectively undertaken by China Gezhouba (Group) Corporation and Sinohydro Bureau 14 Co., Ltd., and their project management offices assume environmental protection and water and soil conservation works within their contract sections.

11.2.6 Environment management content in operation periods

Because of the hydropower station is a non-pollution projects, during the operation periods of hydropower station, the environmental mitigation measures are relatively less.During the operation of Chipwi Nge Hydropower Station, the main contents of environmental management including the establishment of specialized environmental management agency,the implementation of the environmental mitigation measures and the establishment of environmental management and supervision system. The content are shown in Table 11.2-1.

Table 11.2-1 Main content of Environmental management in operation periods

Item	Main content	Implementers	Supervisor
Mitigation measures	To establish specialized environmental management agency	CPI	Local Gov., NGO, Local people
	a discharging ecological flow of 0.53m3/s	Contractor	Local Gov., CPI, NGO, Local people
	transplanting for saplings and nursing for big trees	Contractor	
	Further investigate the terrestrial organisms on a regular and irregular basis	Contractor	
	Environmental monitoring	Contractor	
	By taking a series of measures to promote education and training, to raise the public awareness to environmental protection	CPI	Local Gov., NGO, Local people
Method and regime	To develop Risk accident emergency plan	CPI	Local Gov., NGO, Local people
	To develop Environmental management method and regime	CPI	
environmental supervision	Supervise and inspect the implementation of environmental planning and operation of environmental protection measures	CPI	Local Gov., NGO, Local people.
	supervise and inspect ecological and environmental monitoring works in the reservoir and downstream areas	CPI	
CSR fund	After consultation with MOEP, we have agreed to allocate 1% of the project's profit to CSR fund.	CPI	Local Gov., NGO, Local people.

11.2.7 Environmental Management Plan during Operation Period

11.2.7.1 Terrestrial Ecology (Biodiversity) and Watershed Management Plan

Objectives: Ensure protection of local and regional biodiversity and minimize project impacts on protected areas.

Legal Requirement

Environmental Conservation Law (2012)

Environmental Conservation Rule (2014)

The protection of wildlife, wild plant and Conservation of Natural Area Law (1994)

The Forest Law (1992)

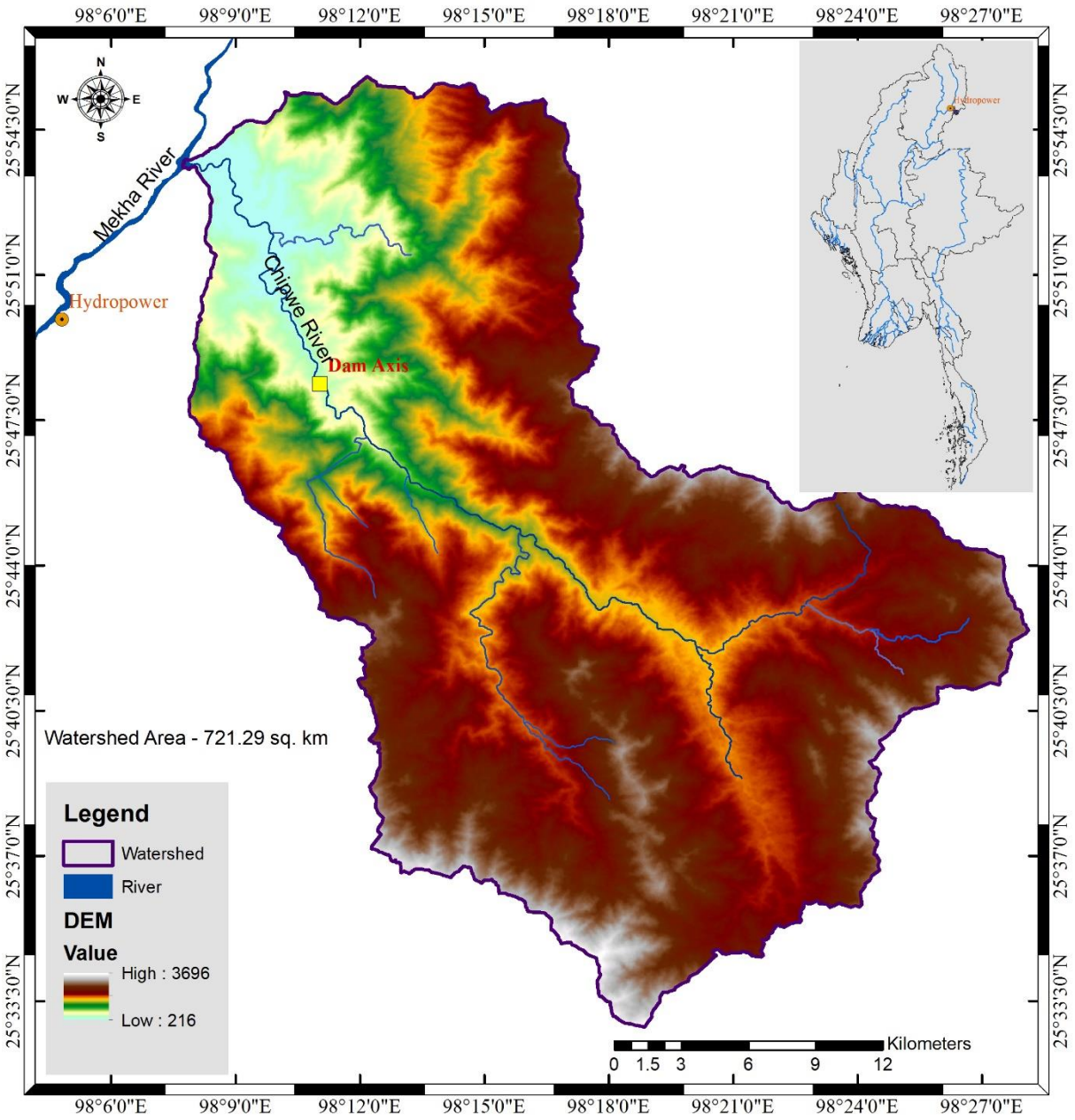


Figure 11.2.7-1Watershed of Chipwi Nge Reservoir.

Figure 11.2.7-2 Buffer zone for protection measure for habitat of Chipwi Nge Reservoir.

Figure 11.2.7-3 Buffer zone for protection measure for habitat in Power Plant area.

Implementation Plan

Chipwi River is winding and zigzagging from southeast to northwest. The average hydraulic gradient is 5%～6%. River valleys are deeply cut and take on the shape of "V." The reservoir area is of low middle mountain gorge river valley landform, and mountains on both banks are steep. Topographic slope is 35°～45° and distributed on Grade I and II bench platforms along the river.

Due to reservoir inundation of Chipwi Nge Hydropower Station as well as construction of dam, powerhouse, construction road, diversion tunnel and construction adit, 12.2hm^2 of surface vegetation will be damaged, including 0.5hm^2 of orchard, 6.5hm^2 of economic forest, 0.7hm^2 of timber forest, 2.7hm^2 of grass land and 1.2hm^2 of shrub forest.

Reservoir for Chipwi Nge Hydropower Station is small and its area will increase by only 0.08km^2 after filling. It will almost not affect reptiles and mammals inhabiting around the reservoir.

Due to disturbance of human activities, there is a small number of wild animals in the project area, which are mainly small ones such as snakes, rodents and birds. Direct influence of the project construction on reptiles, birds and animals is that focused activities and construction of construction personnel will drive these animals to leave the construction site and take secondary forests and shrubs as the habitats. There are habitats for small animals to habitat or migrate in the edge of the construction area. Therefore, the direct influence on these wild animals will be slight.

Disturbance to living environment of animals and even hunting in the project construction will reduce animals. But main animals in the construction area are frogs, common lizards, small birds and small mammals and have a small number. For the reason, activities of construction personnel will have little influence on wild animals in the area. But wildlife purchasing of construction personnel or management personnel will increase wildlife trading in the project area. It can improve intensity and frequency of hunters for hunting so as to reduce wild animals in the project area.

The biodiversity and watershed management plan will contain measures to protect biodiversity within the Chipwi Nge Hydropower project area including all, or a combination of the following:

- Improvements to the physical demarcation of reserve areas;
- Coordination of the implementation of watershed area management plans;
- Capacity building and training for watershed area's wardens and patrols;
- Additional ecological baseline studies, as required;
- Coordination of establishment of necessary infrastructure – control posts, toll gates, staff housing, trails;
- Installation of signage and fencing, as required in watershed area;
- Development of an access management strategy including control of ingress and egress of vehicles to the project area, gates and access barriers;
- Development and implementation of a worker code of conduct prohibiting hunting, fishing and possession of wildlife for human consumption (bush meat);
- Development of mechanisms for inter-agency cooperation between the provincial forest management department and natural reserve management board;
- Environmental education and awareness in local communities and project personnel;
- Coordination of activities in the protected areas buffer zone; and

Strengthening forest patrolling and law enforcement: To minimize impacts that increase threats to forests and biodiversity (forest clearance for agriculture, hunting/trapping wildlife, timber and harvest, forest fire, etc.) and its buffer zone.

Main activities include:

- Strengthening forest patrol in watershed area for violations of forest clearing for agriculture,

timber extraction, harvest, wildlife hunting/trapping, burning by illegal encroachers, and applying strict enforcement measures.

- Regular patrol of vegetation burnings made by local residents for upland field preparation in buffer zones to prevent forest fire.
- Regularly checking (at least, every 3 months) local markets, restaurants, eating shops, souvenir shops, traditional medicine stores, ornamental plant shops etc. Chipwi Town and power plant areas for any violations on wildlife trade and remedy
- Enhancing participation of local communities in biodiversity and watershed management: currently, participation of local communities in this management are still weak. Possible participatory management activities include:

1) Meeting with local households for explaining this management objectives and develop in community forest, minimize for harvest, wildlife hunting/trapping, forest clearing for agriculture, etc.

2) To establish and operate Village and Community Forest Program.

Enforcement of rules of the reserve and forest exploitation must be done. Monitoring (by guards) for illegal activities in forest around project areas and the imposing of sanctions as fines will be continued.

Developing model of Community-based forest management (CBFM)

The specific objectives are:

- Undertake the re-afforestation and improvement of existing forests necessary for watershed protection and biodiversity conservation
- Establish firm community control over the use of forest resources and forest lands

Environmental education for project workers and local public

To raise awareness on environment protection and biodiversity conservation in project workers, their followers and local public to reduce exploitative approaches to wildlife and habitats.

Main activities include:

- Install educational sign boards with conservation messages and forest fire prevention in nearly towns (Chipwi), along roads to Project and dam site. Signboards may be various sizes but must be large enough and with big clear letters (especially local language) for quick reading and must be attractive of attention. Conservation messages could relate to no consuming wildlife and wildlife products, no wildlife hunting and trading, no illegal transporting wildlife and forest products, no forest destruction, no forest fire, no disposal of wastes outside allowable areas, etc.
- Print posters, leaflets, etc. with nature conservation messages and distribute them to worker camps, service facilities (shops, restaurants, office, etc.) in power plant, dam site, and villages within project area.
- Develop teaching nature education materials (video, slides, presentation speeches) and conducting training classes for project workers, administration officers of constructors and sensitive public groups. The education material should be simple for easy understanding, fitting and attractive to relevant audience.
- Establishing a mobile audio-visual education team with necessary teaching equipment (slide projectors, video player, loudspeaker system, etc.)
- Environmental Engineer of Environmental Management Department will be responsible for implementation of these activities. Fund for these activities will be from Chipwi Nge Hydropower Company Ltd.

Monitoring program for impacts on Endangered wildlife species in Project areas (Power Plant, Reservoir Area and Watershed)

Get better understanding of population status and ecological requirements of wildlife species of the project. Developing detailed management plan for potential most affected species.

According to updated baseline study, total of 19 mammal species were recorded in Chipwi Nge dam site and Power House area. Among them 7 mammal species were listed as threatened species under IUCN Red List. Out of the recorded threatened species, 3 species were endangered species and another 4 species were recorded as vulnerable species.

A total of 78 bird species were observed in the Chipwi Nge dam site and Power house area. Among the observed species, 2 vulnerable species were recorded. Most of the bird species were found as resident species residing in the area for all seasons. Out of the recorded species, some species were recorded as winter visitors.

A total of 3 reptile species and 1 amphibian species were recorded during the survey period at Chipwi Nge Dam site and Power House area. No threatened species of reptile and amphibian species was found during the survey period.

Total of 105 bird's species were recorded in the proposed project area. The 2 species of Near-threatened and 1 Vulnerable were observed the project area. Member of the family Bucerotidae, Great Hornbill Buceros bicornis and Rufous-necked Hornbill Aceros nipalensis are found near the dam site and listed as forest bird's species. A part from the species family Psittadae, one bird was also observed Grey-headed Parakeet Psittacula finschii was also noted as forest birds.

However, population status in the project area and ecological requirements of these species are poorly known. Monitoring program will help to obtain data on population status and their ecological requirements which are utmost important for effective conservation of these wildlife groups. The monitoring will also determine changes in population size and habitat use, movement of the species due to impacts of the project which will help to apply relevant remedy measures.

Conducting training on techniques of biodiversity monitoring for endangered species: Technical staff members of the company should be properly trained on techniques of biodiversity monitoring (species identification skill, use of survey equipment, survey methods, data analysis, etc.). Training will consists of short classroom theoretical background explanation and mainly practical training in the field. The experience could also be obtained by participating in the biodiversity baseline survey and status survey of monitoring species. Wildlife experts from scientific institutes will be invited for training and supervising/ backstopping of the monitoring programs.

The proposed new forested buffer zone around the reservoir and power plant will provide habitat for these selected faunal species (and many others) as well as protection for the immediate catchment of the reservoir, to reduce soil erosion and potential siltation of the reservoir (some of the slopes near the inundation area approach 50^{o} and are therefore quite vulnerable to erosion).The most suitable tree and shrub species for these purposes will be planted in this area as soon as possible after the project construction starts. Figure11.2.7-2 and 11.2.7-3 shows the proposed buffer zone around the reservoir, which will replace mostly plantations, home gardens, and scrub vegetation.

Vegetation Recovery in Power Plant Area (area, quantity and kinds)

There is teak, banyan, plantain trees, banana trees, mango, rambutan, longan trees, flowers and grass spread over about 3 acres.

Figure 11.2.7-4 Forest Land Recovery

Figure 11.2.7-5 Vegetation Recovery

Implementation Organization

Environmental Management Department will be responsible for implementation and co-ordinate with Department of Forestry. Funding for this Plan will be from Chipwi Nge Hydropower Company Ltd.

***Budgets*:** These measures will require some additional budget, but the amount cannot be estimated precisely as the nature of the work and the budget is not known at this stage. The

project company should therefore recalculate the budget when incorporating the additional work.

11.2.7.2 Environmental Management Plan for Hydrology and Environmental Flow

Objectives: To maintain discharging ecological flow of 0.53m^3/s and to address long-term downstream hydrological impacts.

Legal Requirement

The Conservation of Water Resources and Rivers Law (2006)

The Conservation of Water Resources and River Rules (2013)

The Conservation of Water Resources and River Law (2006)

Minimum environmental flow (or ecological flow)

During the operation period, about 15.7km long river reach downstream of the dam, i.e. the river section between the dam site and the river estuary, will be affected by water reduction section. In accordance with site survey, scattered settlements are distributed on both banks of the section. As people are living at high areas which is far away from Chipwi River, they take water mainly from nearby streams or springs rather than from Chipwi River. In addition, there is no irrigation and other water supply demands along the water reduction river section. Thus, the major demands for this part of the river is to maintain basic ecological, considering the power demands for the construction needs of Myitsone and Chipwi hydropower plants. As there are quite a few branches join in the downstream of the dam and the lateral flow is large, discharged flow of Chipwi Nge Hydropower Station will take 10% of minimum monthly average flow in the dry season, namely 0.53m^3/s. It was proposed to discharge 0.53m^3/s as the ecological flow from the reservoir.

From May to October, as the natural river flow is large, power generation through diversion shows little impact on flow at the downstream of the dam, and water level downstream of the dam changes slightly. From November to next April, natural reservoir inflow declines and diversion power generation reduces downstream flow significantly. With 0.53m^3/s ecological flow discharged from the dam, downstream water level falls. However, with considerable water contributed by many streams downstream of the dam, river discharge of the water reduction section will gradually increase, so that the differences from natural conditions at this section will reduce from upstream to downstream. It should be noted that such water reduction will cause reduction of plankton and benthos in this river section, fish resources in the river reach also will reduce. However, the impact on animal and plant habitats is relatively small.

As shown from the investigation, the nearest two small tributaries are about 1.6km in the downstream of the dam, respectively with a catchment area of 10.0km^2 and 5.45km^2. According to estimates, their annual average flows are respectively 0.73m^3 /s and 0.4m^3 / s. Plus discharged flow of 0.53m^3/s, the average flow at 1.6km downstream of the dam can reach 1.66m^3/s. As the annual average flow of confluence between the dam site and estuary is about 13.9m^3/s, plus discharged ecological flow, the flow at the estuary of Chipwi River can reach 14.4m^3/s, accounting for 26.7% of annual average flow at the estuary of Chipwi River.

The regulation process of the Chipwi Nge HPP in 2017 is shown in the table below. During the real time operation, due to the inadequate Power transmission line of Myanmar power grid and the low load in north of Myanmar, the power generation of the project is only 23% of the designed power generation capacity. In 2017, the inflow at the dam site was 32.15 m^3/s, the power generation utilized 5.65 m^3/s, the water discharged from the dam was 26.5 m^3/s, accounting for 82.4% of the natural inflow.

Table 11.2.7-1 The regulation process of Chipwi Nge HPP in 2017 (m^3/s)

Month	1	2	3	4	5	6
Natural flow	10.93	11.16	18.18	29.5	20.34	64.36
Power generation diversion	5.40	5.15	5.48	5.84	6.01	6.00
Water discharge	5.53	6.01	12.70	23.66	14.33	58.36
Month	7	8	9	10	11	12
Natural flow	70.09	55.39	39.20	30.75	20.46	15.73
Power generation diversion	5.05	5.68	5.71	6.09	5.61	5.83
Water discharge	65.04	49.71	33.49	24.66	14.85	9.90
Average annual flow	32.15					
Power generation flow	5.65					
Water discharge	26.50					

Implementation Arrangements: No special arrangements are needed in order to implement this work as it will be conducted by discussion at senior level within EPGE, organized by the Chipwi Nge Hydropower Company Project Manager. Any technical work involved will also be done by Specialist from the company, who will report on the outcome to Electric Power Generation Enterprise.

Monitoring

This could be determined by establishing automatic depth and flow monitoring stations at regular intervals between dam and river mouth of Maykha. However, this would be a major undertaking (and data analysis task) that would not enhance the mitigation, as this is the only way that flow can realistically be increased whilst still meeting the power generation requirements.

Budget

See in main budgets allotment for Environmental Protection Measure.

11.2.7.3 Environmental Management Plan for Water Quality

Objectives: Minimize negative impacts of water quality for down Stream User and Aquatic Organism.

Legal Requirement

Environmental Conservation Law (2012)

Environmental Conservation Rules (2014)

EIA Procedure (2015)

The Conservation of Water Resources and Rivers Law (2006)

The Conservation of Water Resources and River Rules (2013)

Impacts

There are some concerns regarding the quality of water in the reservoir and flowing downstream once the Chipwi Nge HPP is operating, and these are mainly related to the reduced downstream flow discussed above, and the reduced turnover of water in the reservoir in the dry season, when there will be only limited replenishment by rain-driven inflow from upstream. The risks are that:

a) water in the reservoir could become de-oxygenated in the dry season, especially if the present vegetation is left in place to decompose, which could affect fish and other organisms living in the water; and

b) there could be major increases in turbidity if at some stage in the future the sediment that accumulates in the reservoir over the long-term, is pumped downstream.

c) Mitigating these impacts will be implementing Watershed Management to reduce inputs of silt and other pollutants; removing trees and shrubs from the reservoir before impounding.

Implementation Arrangements: Uprooting trees and shrubs in the reservoir area should be done at the very end of the construction period, to avoid disturbed and exposed soil being present over a long period, which could liberate dust or silt-laden runoff. This is already included in the tender documents for the main civil works contract and should be implemented as one of their final activities.

The remaining mitigation measures are ultimately the responsibility of Forest Department and EPGE as the scheme operator, and they will appoint contractors and consultants to conduct some of the work, including: preparation and implementation of the Watershed Management Plan and monitoring water quality in the reservoir.

Performance Indicators and Monitoring Requirements: Water quality monitoring will be done in the reservoir and downstream as monthly basis.

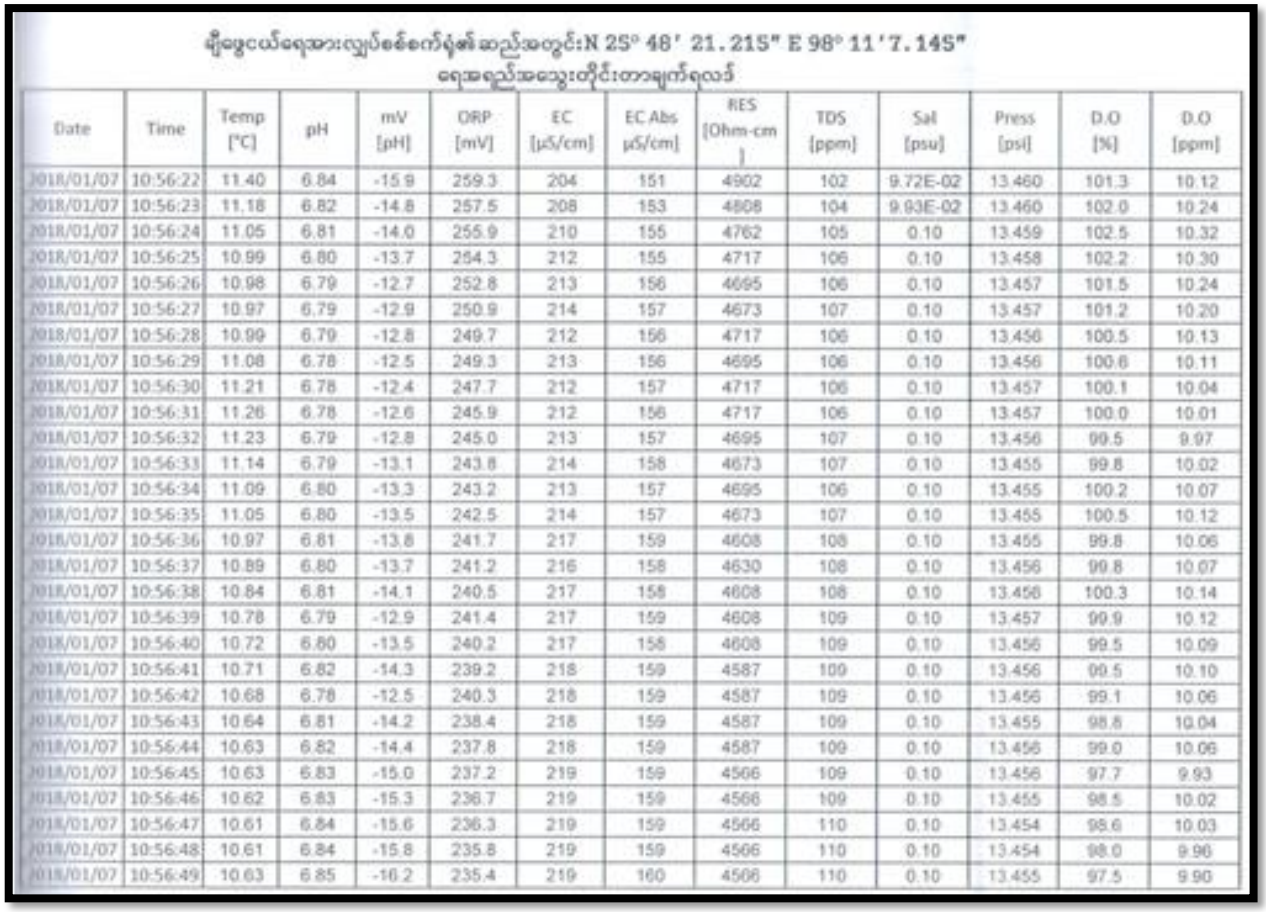
Chipwi Nge Hydropower Station is a daily regulation type with frequent water exchange. It is expected that the impoundment will have little impact on eutrophication situation of water in the reservoir. According to the monitoring data of water quality in the Reservoir and Downstream of the dam in January 2018 (see tables below), the operation of the project has basically no effect on river DO.

Table 11.2.7-2 Water quality monitoring data in the Reservoir

မျိုဖွေငယ်ရေအားလျှပ်စစ်စက်ရုံ၏ ဆည်အထွက် ခန့်မှန်းမြေပုံအညွှန်း N 25° 48′ 24.977″ E 98° 11′ 00.745″
ရေအရည်အသွေးတိုင်းတာချက်ရလဒ်

Date	Time	Temp .[°C]	pH	mV [pH]	ORP [mV]	EC [µS/cm]	EC Abs. [µS/cm]	RES [Ohm-cm]	TDS [ppm]	Sal. [psu]	Press. [psi]	D.O .[%]	D.O. [ppm]
2018/01/07	11:14:05	10.34	6.87	-17.6	241.4	225	162	4444	113	0.11	13.517	99.1	10.19
2018/01/07	11:14:06	10.34	6.88	-18.1	240.8	225	163	4444	113	0.11	13.516	99.2	10.20
2018/01/07	11:14:07	10.34	6.89	-18.5	240.2	226	163	4425	113	0.11	13.517	99.2	10.19
2018/01/07	11:14:08	10.34	6.90	-19.0	239.8	226	163	4425	113	0.11	13.518	99.6	10.24
2018/01/07	11:14:09	10.35	6.90	-19.3	239.6	226	163	4425	113	0.11	13.518	98.9	10.17
2018/01/07	11:14:10	10.35	6.91	-19.5	239.5	226	163	4425	113	0.11	13.518	98.8	10.15
2018/01/07	11:14:11	10.35	6.91	-19.6	239.1	226	163	4425	113	0.11	13.518	98.9	10.16
2018/01/07	11:14:12	10.35	6.92	-20.1	238.6	226	163	4425	113	0.11	13.517	100.5	10.33
2018/01/07	11:14:13	10.35	6.92	-20.4	238.3	226	163	4425	113	0.11	13.517	98.3	10.10
2018/01/07	11:14:14	10.35	6.93	-20.7	237.9	226	163	4425	113	0.11	13.517	98.4	10.11
2018/01/07	11:14:15	10.34	6.94	-21.1	237.8	226	163	4425	113	0.11	13.518	98.6	10.13
2018/01/07	11:14:16	10.34	6.94	-21.3	237.5	227	164	4405	113	0.11	13.517	98.3	10.10
2018/01/07	11:14:17	10.34	6.95	-21.7	237.4	227	164	4405	113	0.11	13.518	97.9	10.06
2018/01/07	11:14:18	10.34	6.95	-21.9	236.8	227	164	4405	113	0.11	13.518	96.9	9.96
2018/01/07	11:14:19	10.34	6.95	-22.2	236.9	227	164	4405	113	0.11	13.518	96.8	9.95
2018/01/07	11:14:20	10.34	6.96	-22.4	236.4	227	164	4405	113	0.11	13.518	96.5	9.92
2018/01/07	11:14:21	10.35	6.96	-22.6	236.3	227	164	4405	113	0.11	13.518	97.8	10.05
2018/01/07	11:14:22	10.35	6.97	-22.9	236.1	227	164	4405	113	0.11	13.519	96.6	9.93
2018/01/07	11:14:23	10.35	6.97	-23.2	235.8	227	164	4405	114	0.11	13.519	97.0	9.97
2018/01/07	11:14:24	10.35	6.97	-23.2	235.6	227	164	4405	114	0.11	13.518	96.6	9.93
2018/01/07	11:14:25	10.36	6.98	-23.6	235.2	227	164	4405	114	0.11	13.518	97.2	9.99
2018/01/07	11:14:26	10.37	6.98	-23.7	235.2	227	164	4405	114	0.11	13.518	97.2	9.98
2018/01/07	11:14:27	10.36	6.98	-23.8	235.1	227	164	4405	114	0.11	13.519	97.0	9.96
2018/01/07	11:14:28	10.37	6.99	-24.3	234.7	227	164	4405	114	0.11	13.519	97.7	10.04
2018/01/07	11:14:29	10.37	7.00	-24.5	234.1	227	164	4405	114	0.11	13.519	97.3	9.99
2018/01/07	11:14:30	10.38	6.99	-24.4	234.2	228	164	4386	114	0.11	13.518	96.7	9.94
2018/01/07	11:14:31	10.38	7.00	-24.8	233.8	228	164	4386	114	0.11	13.517	96.1	9.87
2018/01/07	11:14:32	10.37	7.00	-24.9	233.6	228	164	4386	114	0.11	13.516	96.3	9.89
2018/01/07	11:14:33	10.37	7.01	-25.1	233.5	228	164	4386	114	0.11	13.516	95.7	9.83
2018/01/07	11:14:34	10.37	7.01	-25.3	233.3	228	164	4386	114	0.11	13.516	96.6	9.92

Table 11.2.7-3 Water quality monitoring data at the Downstream of the dam



မျိုဇွေငယ်ရေအားလျှပ်စစ်စက်ရုံ၏ဆည်အတွင်း N 25° 48' 21.215" E 98° 11'7.145"
ရေအရည်အသွေးတိုင်းတာချက်ရလဒ်

Date	Time	Temp [°C]	pH	mV [pH]	ORP [mV]	EC [µS/cm]	EC Abs µS/cm]	RES [Ohm-cm]	TDS [ppm]	Sal [psu]	Press [psi]	D.O [%]	D.O [ppm]
2018/01/07	10:56:22	11.40	6.84	-15.9	259.3	204	151	4902	102	9.72E-02	13.460	101.3	10.12
2018/01/07	10:56:23	11.18	6.82	-14.8	257.5	208	153	4808	104	9.93E-02	13.460	102.0	10.24
2018/01/07	10:56:24	11.05	6.81	-14.0	255.9	210	155	4762	105	0.10	13.459	102.5	10.32
2018/01/07	10:56:25	10.99	6.80	-13.7	254.3	212	155	4717	106	0.10	13.458	102.2	10.30
2018/01/07	10:56:26	10.98	6.79	-12.7	252.8	213	156	4695	106	0.10	13.457	101.5	10.24
2018/01/07	10:56:27	10.97	6.79	-12.9	250.9	214	157	4673	107	0.10	13.457	101.2	10.20
2018/01/07	10:56:28	10.99	6.79	-12.8	249.7	212	156	4717	106	0.10	13.456	100.5	10.13
2018/01/07	10:56:29	11.08	6.78	-12.5	249.3	213	156	4695	106	0.10	13.456	100.6	10.11
2018/01/07	10:56:30	11.21	6.78	-12.4	247.7	212	157	4717	106	0.10	13.457	100.1	10.04
2018/01/07	10:56:31	11.26	6.78	-12.6	245.9	212	156	4717	106	0.10	13.457	100.0	10.01
2018/01/07	10:56:32	11.23	6.79	-12.8	245.0	213	157	4695	107	0.10	13.456	99.5	9.97
2018/01/07	10:56:33	11.14	6.79	-13.1	243.8	214	158	4673	107	0.10	13.455	99.8	10.02
2018/01/07	10:56:34	11.09	6.80	-13.3	243.2	213	157	4695	106	0.10	13.455	100.2	10.07
2018/01/07	10:56:35	11.05	6.80	-13.5	242.5	214	157	4673	107	0.10	13.455	100.5	10.12
2018/01/07	10:56:36	10.97	6.81	-13.8	241.7	217	159	4608	108	0.10	13.455	99.8	10.06
2018/01/07	10:56:37	10.89	6.80	-13.7	241.2	216	158	4630	108	0.10	13.456	99.8	10.07
2018/01/07	10:56:38	10.84	6.81	-14.1	240.5	217	158	4608	108	0.10	13.456	100.3	10.14
2018/01/07	10:56:39	10.78	6.79	-12.9	241.4	217	159	4608	109	0.10	13.457	99.9	10.12
2018/01/07	10:56:40	10.72	6.80	-13.5	240.2	217	158	4608	109	0.10	13.456	99.5	10.09
2018/01/07	10:56:41	10.71	6.82	-14.3	239.2	218	159	4587	109	0.10	13.456	99.5	10.10
2018/01/07	10:56:42	10.68	6.78	-12.5	240.3	218	159	4587	109	0.10	13.456	99.1	10.06
2018/01/07	10:56:43	10.64	6.81	-14.2	238.4	218	159	4587	109	0.10	13.455	98.8	10.04
2018/01/07	10:56:44	10.63	6.82	-14.4	237.8	218	159	4587	109	0.10	13.456	99.0	10.06
2018/01/07	10:56:45	10.63	6.83	-15.0	237.2	219	159	4566	109	0.10	13.456	97.7	9.93
2018/01/07	10:56:46	10.62	6.83	-15.3	236.7	219	159	4566	109	0.10	13.455	98.5	10.02
2018/01/07	10:56:47	10.61	6.84	-15.6	236.3	219	159	4566	110	0.10	13.454	98.6	10.03
2018/01/07	10:56:48	10.61	6.84	-15.8	235.8	219	159	4566	110	0.10	13.454	98.0	9.96
2018/01/07	10:56:49	10.63	6.85	-16.2	235.4	219	160	4566	110	0.10	13.455	97.5	9.90

Budgets: Chipwi Nge Hydropower Company will employ an environmental monitoring contractor to monitor water quality in the reservoir and downstream, so a budget for this activity is given below.

Work Item	**Quantity**	**Unit**	**Rate (USD)**	**Cost (USD)**
Monitor water quality in reservoir and river				
Senior Water Quality Specialist	36	Day rate	120	4,320
Field Assistant (2)	36	Day Rate	40	1,440
Boat and operator	36	Day Rate	30	1,080
Laboratory Analysis and in-situ test (Tem., pH, Turbidity, TSS, DO, BOD, Ammonia, Nitrate, Phosphorous, Fecal Coliform, Total Coliform)	18 x 12	Per sample	140	30,240
Transport	24	Per trip	40	11,040
Per diem	3 x 3 x 12	Day	25	2,700
Total				**50,820**
Assumption: Water Quality Monitoring Point – 1 station in reservoir, 1 station in upstream of dam, 1 station in downstream of dam, 1 station in downstream of power house and 1 station in upstream of power house (surface, mid depth and bed,). Monitoring time : Every 6 months for 5 years				

11.2.7.4. Environmental Management Plan for Dam Safety

Impacts and Mitigation: The FS Review study explained that 2,500 concrete gravity dams have been built worldwide since the 1930's and none has failed. Nevertheless Department of Hydropower Implementation wishes to ensure that rigorous safeguards are in place to reduce and avoid to the extent possible the widespread damage and destruction of property, assets, livelihoods and natural resources that may occur downstream in the unlikely event that the dam were to break, and the associated loss of life.

The main safety risk of Chipwi Nge HPP can be assessed from the aspects of dam stability, structure strength, flood discharge and energy dissipation, and seismic risk. According to calculation result and analysis, the major findings and main conclusions of dam safety assessment are as follows:

1) Calculation and analysis has been made on the anti-sliding stability considering static working condition. The results show that the safety margin of dam sliding is large, and the risk of dam stability is very low.
2) According to the calculation result considering static working condition, the maximum dam stress is much smaller than the concrete strength, the safety margin is large, and the structure strength risk is very low.
3) According to hydraulic calculation result, the discharging ability is greater than the peak value of checking flood and design flood. During discharging, the flow speed is not very high, with concrete of high ability of scour-resistant and wear-resistant, it can effectively protect the passageway. According to the hydraulic calculation result, the concrete apron and revetment can effectively protect the dam and bank, satisfying discharging capacity needs and energy dispersion requirement. Thus, the risk of scouring during flooding is small.
4) Seismic calculation results show that the anti-sliding stability and stress of the dam under the earthquake load meet the requirements, and there is a certain safety margin, and the seismic safety risk of the dam is small.

From above all, the dam safety risk is low.

Proving Data of Dam Safety

Dam stability data

1) Slide stability on foundation surface

The resisting force on foundation surface is bigger than applied load, and the minimum ratio of resisting force to applied load is 2.12, the safety margin is very large.

2) Slide stability on probable deep sliding surface of dam foundation

Under all kinds of working condition, the minimum ratio of resisting force to applied load is 1.58 for the first deep sliding model of dam foundation, and 1.05 for the second deep sliding model of dam foundation, the safety margin is adequate.

Strength safety data of dam structure

1) Pressure stress

The maximum vertical stress at the dam toe is 1.72 MPa, which is much smaller than the rock pressure strength of 64.5 MPa and the dam concrete's strength of 18.5 MPa, the safety margin is very large.

2) Tension stress

Under all kinds of working condition, the vertical pressure at dam heel is bigger than 0, no tension stress is appeared.

Flood Discharge and Energy Dissipation Risk

1) Discharge capacity

The return period of design flood for Chipwi Nge HPP is 50 years, return period of checking flood is 500 years, and the corresponding flood peak values are 1710m^3/sand 2540m^3/s, respectively.

At water level of 746m, the dam orifices discharge capacity is 2547m^3/s; at the dam top level of 747.5m, the corresponding discharge capacity is 3345m^3/s. The discharge capacity is adequate, and risk of flood overtopping is very low.

2) Scour and Erosion Risk on Flow Passageway

On checking flood condition, the minimum pressure on crest weir is 2.025 kPa, bigger than Chinese-design code's safe value of 6×9.8 kPa. The safety margin is very large.

The calculating maximum flow rate of the top outlet is 22.46 m/s, and 19.9m/s for the flood and sediment discharging orifice. Surface of the flow passageway is lined with abrasion resistant concrete. Risk of destroying is very low.

3) Scouring Risk at Downstream of the Dam

The minimum jetting distance for flood discharge of the top outlet is 41.81m flow, far from the toe of the dam, and the maximum depth of the pit is 5.67 m, which will not affect the stability of the dam and the slopes of both banks.

The minimum jetting distance for flood and sediment orifice is 37.11m, far from the toe of the dam, and the maximum depth of the pit is 8.5m～12.3m, which will not affect the stability of the dam and the slopes of both banks.

Seismic Risk

Chipwi Nge HPP is located at relatively stable tectonic region, where the peak earthquake horizontal acceleration of exceedance probability of 10% in 50 years is 0.17g, the dam design earthquake intensity magnitude is considered as grade 8. Quasi-static method is applied in dam seismic calculation, 0.2g is used as the horizontal acceleration, and the vertical acceleration is 2/3 of the horizontal one.

In seismic working condition, the resisting force is bigger than applied load on foundation surface, and the minimum ratio of resisting force to applied load is 1.99, the safety margin is large. On deep probable sliding surface the resisting force is also bigger than applied load for two sliding models, and the ratio of resisting force to applied load are 1.62 and 1.22, respectively. The safety margin is adequate.

In seismic condition, the maximum vertical pressure at dam toe is 1.76 MPa, much smaller than 77.4 MPa and 22.22 MPa, which are the value of dynamic pressure strength of foundation rock and dam concrete respectively, the safety margin is adequate. Tension stress is only appeared at dam heel of 6# dam block, and the tension stress is 0.07 MPa, much smaller than concrete dynamic tension strength, and the safety margin is large.

The seismic acceleration of Chipwi Nge HPP is studied from the following aspects:

1. According to the regional geological structure, zoning of the seismic statistics is made (Figure 4.1-1). The maximum earthquake affected intensity on the study area is determined based on the historical earthquake occurred in the seismic statistical zone.
2. According to the distribution of the regional active fault zone, the potential seismic region is divided (Figure 4.1-2). The maximum magnitude of the potential seismic region is determined by the historical strong earthquakes.

3. According to the seismic zone and potential seismic region of the study area, seismic activity parameters and ground motion attenuation relationship, the international general earthquake risk analysis formula is used to calculate the earthquake acceleration in the project area.

Analysis shows that the seismic peak acceleration for the exceedance probability of 10% in 50 years at the area is 0.20g.

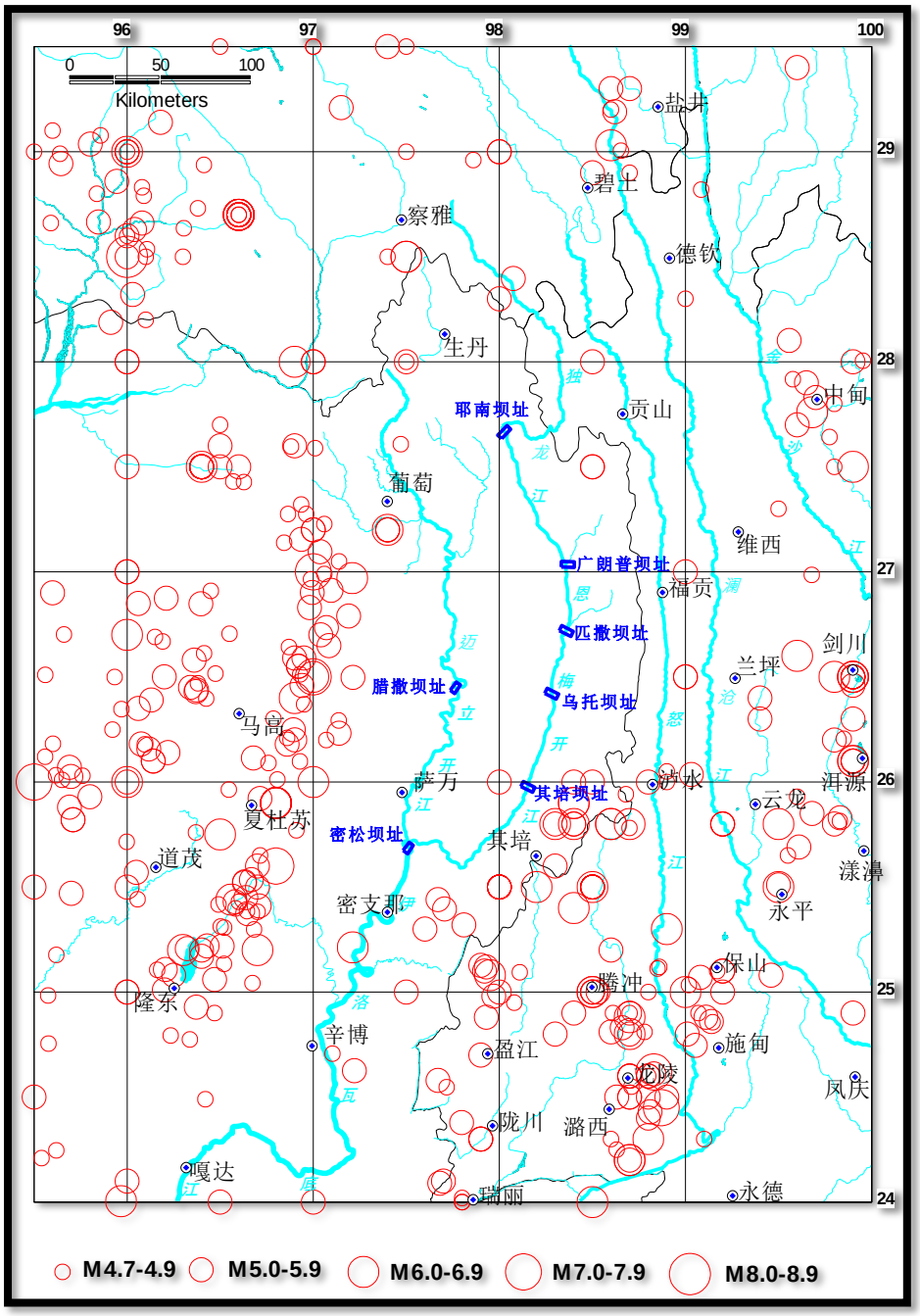


Figure 11.2.7 -6 Distribution of Historical Earthquake (M≥4.7 from 1128 B.C to 2011)

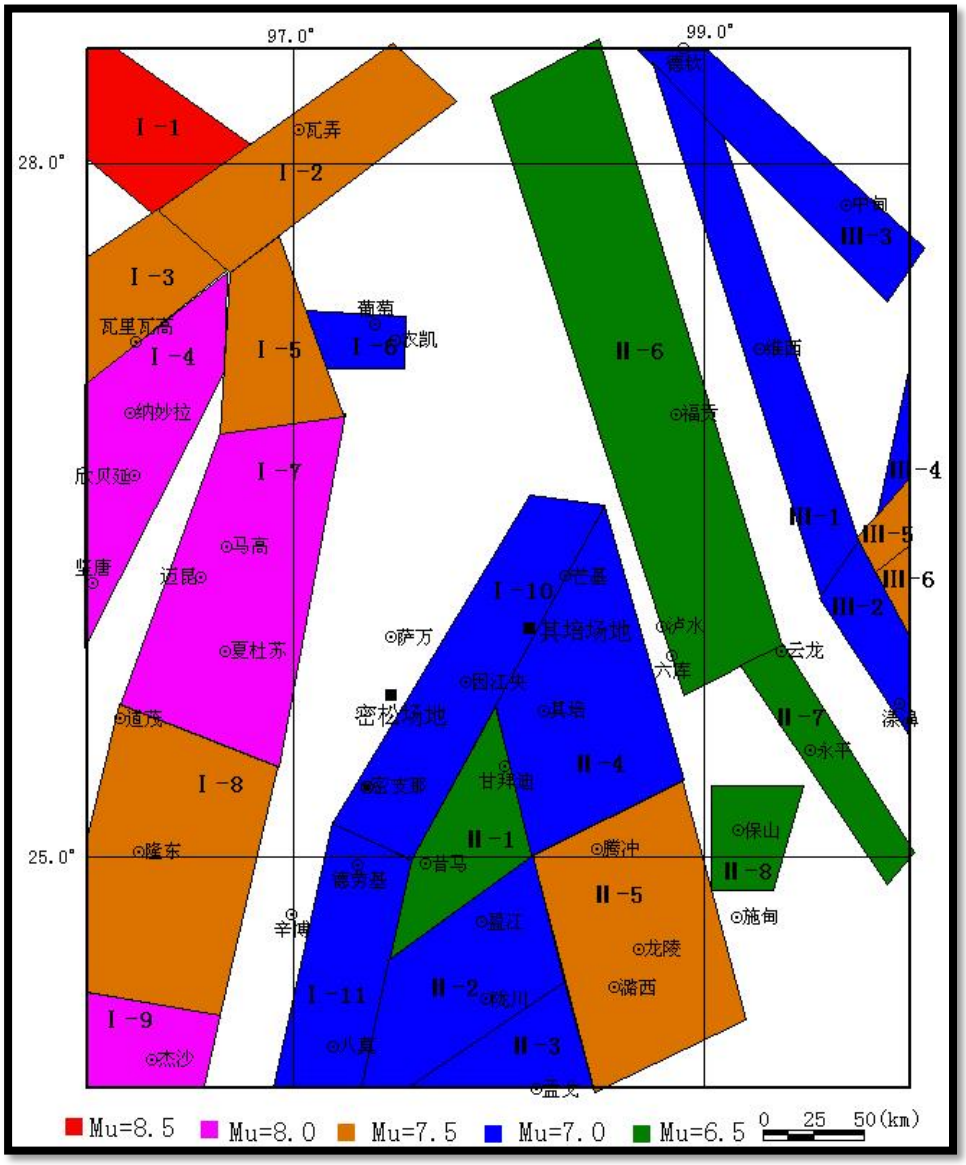


Figure 11.2.7 -7 Potential Seismic Source Zoning.

Dam Safety Reviews

The initial dam safety review should be carried out two years after construction is substantially complete and then every five years afterwards.

Dam safety reviews should be carried out by an internationally recognized, independent dam safety engineer who was not involved in the design of the project. Normally this review would look at previous inspections, instrumentation reports and annual inspection reports, along with a comprehensive site inspection.

The table below shows that the mitigation proposed to provide these safeguards is to establish a Disaster Preparedness Plan (DPP) and an early warning system, and to regularly train the key persons responsible for implementing the DPP.

Table 11.2.7-4 Potential operation phase impacts on dam safety and mitigation required

Potential Impact	Required Mitigation	Implementation	Checked by
It is very unlikely that a concrete dam will fail as this has not occurred since 1930s. If there was a failure, water levels would rise by 20 m over a wide area, causing large scale damage, destruction and death.	Prepare a Disaster Preparedness Plan (DPP) with activities and responsibilities to minimize loss of life and property damage. Set up emergency warning system to inform people of likely dam failure and emergency actions to save lives and communities.	Chipwi Nge Hydropower Company	Department of Hydropower Implementation

The DPP should address the training, resources, responsibilities, communications, procedures and other aspects required to respond effectively to the emergencies associated with a potential dam failure. It should include a plan to provide appropriate information to the potentially-affected communities about emergency preparedness and response activities, resources and responsibilities, in a manner that is appropriate to the risk that will not raise unnecessary alarm.

The DPP should include but not be limited to the following elements:

Dam Break Analysis and Inundation Mapping	• Risk of dam breach, including seismic analysis; • Accurate and current inundation mapping for the dam breach event (incorporating analyses from the design stage if suitable); • Land use in inundation areas, inhabitation, significant development and high-risk areas (schools, hospitals, dense inhabitation, etc.);
Emergency Action Plan	• All actions in the event of a dam breach, covering pre-disaster, emergency, and post-disaster stages, with activity schedules and responsibilities; • Actions include: preventative; notifications; warning procedures; interagency coordination; evacuation plans, with prioritization and shelter plans;
Preventative Action	• Dam inspections; spillway opening regimes; regimes at downstream dams; • Emergency equipment and personnel (sources and sourcing);
Notification:	Notification procedures: key responsible personnel; emergency agencies; national authorities; communication methods; contact details

Meanwhile, to protect the intake of water conveyance structure against sediment blocking, sediment flushing outlet for flood discharge shall be used at the beginning and the end of flood season each year for sand removal. Detailed application is explained as follows:

(1) When the water inflow reaches about 80m^3/s at the beginning and the end of flood season each year, the sediment flushing outlet for flood discharge must be used for one operation of sand removal.

(2) The sediment flushing outlet for flood discharge shall be put into operation when the discharge flow of the complex reaches 170m^3/s, then closed when the reservoir level is down to 735m and started again when the discharge flow reaches 170m^3/s. Repeat the foresaid procedure and carry out the sand removal.

(3) With regard to the relatively numerous floating objects and serious silting in the reservoir at present, they are mainly caused by construction wastes in the upper reaches. Before impoundment and power generation, the sediment flushing outlet for flood discharge shall be put into operation and dredging & excavation work shall be done if necessary, to reserve a sufficiently effective capacity of the reservoir.

Budgets: This study and follow-up actions will be conducted by external consultants with no prior relationship to the Chipwi Nge Hydropower Project, who will be appointed by the company. A budget for the work is given below.

Work Item	**Quantity**	**Unit**	**Rate (USD)**	**Cost (USD)**
Senior Disaster Management Specialist	10	Persons-month	1400	14,000
Flood risk modeller	2	Persons-month	700	1,400
Supporting Staff	10	Persons-month	350	3,500
Per Diem	10 x 22	Day	15	3,300
Transport	2	LS	2,450	2,450
			Total	24,650
Assumptions: Senior specialist and support staff – 50% home office, Flood modeler – 100% hoe office. Fieldwork conducted in two –week visits, including travel, one vehicle.				

Implementation Plan

Senior Disaster Management Specialist:

 Obtain from Chipwi Nge Hydropower Co., Ltd. and review all available material on the Chipwi Nge Hydropower Project (Feasibility Study reports, FS Review reports, Detailed Designs, reports and drawings); and the project location and its characteristics (Environmental Impact Assessment Report and EMP), etc.

 Obtain and review data from other studies, government departments, satellite imagery, etc., as appropriate;

 Plan and manage dam break analysis, flood-risk modelling and inundation mapping; quantify risks and prioritize areas using internationally accepted norms;

 Plan all emergency procedures and prepare a draft Disaster Preparedness Plan;

 Plan, organize and conduct a programme of awareness raising amongst institutions and the general public in the flood risk area (in discussion with MOEE), which is appropriate to the level of risk, and prepares people and institutions, without raising undue alarm;

 Assist EPGE in setting up an Emergency Action Committee and other necessary organizations; and prepare and conduct training for all members in their roles, responsibilities and activities in DPP implementation

 Assist EPGE in planning, organizing and conducting a practice Disaster Management Exercise, and recording the outcomes, effectiveness and any necessary revisions;

 Revise the draft DPP as necessary to incorporate experience and feedback from the practice exercise and prepare and submit the final version.

b) Supporting Staff:

 Work under direction of the Senior Specialist, providing assistance in: obtaining, analysing and reviewing data; conducting field observations; preparing material for the

DPP; preparing training materials; liaising with community organizations and other parties; etc., as directed.

c) Flood-risk modeller:

 Create and run a topographically accurate mathematical model of the area downstream of the Dam and conduct an analysis of the flood risk following total dam failure with the reservoir in maximum flood. Include on the model accurate depictions of land use, inhabitation, population

and other key features to enable a comprehensive analysis of flood risk areas, categories of risk and prioritisation;

 Assist the Senior Specialist in interpreting the model and applying its output in providing material for the DPP as necessary.

11.2.7.5 Waste Management Plan

Objectives: To minimize impacts on environment due to improper disposal of domestic wastes from the office, accommodation and canteen of hydropower plant and accommodation facilities.

Legal Requirements

Environmental Conservation Law, 2012

Environmental Conservation Rules, 2014

Environmental Impact Assessment Procedure, 2015

The wastes generated basically during operation phase will be managed according to related Municipal Legislation, and the Prevention of Hazard from Chemical and Related Substances Law (2013).

Domestic Waste Storage Places during Operation

There are 73 Chinese and Myanmar employees in the Chipwi Nge HPP, including 15 from China, 12 from EPGE, 42 from Myanmar and 4 dispatched workers. The HPP is equipped with single apartments and such living goods as quilts and televisions for employees. Staff canteen, with professional chefs, is provided. In order to enrich staff's life in spare time, billiard room, gym, basketball court, badminton court, sepak takraw court, KTV and other activity places are provided.

Both living quarters and office area have water dispensers and barreled water. To ensure the water safety, the domestic water system is inspected regularly, with water tanks cleared, and water samples are sent to Tengchong County in China for testing.

The domestic waste incineration disposal pit is provided adjacent to living quarters, and green bins are arranged in living quarters, office area and production area so that the wastes can be collected separately, stacked in a centralized manner and processed at specified locations.

The domestic waste incineration disposal pit is provided adjacent to living quarters, and green bins are arranged in living quarters, office area and production area so that the wastes can be collected separately, stacked in a centralized manner and processed at specified locations.

Centralized Stacking Field of Domestic Waste

Domestic Waste Disposal Pit

Domestic Waste Sorting (Dustbin)

Implementation Arrangements

In order to calculate daily solid waste production due to workers the statistics provided by the EU is considered. In this respect, daily municipal waste production is approximately 1.43 kg/day-capita in similar hydropower projects according to 2007 statistics (Eurostat News Release, 2009). To be on the safe side, the daily solid waste production is taken as 1.5 kg/day-capita. Considering the numbers of employees in construction and operation phases are 73, total daily solid waste production is calculated as 110 kg/day.

The following tasks shall be done as daily basis.

• Waste shall be systematically collected and all types of waste will be separated for (kitchen waste, office's waste, etc.) proper handling and disposal.

• No waste shall be disposed of or buried on the site. Illegal dumping, either at the office compound, along public roads or in the surrounding areas, or into the river shall not be allowed.

• It shall be ensured that power house, reservoir office compound and surroundings are kept in clean and neat conditions at all times and that windblown litter is cleared on a daily basis.

• Separate waste containers (drums, bins, skips or bags) shall be provided for different types of waste.

• Waste containers shall be provided with lids or netting to prevent wastes being carried around by scavengers or the wind and to prevent animals to be attracted to the waste.

• Domestic solid wastes will be collected and disposed properly by the nearest municipality to the designated disposal site after agreement with the municipality.

• At these disposal sites drainage channels and culverts will be incorporated so that the stored material is not washed out. In this way, both the material will be kept stabilized in place and the river water will be protected against sedimentation.

• Power house and reservoir workers will be instructed in proper solid waste storage and handling procedures.

Monitoring Plan

Domestic waste from office, canteen and accommodation during operation phase will be managed according to related Municipal Legislation. The waste management plan will be implemented easily and no further monitoring plan will be required.

Projected Budgets and Responsibilities

The implementation of domestic waste management plan will be done by staff of HSE department of the Chipwi Nge Hydropower Company in the course of their normal duties so no budget provision is needed.

Responsibilities

Environmental Management Department, Chipwi Nge Hydropower Company.

11.2.7.6 Health and Safety Plan

Objectives

The objectives of the Regional Health Program are as follows:

- Prevent and mitigate effects of construction and of operation on the local population
- Improve the health situation of the local population
- Assist in capacity building of the Public Health Institutions for addressing their target populations‟ health needs

Legal Requirement

The project activities should be carried out in accordance with the relevant health and safety issues that are in the scope of Relevant Myanmar Law and IFC Standards and Requirements.

Furthermore, Labour Law of Myanmar stated in Chapter 2 also includes the significant issues regarding health and safety of workers.

Public Health Law (1972): The law is concerned with protection of people's health, controlling the quality and cleanliness of food, drugs, environmental sanitation and epidemic diseases.
Prevention and Control of communicable diseases Law (1995) (Revised in 2011): The law described the functions and responsibilities of citizens and health personnel in relation to prevention and control of communicable diseases. It also describes measures to be taken in relation to environmental sanitation, reporting and control of outbreaks of epidemics.

Implementation

Occupational health and safety management organizations are established and occupational health and safety management systems are developed in all department. The management at all levels from headquarters to all project management offices have established on-site clinics responsible for epidemic prevention, prevention and control of infectious diseases and drinking water inspection to optimize the protection of the health of workers.

• On-site medical/first-aid facilities are provided in medical center in power house for operation phase to cater for primary health care needs of personnel.

• Vehicles were available on-site for emergency situations.

• Workers were selected from the workforce and given additional training in occupational health and first aid to form teams of three personnel at each department. These workers shall be under the supervision of the person responsible for occupational health and safety.

• Personal protective equipments for workers were provided, when necessary to minimize health and safety risks.

• Appropriate health and safety signs such as “Danger”, “Entrance Prohibited” were placed in proper places.

Regional Health Program will address key national health priorities as follows:

o Expanded Program of Immunization

o Tuberculosis control and prevention

o Malaria control and prevention

o Fresh water and environmental sanitation

o Food hygiene and safety

o Diarrhea prevention

o Acute Respiratory Infection Prevention

o Malnutrition prevention

The Regional Health Program will support improvement of public health institutions and programs through capacity building, infrastructure, equipment, transport, medicine and supplies and operational costs. .

 Implementation and planning will be integrated;

 Capacity building is recognized as a key program component;

 A referral system will be developed linking Commune Health Centers, District Hospitals and Provincial Hospitals;

The Chipwi Nge Hydropower Company shall develop OSH committee and the OSH committee aim to develop in the workplace a collaborative approach to managing Occupational health and Safety between management and employees; to provide and maintain safe working procedures and operations ;to ensure awareness of all potential workplace risks and hazards and to develop preventive strategies against these risks and hazard develop; to monitor ongoing health and safety procedures; to investigate accidents and employee concerns; to recommend opportunities to improve conditions; to promote compliance with health and safety requirements and to promote cooperation throughout the team.

Safety officer checks what measure need to be taken during the works on site to ensure safe working as well and management arrangements. Occupational health and safety procedures are conducted in accordance with Myanmar labor law and international standards. The best facilities such as adequate toilets, clean accommodation, canteen, proper PPEs, first aid kids, medical check-up, etc. have been provided to the employees.

OSH activities

- Promoting health and safety awareness through training workers on health and safety regulations;
- Regular inspection of the workplace;
- Correcting unsafe work practices and conditions;
- Reporting and investigating all accidents or incidents so as to minimize or eliminate hazards;
- Supporting everyday health and safety activities such as ensuring personal protective equipment is available;
- Provision of medical and first aid facilities;
- Monitoring and evaluating occupational health and safety;
- Consider the assembly area and distribute the emergency response practices to all employees;
- Keep the proficient drivers to reduce the traffic accidents;
- Post the safety sign such as “ENTRANCE”, “EXIT”, “DANGER”, etc. in the workplace;

- Keep fire extinguishers, first-aid kits and PPEs adequately in the workplace;
- Tool box meeting is hold separately in accordance with the respective departments;
- Conduct the risk assessment where hazardous area, record every case and reported.
- Keep the emergency contact numbers at the workplace where employees see it clearly.

Main Diseases in the Project Affected Area

According to the Health Study conducted by HIA team (2016), the most common diseases in Chipwi town are Acute Viral Infection (AVI), malaria, Diarrhea, Dysentery, Hypertension, Flu.

The districts are also "hot spots" for illicit drugs. The area not only sells and transports drugs, but local drug consumption is very high.

The Contractor shall prepare and enforce a Health Management Plan to address matters regarding the health and safety of project staff. The Contractor shall include in his proposal the outline of the Health Plan. The Environmental Supervisor will issue a certificate of compliance to the Contractor prior to the initiation of Construction.

The following measures shall be implemented by the Contractor to ensure an adequate Project Health Program:

- Screening of all workers on recruitment and annually;
- Implementation of a comprehensive vaccination program including but not limited to hepatitis A and B, tetanus, polio, etc.;
- Implementation of anti-malaria measures following current accepted practice at the project area and establishment of facilities for the early diagnosis and treatment of patients with the disease;
- Storing sufficient medicines for malaria treatment;
- Storing antibiotics for treatment of respiratory infections;
- Storing medicines and transfusion fluid to treat food poisoning and diarrhea;
- Develop solutions for mass outbreaks of food poisoning;
- Establishment of a medical center located at the main office in power house for the diagnosis and treatment of communicable diseases, simple medical complaints, and the handling of medical emergencies and accidents, prior to transportation to the hospital. The medical center shall have:
  - A 7-10 bed health facility fully equipped to provide emergency medical care to stabilize emergency patients before they can be referred to district or provincial hospital;
  - Essential medical equipment for the center to provide emergency care;
  - Short term care of patients requiring hospitalization;
  - Isolation room (one bed) for any infectious disease patient (in epidemic situations, district and provincial facilities will have to be used;
  - Distribute educational materials including brochures, and leaflets which provide information of Malaria, HIV/AIDs symptoms and counseling and treatment services;
- Mobile clinic shall be provided for public health care program.

Projected Budgets and Responsibilities

The health and safety management plan will be done by staff of HSE department of the Chipwi Nge Hydropower Company in the course of their normal duties so no budget provision is needed.

Responsibilities

Environmental Management Department, Chipwi Nge Hydropower Company.

Institutional Arrangement

Though there is detailed workplace and community health requirement stipulated for power generation sectors, matter pertaining to occupational and community health requirements are general under the jurisdiction of Ministry of Health, Ministry of Electrical Power, and Ministry of Labor. However, when it comes to project development, it is fully responsibility of project proponents to excuse in accordance with existing laws or project principles.

Provided that existing laws do not adequately address mechanism to solve occupational and community health issues arising from project, the role and responsibilities of institutions concerned for health issues shall be falling within the jurisdiction of project management during construction and operation phases.

Institution	Role and Responsibilities
Project Management	- Assigned a staff to deal with workplace health related issues - Assigned a staff to lead a community health care plan - Deal with township authorities for implementing community health care plan
Project Health ,Safety and Environmental Division	- Prepared detailed health management and monitoring scheme largely based on generic EMP and incorporated the workplace and community health matters into EHS Management System - Ensure that all issues pertaining to occupational and public health are adequately addressed - Establish a community health care plan
Occupational and Community Health Staff in Project HSE division	- Dealt with workplace health and community health issue - Develop, maintain and monitoring the health related mitigation measures as required by project EMP - Development community health surveillance mechanism - Report to any health related issues to chief of project HSE Management unit and project management - Update the occupation and community health related legislative framework - Establish communication channel with township or district level public health department to discuss and report any project related occupational and community health issues - Ensure implementation of health monitoring scheme Work together with other occupational safety and environmental management staff for effective performance of EHS Management System.

Budget for Implementation of Health Care Management

The total budget for implementation of health care management is about USD 174,800 including health checkup for the labourers. The details are given in the following paragraphs.

A. Expenditure on salaries

Dispensary

Post	Number	Monthly Expense (USD)	Annual Expenditure
Doctors	1	1,200	14,400
Nurse	2	400	9,600
Male Multipurpose	1	200	2,400
Driver	1	200	2,400
		Total	28,800

B. Expenditure on Material and Supplies

Dispensary

Non-recurring

i. 2 Vehicles (Ambulance and Jeep) - USD 22,000

ii. Furniture, etc. - USD 21,000

Recurring

i. Drugs and Medicine - USD 82,000

ii. Contingencies - USD 10,000

C. Health Checkup

Full health screening of labourers a provision of USD 11,000 per year can be estimated.

11.2.7.7 Environmental Management Plan for Aquatic Ecology (Mainly fish)

Objectives

The main concern in the operation phase is maintaining present fish populations above and below the dam site in a viable state (effectively continuing to breed within the newly confined sections, above and below the dam).

Impact and Mitigation

Chipwi River is a fast-flowing mountain stream with average slope of 5% to 6%. Schizothorax, pareuchiloglanis, glyptothorax and pseudecheneis of fishes suitable for rapid stream habitats are likely to inhabit in Chipwi River. Spawning sites are located at the transition area between turbulent and low flow in valleys.

After the power plant is completed, water flow of about 15.7km long river reach from the downstream to the powerhouse will decline sharply which in turn will cause reduction of plankton and benthos. Fishes in this river reach will also decrease. Affected by the reduction of water volume in this river section, the Spawning sites will transfer to the upstream or rapids environment of Nmaihka River. However, the fishes of Chipwi Nge River are widely distributed in the Nmaihka River basin. Comparing to the scales of these two rivers, the project reduces only their scope of habitats and the reduction is very small. Thus, reduction of water flow in the water reduction river reach has a limited impacts on fishes.

Direct impact on the water ecological environment by a hydropower project is damaging continuity of flow and causing fragmenting of ecological environment, which are common issues of all hydropower stations. As for migratory fishes, blocking- affects of the dam may cause failure of life history of some individuals; for fish without obvious migration features and resident fishes, long-term consequences of breaking of the ecological environment may lead to reduction of diversity of fish community heredity and affect population survival.

According to comprehensive analysis on fish distribution, migrating habits and spawning habits in the Chipwi Nge, fishes in the river are resident with short migration distance. Proper ecological environment can be found in the lower and upper reaches of the dam and the life history can be completed. Reference to hundreds of small water diversion-type power stations, no fish passages are generally built in the absence of migratory fishes that require special protection.

The most appropriate and practical mitigation measures during the operation phase are described below.

The Chipwi River upper catchment is identified as a key area for aquatic (mainly fish) habitat protection, to enhance the conservation of moderate priority fish in the project area, as well as to maintain vegetation and reduce soil loss, to prevent negative impacts on aquatic habitats.

Table 11.2.7-4 is provided here to summarize the main actions as they relate to protection or enhancement of fish habitat.

Table 11.2.7- 4 Proposed offset habitat protection program.

Action	Output/ Outcome for Fish Habitat
Identification of critical areas for fish in order to facilitate natural movement and relocation; this action is linked with the fish translocation plan described previously.	Map of the critical and suitable areas in the Chipwi River system for natural upstream relocation and facilitation of natural upstream movement of fish.
Identification of the most depleted areas in the upper catchment and preparation of suitable habitat improvement plans that include sediment erosion controls (watershed management).	Map of the upper catchment up to available area prepared, along with proposed watershed management plans (sediment erosion controls).
Implementing an afforestation program around the reservoir. This action is linked with terrestrial habitat enhancement for wildlife.	Reservoir buffer zone (200-meter wide) planted; reducing sediment inputs to the reservoir and providing shade along reservoir edges.
Community awareness program; this action can be linked with other awareness programs related to fish conservation and the afforestation and watershed management plan.	Communities are educated about the importance of upper watershed management for the conservation of the native fish of the area.

Implementation Organization

Environmental Management Department is responsible to lead and coordinate with aquatic specialist to develop this action.

Budget

The cost for implementing this plan is included in the main budget for Implementation of EMP.

11.2.7.8 Environmental Management Plan for Flood Risk

Objective

The environmental management plan for flood risk is to prevent loss of life in downstream area.

Implementation

The maximum flood peak and minimum discharge are calculated based on the average monthly run off first and estimation of design flood for Chipwi Nge Hydropower was conducted.

Maximum flood peak and minimum discharge (or runoff)

Calculation of runoff

The average monthly runoff of the hydropower plant at the dam site is calculated using the hydrological measurement of Dongying Station.

Using the time series of Dongying hydrological station during 1959～1987 (measurement is unavailable in some years), the ratio of monthly distribution of runoff was calculated. The monthly runoff at the dam site was therefore obtained using such distribution ratio at Dongying station, according to rainfall at the dam site. The monthly (and annual) runoff at the dam site is shown in in Table 11.2.7-5.

Table 11.2.7-5 Monthly runoff of the dam site of the hydropower plant

Month	January	February	March	April	May	June	July	August	September	October	November	December	Year
Flow	10.2	9.65	11.6	10.7	18.4	75.9	104	85.6	65.1	49.9	23.1	13.6	40.1
Runoff	0.27	0.24	0.31	0.28	0.49	1.97	2.80	2.29	1.69	1.34	0.60	0.36	12.6
Ratio	2.2	1.9	2.5	2.2	3.9	15.6	22.1	18.1	13.4	10.6	4.7	2.9	100

Flow: m^3/s; runoff: hundred million m^3; ratio: %

Estimation of Design Flood

The estimation of design flood at Chipwi Nge HPP follows the steps of:

1) Estimate design storm: Convert the annual maximum storm in 1 day into 24hr storm, and then calculate the design storm volume for 1hr and 6hr according to the distribution ratio for 1hr and 6hr of the basin near Yunnan province in China;
2) Estimate design area rainfall (volume): According to the Manual, taking the reduction coefficient of spot and area in the 4thzone as the reduction coefficient of spot and area of storm of catchment area cc of the hydropower project, calculate the design area rainfall (volume);
3) Estimate design area rainfall (hydrograph): obtain the design area rainfall process by referring to the design hydrograph in the 4thzone.

Considering the well-conserved vegetation of Chipwi Nge River basin and the landform of mountainous areas, referring to the values applied in the neighbor area of Yunnan province, the initial loss of 25 mm and the infiltration rate of4.5mm/h were adopted. Similarly, the routing parameters of the 6th and 8thzones of Yunnan province are adopted. Design flood with various frequencies of Chipwi Nge is then estimated using parameters obtained. The results are shown in Table11.2.7-6.

Table 11.2.7-6 Design flood of the Chipwi Nge HPP

Frequency	0.2%	0.5%	2%	3.33%	5%	10%	20%
Flood peak (m^3/s)	2540	2200	1710	1500	1320	958	489
Flood peak modulus ($m^3/s \cdot km^2$)	6.11	5.29	4.11	3.61	3.17	2.30	1.18

Implementation for Mitigation

The total annual mean sediment discharge at the dam site is 869,000 t and the reservoir capacity below normal pool level is 789,000 m^3. Therefore, the ratio of reservoir capacity below normal pool level to annual sediment discharge (volume) is comparatively small, indicating that there exist relatively severe deposition. The calculation result shows a fast deposition rate and the total deposition is about 690,000 m^3. To mitigate the deposition effects on the reservoir

operation, one orifice with the size of 5m×6m is placed in the dam body to discharge flood and sediment. This orifice will be put into use for sediment flushing when the incoming sediment load is high.

It should be noted that no sediment deposition is found in the tailrace area of the power plant.

Implementation Organization

Environmental management team of the company will responsible for this action and budget for this plan is included in main budget for EMP.

11.2.7.9 Emergency Action Plan

A draft emergency preparedness/action plan has been prepared for the emergency situations that could occur in operation phases. According to the following plan, Coordinator of Emergency Action Plan identified missions and responsibilities of every individual, and the procedures that should be implemented in emergency situations via forming an Emergency Action Team. This Draft Emergency Action Plan will be improved during operation phases by the Coordinator and Emergency Action Team as necessary.

Purpose

The purpose of this Emergency Action Plan (EAP) is to protect lives that would be affected from emergency events that are not foreseen during construction and operation phases of the project, natural disasters (fire, earthquake, flooding etc.), hold up, communication loss, incidents in facility, wrong operation, disordered maintenance, and reduce the potential impact on dam and nearby settlements.

In order to implement this plan, an Emergency Action Plan Coordinator and team will be assigned by the project owner/sponsor/developer. These persons will be trained and their mission will be clearly specified. Thus, it will be ensured that each staff would know his/her own responsibility in a potential emergency situation.

Mission and Responsibility

Project Owner/Developer

All the activities that are performed during operation phases of the project are under the responsibility of the project owner (his representative).

The missions and responsibilities of the project owner in the context of Emergency Action Plan are summarized below:

- Selection of the Emergency Action Plan Coordinator and approval of Emergency Action Team
- Attending the annual review meetings related to EAP and approval of the recent version of the EAP
- Approval of the activities that are not included in EAP during emergency situation
- Analyzing the reports prepared after any emergency situation

Emergency Action Plan Coordinator (EAPC)

In general implementation of the activities developed and specified in the Emergency Action Plan, and improving this plan are the main responsibilities of the Emergency Action Plan Coordinator. More detailed responsibilities of EAPC can be summarized as follows:

- Establishment of the Emergency Action Team (EAT)
- Training the EAT and the project staff for emergency situations
- Making the division of responsibilities between EAT members
- Reviewing and improving, if necessary, the EAP with the EAT annually
- Controlling functionality and practicality of the EAP by performing maneuvers in specified intervals

- According to type of emergency situation, determination of the people that will be contacted during emergency action, and keeping contact information of these people in written form in a place that everybody in the EAT can reach
- Keeping the contact information of the EAT and people that will be contacted in emergency situations updated
- In emergency situations, coordinating the EAT in order to successfully implement the EAP
- Implementation of the necessary measures, which are not specified in the

EAP, in an emergency situation after the approval of the project owner and after the end of emergency revising the EAP accordingly

- After the end of emergency, reviewing the situation with the EAT and reporting to the project owner

Emergency Action Team (EAT)

Emergency Action Team will be established from the project staff according to their abilities. The responsibilities of the EAT can be summarized as follows:

- Attending the training sections and maneuvers for implementing the EAP
- Reviewing and improving, if necessary, the EAP annually together with the EAPC
- Informing EAPC when an emergency situation occurs
- According to type of emergency situation, implementing the necessary measures in accordance with the EAP
- Notifying the relevant contact people as required in the EAP
- Reviewing the situation with the EAPC after the emergency situation, and preparation of the report

Possible Emergency Situations

Accidents

Potential accidents during operation may cause injuries and even death. In such situations, the first aid will be provided by the EAT team and for further action assistance will be sought from the office clinic and/or the closest hospital. In any injury encountered in the power plant first aid will be the responsibility of the EAT team members and/or the medical doctor available at the office facilities. In the meantime, to prevent any further damage other EAT members will ensure environmental safety, investigate any fire possibility, and clean any spilled materials.

As a result of some accidents, fuel, oil, or other hazardous liquids may reach the surface waters. When fuel or other hazardous materials are seen floating in the surface waters, first EAT will intervene, and, if necessary, the closest fire department will be contacted to get assistance. Fuel, oil, and other floating materials will be separated from water via skimming. These skimmed materials will be collected in sealed tanks and disposed in accordance with relevant Regulations.

Mission and responsibilities of the EAT in accidents are as follows:

1. All of the team members should know the type of injury risk in each work area.

2. In emergency situations, team members will check for the persons that might be injured in their area of responsibility.

3. The EAT member who identifies a person with injury will provide first aid as proper. If he/she decides that the injury is beyond his/her ability for first aid than a more capable, or authorized person (such as a doctor) will be waited. Any attempt that may worsen the situation of the injured person should be prevented.

4. Depending on the type and extent of injury an ambulance may be required.

In such a case, a member of the EAT will wait in the road junction (or such) to direct the ambulance to the incident location.

5. After the arrival of the ambulance the responsibility passes to the medical personnel that arrived with the ambulance, but EAT member(s) will help first aid activities if needed.

6. During the first aid activities, EAT prevents the entrance of irrelevant people to the incident area.

7. After the completion of the necessary actions and/or injured person is sent to the hospital, the incident record is prepared.

8. If there is no injured person in an accident, EAT secures the incident area and reports to the EAPC.

Fire

Fire possibilities will be minimized in the power plant and office facilities by taking necessary preventive measures. In addition, in working areas fire extinguishing equipment shall be kept at proper places for emergency action.

Furthermore, no fires are allowed in the forest areas and all precautions shall be taken in the reservoir area and power plant site to prevent fire. Mission and responsibilities of the EAT in case of fire are as follows:

1. All of the team members should know the fire risk in each work area. They have to know how to extinguish different types of fires as well.

2. In emergency situations, team members shall check for any fire in their area of responsibility.

3. If any fire is determined or emergency situation is a fire, EAT takes the necessary actions for extinguishing without panic under the control of the team leader.

4. Depending on the type and extent of fire a fire engine may be required. In such a case, a member of the EAT will wait in the road junction (or such) to direct the fire engine to the incident location.

5. After fire engine arrives, team members help extinguishing activities if needed.

6. During the fire fighting, EAT prevents the entrance of irrelevant people to the area.

7. If any fire is not determined after emergency situation, team members are counted, and present under the head of team leader collectively.

Earthquake

Trainings will be provided to all workers related to actions to be taken during an earthquake for their safety. If an earthquake greater with a scale of more than 5 on Richter scale is determined in the area, and workers on duty feel earth tremor or are exposed to specified earthquake consequences (feeling of the earthquake by everybody, moving/falling of objects in the shelves, moving/falling down of furniture, fracturing of some plasters and walls, quaking of trees and shrubs), the steps given below will be followed and implemented:

1. After the incident, general visual control of dam shall be done.

2. After audits and controls are completed, relevant authority shall be notified regarding the results.

3. If dam collapses or a serious damage is of concern, settlements located in the downstream, and other dams shall be informed immediately.

Furthermore, water level in reservoir shall be reduced under control.

4. If a serious damage on the embankment of the dam is determined, water level in the reservoir shall be reduced under control. Water releasing shall continue until dam embankment is controlled by an authorized engineer or dam owner.

5. If a minor damage on the dam is of concern, monitoring of relevant elements of the environment shall be initiated immediately and collapse risk of dam shall be assessed. Afterwards, instructions shall be applied via contacting with local and national institutions.

Flood Risk

The water level in the reservoir may increase rather quickly due to high intensity of precipitation and increased flows in the tributaries and surface runoff. In such situations, steps given below shall be followed in order to prevent any adverse impacts on dam embankment, reservoir area and its surrounding, settlements located in the downstream:

1. Local emergency units shall be contacted. Information related to below subjects shall be given.

· Existing reservoir height and free board (safety portion/height) height

· Reservoir rising velocity

· Weather conditions (past-momentary-future)

· Discharge/drainage conditions of downstream of river

· Leakage velocity from canals

2. If it is possible, discharge amounts at gates and spillways shall be increased incrementally.

3. Public living at the downstream will be warned and discharge amount shall be increased incrementally in order not to affect them adversely.

4. Depending on the change in water level, increased or decreased leakage shall be controlled.

5. Areas close to dam foundation or crest shall be controlled against leakage, decadence, collapse, slide and other dangerous situations. If such situations exist, settlements located at the downstream and relevant authorities shall be informed immediately.

Risk of Dangerous Materials

Special warehouses or oil depots are set for dangerous materials and special management regulations are made for effective management. Relevant management regulations include *Regulations for Management of Major Hazard Sources of Chipwi Nge Generation Branch of SPICYN, Management of Dangerous Goods and Major Hazard Sources of Chipwi Nge Generation Branch of SPICYN* and *Management Measures for Major Hazard Sources Monitoring of Chipwi Nge Generation Branch of SPICYN*.

Chemical Warehouse

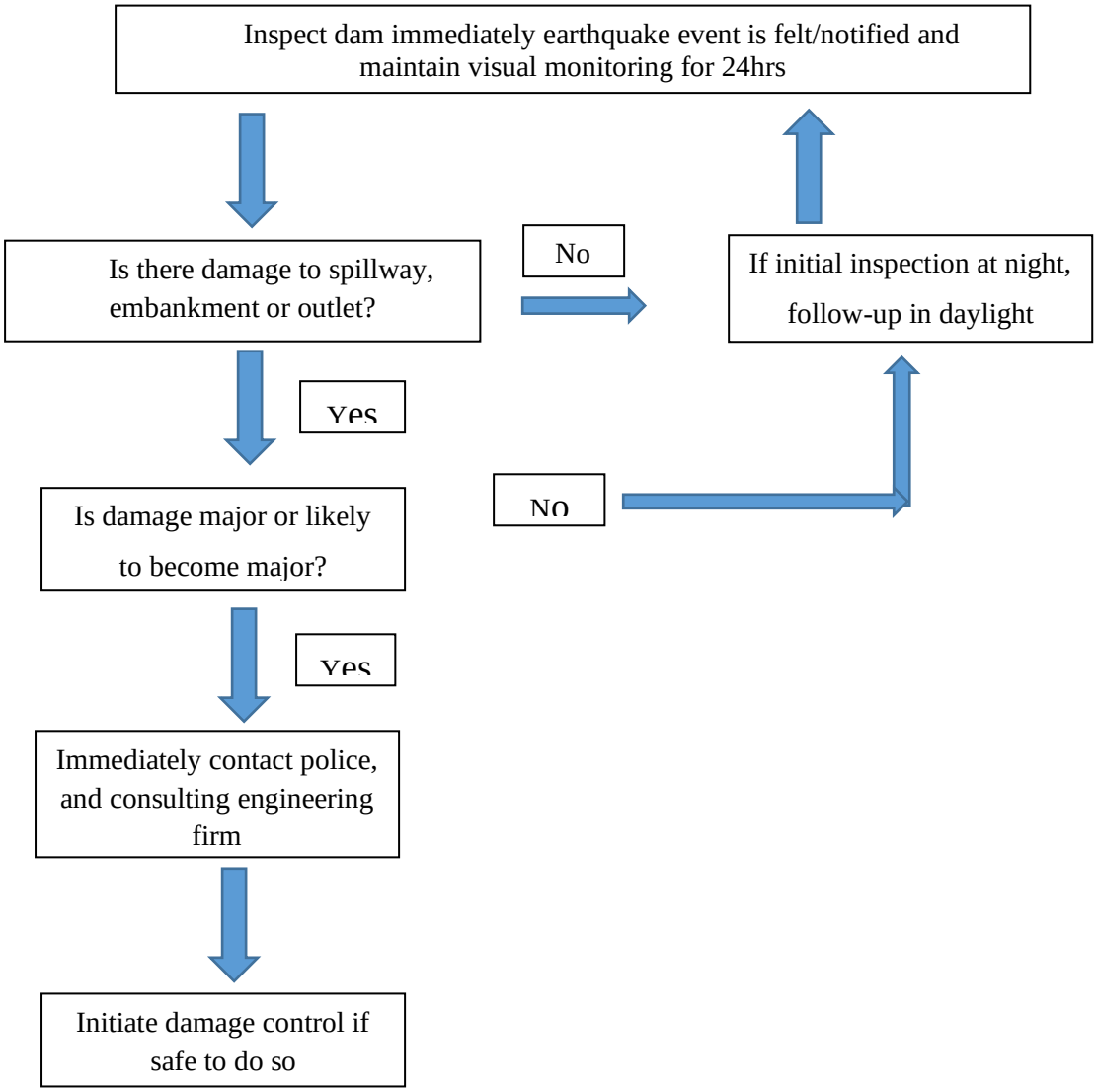
Lightning Rod for Oil Depot

End of the Emergency Situation and Further Actions

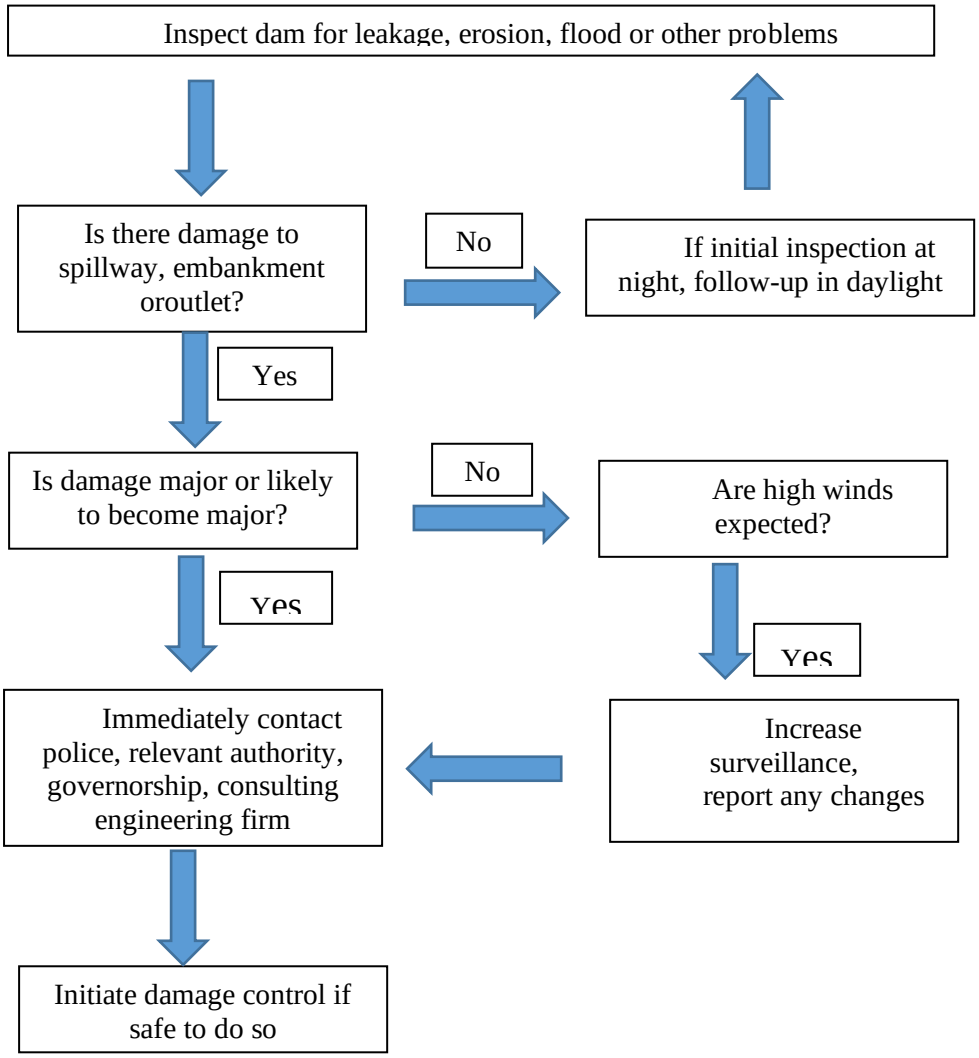
When the emergency conditions end at the reservoir and power plant area and EAPC approves the safety of the project area, relevant units and authorities are informed related to the incidence. EAT makes a general assessment together with the EAPC and prepares the report regarding the emergency incidence. The activities taken during the emergency shall be assessed and any necessary adjustments and/or improvements shall be made in the EAP. If the emergency incidence is an unforeseen case, the precaution measures to prevent this type of emergency incidences and the action plan for such emergencies will be developed and integrated into the EAP.

Emergency Action Flow-Charts

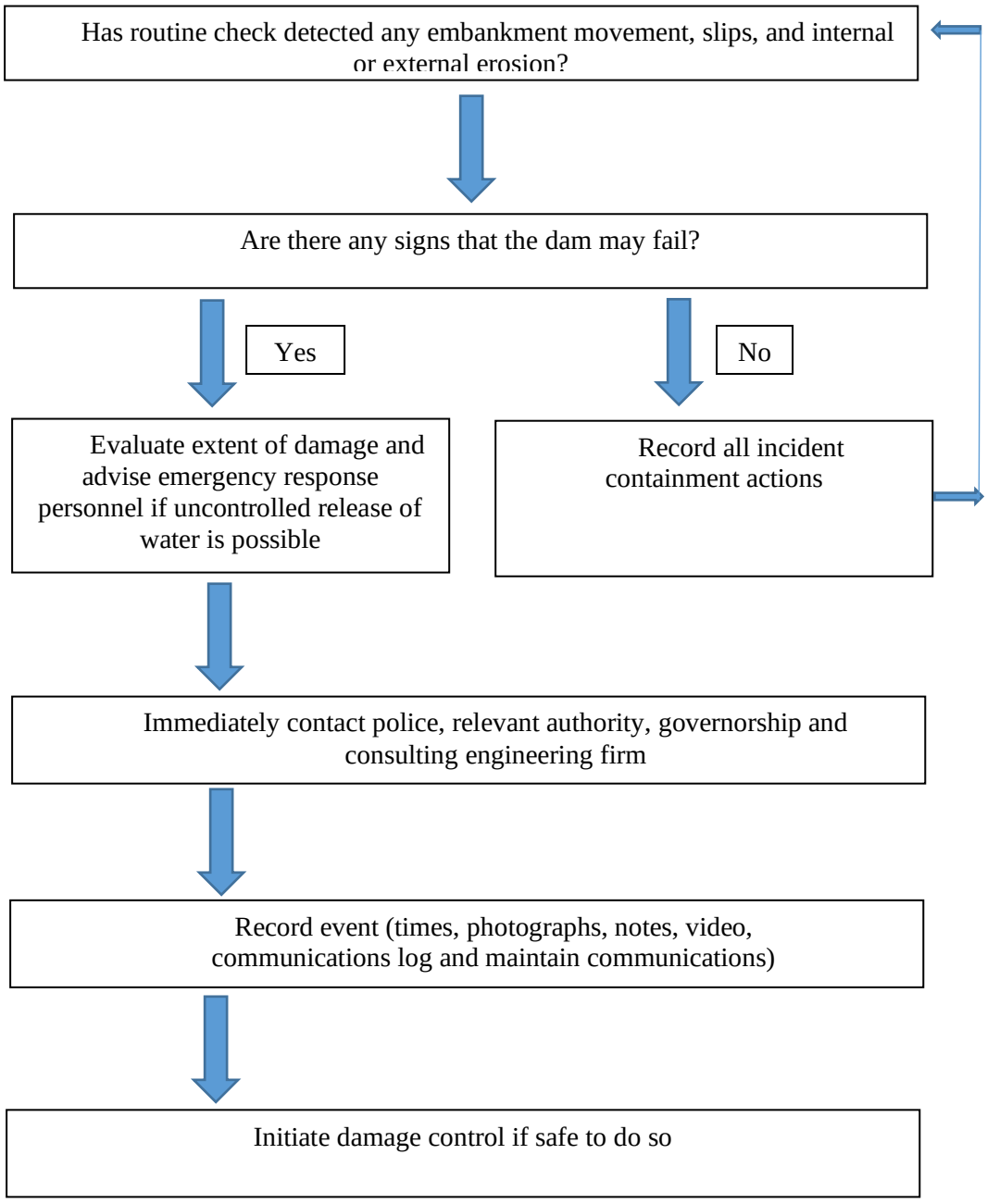
Earthquake:



Extreme flood/ flow:



Major Structural Failure:



Emergency Action Team (EAT)

Table of Emergency Contact List

Main Contact Numbers of Power Plant and Reservoir Area		
Name	**Position**	**Phone No:**
Mr. Xia Yuankang	Project Manager	0086-08756839001
Mr. Zheng Fumin	Health and Safety Supervisor	
Mr. Chen Feng	Assistant General Manager	0086-08756839002
Daw Moe Moe Aye	SE	
U Nay Chi Min	First-aider (Power House)	013331127
U Kawn Bawn	First-aider (Reservoir)	013336528
Mr. Fan Linpeng	Emergency Controller	013331127

Main Contact Numbers from Local Area		
Name	**Position**	**Phone No:**
Chipwi Township Fire Department	For emergency	09-753214
Chipwi Township Police Station	For security	09-451472
Chipwi Township Hospital	For injury	09-853214
Chipwi Township	Chief Administrator	0991001807

11.2.7.10 Public Consultation and Stakeholder Engagement Plan (SEP) during Operation Period

Objectives

The SEP describes the Project strategy and procedures for interactions with stakeholders at local, regional and national level, with particular focus on Project Affected Parties (PAPs). The SEP also outlines a grievance mechanism to allow stakeholders to bring concerns to the Project attention. The SEP is designed to promote the Project objectives in the field of stakeholder engagement: by providing good public information, communicating well with all stakeholders, and developing positive relationships with local and regional communities, markets and clients, the Project enhances its reputation, brand, and ultimately, value but it also reduces the risks deriving from social instability improperly managed and impacting Project activities. By adopting this document, Chipwi Nge Hydropower Company shows its will to engage in fostering good stakeholder relations and communication with local and national groups.

The purpose of this SEP is to establish and maintain a constructive relationship with affected people and other interested parties over the life of the Project in order to obtain and maintain the "social license to operate" and broad public support.

The objectives of stakeholder engagement are:

- to ensure the timely provision of relevant and understandable information;
- to create a process that provides opportunities for stakeholders to express their views, concerns and complaints, and allow Chipwi Nge Hydropower Company to consider and respond to them;
- to maintain awareness of safety and environmental issues among communities in the vicinity of Project facilities;
- to monitor community attitude to the Project;

- to manage and monitor the effectiveness of any corrective actions implemented as a result of stakeholder concerns or complaints during Project activities;
- to manage and report on the closing out of stakeholder concerns or complaints; and
- to comply with IFC PS.

Stakeholder engagement will include an on-going communication process based on:

- public disclosure of appropriate information so as to enable meaningful, accessible and continued communication to consultation with stakeholders;
- meaningful consultation with potentially affected and interested parties; and
- a procedure by which people can make comments or complaints.

Legal Requirements

Environmental Conservation Law (2012)

Environmental Conservation Rules (2014)

EIA Procedures (2015)

Implementation

Engagement Strategy and Methods

Chipwi Nge Hydropower Company will keep ongoing consultations with all identified stakeholders. Consultation activities will not be limited to a single meeting with the interested parties but will entail a series of meetings, discussions, and opportunities for affected parties to learn about the Project details, be informed of the potential impacts, and of planned mitigation measures. They will be followed up with written records and agreements. These activities are valuable for Chipwi Nge Hydropower Company to understand stakeholder concerns, gain feedback, identify potential risks and act pre-emptively to ensure positive outcomes. At the same time, the Chipwi Nge Hydropower Company awareness of the local context will allow to better define and tailor community development activities.

Chipwi Nge Hydropower Company will prepare information to be disclosed in advance and in a format adapted and suitable to the different public and groups. It will identify multiple and preferred communication channels to convey information on the Project activities and mitigation of identified impacts, or occurrence of new impacts, effectively so as to be fully transparent and informative. In addition, the venue and timing of meetings will be adapted to stakeholders' preference and needs.

Chipwi Nge Hydropower Company will create a website with the main Projects' information and events of interest for the various stakeholders. The documents and information that will be disclosed in the website include, but are not limited to, the following:

- the SEP, that will be disclosed in English and Burmese;
- ESIA executive summary;
- information on the construction schedule and services disruption;
- stakeholders consultations time, venues and minutes;
- grievance procedure;
- community development activities; and
- SEP Manager contact.

Considering the low percentages of internet users in the affected area, the Project disclosure through Chipwi Nge Hydropower Company website will be mainly targeted, but not limited to, specific stakeholders (NGOs, national or regional stakeholders, authorities, Lenders, etc.).

In addition, given the particular setting of Project operational areas, possible methods to reach the target audience include, but are not limited, to:

- open meetings with residents of the affected communities (e.g., at schools, public/ religious or associations premises);
- separate meetings with land owners/land users, vulnerable groups, farmers associations and local NGOs, as needed and appropriate;
- brochures, posters, informative leaflets at key communities' centres, and radio announcements, in particular to inform about the construction schedule, grievance mechanism and forthcoming community meetings. Written information material should take in duly consideration the fact that there is a relevant number of illiterate people in the area; and
- social media: this method can be useful to keep ongoing communication with NGOs and other interested stakeholders.

Chipwi Nge Hydropower Company will provide and publicise well in advance a schedule of the dates and locations of any planned consultation activities, including follow up and disclosure activities. A stakeholder engagement and disclosure plan detailing methods and content of engagement and disclosure for each type of stakeholder is presented in Table 11.2.7.7.

All meetings will be carefully documented and logged, minutes taken, and follow up activities recorded. A Public Grievance Sample Form and the Consultation Information Template are presented in the following Tables.

Table 11.2.7-7 Preliminary Stakeholder Disclosure Plan during Operation Phase.

Project Information Dissemination Methods	Stakeholders Addressed	Information Disclosed	Timeline	Resources - Responsibilities
Face-to-face meetings with PAPs	Residents and representatives of the Project affected communities, vulnerable groups, local businesses	Information on planned activities, assessed positive and negative impacts and mitigation measures, presentation of the external grievance mechanism	Operation Period	Project staff with SEP Manager
Meetings with local level authorities and administrations, National Government Bodies involved in the authorization phases	Regulators (national, governorate, and local)	Project development, identified ES impacts, schedule of activities, definition of the emergency response plan	Operation Period	Chipwi Nge Hydropower Company Managers with SEP Manager
Induction and staff trainings	Staff of Power House and reservoir	Working conditions, OHS induction, and code of conduct/ awareness raising on local customs, internal grievance mechanism	Immediately after hiring and later only when contractual changes occur	Chipwi Nge Hydropower Company Human Resources
Publications/announcements in national and local media, social media, company website	All identified stakeholders	Implementation of EMP and mitigation measures, presentation of grievance mechanism and company points of contacts	Operation Period	Project staff with SEP Manager
Notice boards in the main public spaces of the affected areas	People in the Project affected area (mainly residents), land owners and users	Updated project information, grievance mechanism, SEP Manager contacts	Operation Period	SEP Manager

Table 11.2.7-8 Public grievance sample form.

Reference No:	
Full Name	
Contact Information **Please mark how you wish to be contacted (mail, telephone, e-mail).**	☐ **By Post: Please provide mailing address:** _____ _____ _____ ☐ **By Telephone:** _____ ☐ **By E-mail** _____
Preferred Language for communication	☐ **Burmese** ☐ **English** ☐ **Other**
Description of Incident or Grievance:	What happened? Where did it happen? To whom did it happen? What is the result of the problem?
Date of Incident/Grievance	
	☐ **One time incident/grievance (date _____)** ☐ **Happened more than once (how many times? _____)** ☐ **On-going (currently experiencing problem)**
What would you like to see happen to resolve the problem?	

Signature: _____

Date: _____

Please return this form to:

Name of Contact Person, Position and Title:_____

Address:_____

Tel.:_____

E-mail: _____

Table 11.2.7-9 Consultation information Template.

Disclosure plan

Reference No: **(to be determined by the project)**	
Site name	
Contact details of appointed staff	**Name _____** **Telephone: _____** **E-mail _____**
Language of the Communication Activity	☐ **Burmese** ☐ **English** ☐ **Other_____**
Description of Consultation Activity:	Meeting, Location, office address, etc.
Type and number of stakeholders met (specify gender):	
Materials Provided:	
Date of Consultation Activity	**Location where information is available**
	☐ **Website _____** ☐ **Hard copy _____** ☐ **Other _____**

Issues raised	**Response provided**	**Actions to be taken**	**Deadline**

The disclosure plan, as preliminarily presented in

Table 11.2.7-7 , is mainly addressed to the operation phases and only in very generic terms to

Project Information Dissemination Methods	Stakeholders Addressed	Information Disclosed	Timeline	Resources - Responsibilities
Face-to-face meetings with PAPs	Residents and representatives of the Project affected communities, vulnerable groups, local businesses	Information on planned activities, assessed positive and negative impacts and mitigation measures, presentation of the external grievance mechanism	Operation Period	Project staff with SEP Manager
Meetings with local level authorities and administrations, National Government Bodies involved in the authorization phases	Regulators (national, governorate, and local)	Project development, identified ES impacts, schedule of activities, definition of the emergency response plan	Operation Period	Chipwi Nge Hydropower Company Managers with SEP Manager
Induction and staff trainings	Staff of Power House and reservoir	Working conditions, OHS induction, and code of conduct/ awareness raising on local customs, internal grievance mechanism	Immediately after hiring and later only when contractual changes occur	Chipwi Nge Hydropower Company Human Resources
Publications/announcements in national and local media, social media, company website	All identified stakeholders	Implementation of EMP and mitigation measures, presentation of grievance mechanism and company points of contacts	Operation Period	Project staff with SEP Manager
Notice boards in the main public spaces of the affected areas	People in the Project affected area (mainly residents), land owners and users	Updated project information, grievance mechanism, SEP Manager contacts	Operation Period	SEP Manager

the decommissioning phase, which at the moment appears unlikely to occur: in case any decommissioning will take place, this SEP will be updated accordingly and decommissioning will be treated in more detailed terms.

During the operation phase, Chipwi Nge Hydropower Company will disclose information regarding ongoing Project activities or relevant changes in the Project through the following main methods:

- detailed publications in local newspapers or other media and radio spots, which allow to easily reach also illiterate people: this method is aimed at informing all Project stakeholders on the ongoing activities and future development plans, including the impacts and mitigation measures foreseen;
- notice boards in the main public spaces of the affected areas: this method addresses in particular all Project affected communities (residents) and land owners and users on the ongoing activities, including the impacts and mitigation measures foreseen, methods to present complains and comments;

- meetings with land owners and users to disclose the Farming Land Acquisition Procedure and the foreseen additional targeted assistance for vulnerable groups and, grievance mechanism;
- meetings with the stakeholders interested by the relocation of the religious site at the limestone quarry;
- meetings and events (with open or restricted participation), which allow to reach local and national authorities, residents of affected communities, NGOs and civil society associations to present Project activities, including the impacts and mitigation measures foreseen, grievance mechanism, and discussion on relevant topics such as labour issues, environmental impacts, communities health and safety, etc.;
- Chipwi Nge Hydropower Company webpage and SEP Manager contact, which will allow the distribution of information on Project impacts and mitigation measures, schedule of activities and plans, as well as the collection of grievances. Furthermore, it will represent a good channel to collect stakeholders' suggestions and concerns.

An internal and external grievance mechanism will be in place during all the Project phases.

Table 11.2.7-7 presents a tentative plan for stakeholder engagement according to the information available at the time on its preparation. Future updates will be done every time relevant modifications to the Project context are foreseen.

Grievance mechanism

The purpose of the grievance mechanism is to ensure that all requests and complaints from individuals, groups and local communities throughout the Project life, from planning and design through construction, operations and decommissioning, are dealt with systematically in a timely manner with appropriate corrective actions being implemented and the complainant being informed of the outcomes.

As aforementioned, Chipwi Nge Hydropower Companywill establish several channels for grievance and information to enable the public to register any concern about the Project. Grievance mechanism will be in place throughout all Project stages and presented and discussed with the public during consultations. Channels to raise grievances will include:

postal, electronic mail, and local telephone line reaching the administrative office of Chipwi Nge Hydropower Company (to be specifically created);

written or orally to the conveyor belt construction site manager; and written or orally during public events and meetings.

The grievance mechanism is responsibility of the staff appointed for the SEP implementation. All complaints will be logged and processed and addressed within a fixed time, communicated to the complainant, as shown in Figure 11.2.7-8 by the processing grievances flowchart. The procedure is summarized below:

grievances will be logged in a Grievance Register and an acknowledgement of receipt of complaint will be issued to the complainant within five working days;

in case an immediate corrective action is not possible or sufficient, Chipwi Nge Hydropower Company will inform complainant of the proposed long-term corrective action, specifying a deadline, or explain the reason why the action is not feasible within 10 working days;

Chipwi Nge Hydropower Company will identify responsibilities and internal deadline for corrective action(s);

Chipwi Nge Hydropower Company will follow up the implementation of the corrective measures;

Chipwi Nge Hydropower Company will inform the complainant in writing and in person of the corrective action and record the closure of the grievance; and if the corrective action implemented is not accepted, it may be reviewed to identify alternative corrective actions. A revised resolution may be proposed. in case the resolution is then accepted by the stakeholder, the relevant grievance will be closed. On the contrary, if it will be not accepted, and no further improvements can be made, then external remedies may be pursued.

Complaints will be resolved within a period that will not exceed 30 days from their receipt and registration date.

As part of the grievance process, Chipwi Nge Hydropower Company when receiving the complaint will log each grievance and document the action taken. It will regularly review the database of received grievances to identify and analyze any recurrent issues and trends.

A Public Grievance Sample Form is presented in Table 11.2.7-8.

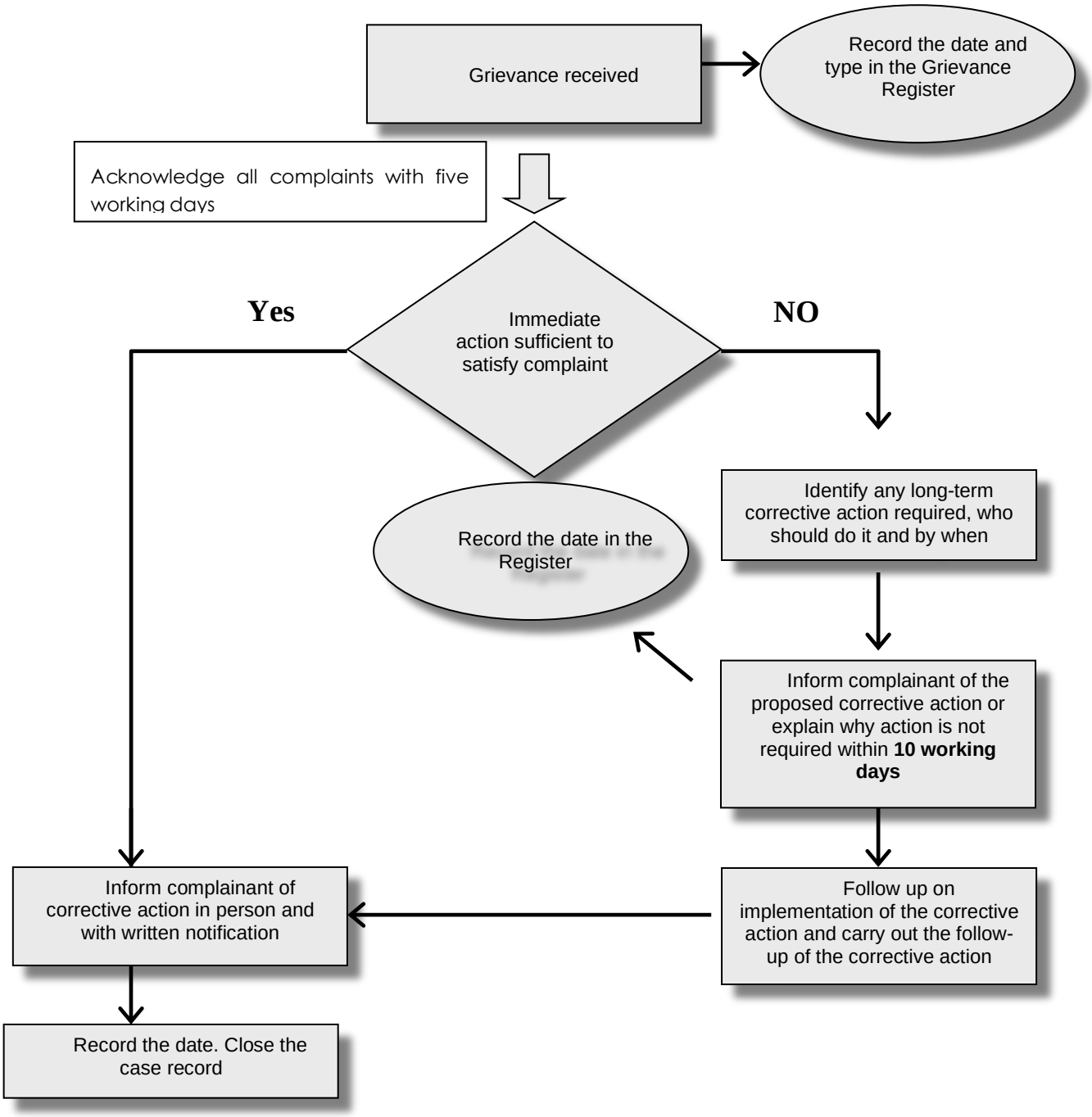


Figure 11.2.7-8 Flowchart for Processing Grievances.

Monitoring and evaluation

The SEP will be endorsed by the Chipwi Nge Hydropower Company, who will have the responsibility for its implementation.

The Company SEP will be regularly updated, presenting changes in Project activities, stakeholders, as well as advice and inputs received, lessons learned and any change to the consultation process. As a minimum, the SEP will be updated before the start of the operation phase.

The Company will develop a programme to monitor the Project stakeholder engagement activities and public perception of the Project. The monitoring programme will detail key elements of the monitoring, such as monitoring parameters, modality and frequency. The Company will also describe how and when the results will be reported.

Stakeholder, consultation and grievance registers, recording relevant information in a tabular form, shall be updated on an on-going basis. Progress reports will be prepared on a quarterly basis during the construction period and on a biannual basis during the operation phase to include updates on the grievance process, with the number of grievances received and addressed/closed, most frequent types of grievances, and any recommendation or action taken to decrease the number of grievances.

As long as there will be open grievances, the SEP Manager will make a selection of a random sample of grievances biannually, and follow up with the complainants to ensure that appropriate corrective actions have been taken and that the outcomes are satisfactory.

The reporting mechanism and responsibilities for stakeholder engagement are outlined in Table 11.2.7-10.

Table 11.2.7-10 SEP Reporting Mechanisms and Responsibilities

SEP Reporting Mechanism	Timing	Responsibility
Consultation Form	For each consultation or stakeholder contacted	SEP Manager
Stakeholder Identification and Consultation Register	Continued	SEP Manager
Grievance Register	Continued	SEP Manager
Grievance Monitoring	Quarterly during construction Biannual during the operation	SEP Manager
SEP Progress Reports	Quarterly during construction Biannual during the operation	
SEP Annual Report	Annually	

Resources and responsibilities

Management functions

The implementation of this SEP is responsibility of Chipwi Nge Hydropower Company during all over Project phases. Chipwi Nge Hydropower Company will appoint one SEP Manager in charge of all SEP activities (from the available staff or an external figure, for example from a local NGO or university, in both cases with appropriate professional background on stakeholder engagement in the local context).

Chipwi Nge Hydropower Company staff involved in the Project will be briefed in order to be aware of the commitments taken by the Project and the Project approach in dealing with stakeholders. The SEP Manager will coordinate the implementation of the SEP activities and keeping ongoing contacts with the construction manager.

The SEP Manager will take part to all the stakeholder engagement activities in the area. He/she has a general control function of the grievance mechanism process and collects, records and deals with grievances.

Budget

The budget for the SEP implementation will consider the following items throughout the Project construction and operation phase:

- cost of human resources: the remuneration of the SEP Manager, if not identified within the internal Chipwi Nge Hydropower Company staff, and of a short-term experts to carry out specific tasks, if necessary;
- training of the SEP Manager;
- specific consultation activities as outlined in the SEP;
- consultation materials and tools; and
- monitoring of the effectiveness of the SEP.

11.3 Residual Impacts

Residual impacts are defined as those impacts that remain following the implementation of the mitigation measures proposed. Mitigation measures for each area of environmental and social impact are discussed in full in the relevant chapters 6. Residual impacts during operation phase are shown in the following table.

Environmental Issue	Possible Impacts	Mitigation Measures	Residual Impacts	Residual Mitigation Measures
Hydrology	- During the operation period, about 15.7km long river reach downstream of the dam, i.e. the river section between the dam site and the river estuary, will be affected by water reduction section. - There are scattered settlements are distributed on both banks of this section. As people are living at high areas which is far away from Chipwi River, they take water mainly from nearby streams or springs rather than from Chipwi River. In addition, there is no irrigation and other water supply demands along the water reduction river section. As there are quite a few branches join in the downstream of the dam and the lateral flow is large, discharged flow of Chipwi Nge Hydropower Station will take 10% of minimum monthly average flow in the dry season, namely	Minimum environmental flow (10% of monthly discharge) is the standard approach to accommodate diverted water, to maintain an aquatic habitat downstream. Perennial tributaries below the dam site will contribute to environmental flow.	The residual impacts will be minor.	This could be determined by establishing automatic depth and flow monitoring stations at regular intervals between dam and river mouth of Maykha river.

	0.53m^3/s. It was proposed to discharge 0.53m^3/s as the ecological flow from the reservoir. As shown from the investigation, the nearest two small tributaries are about 1.6km in the downstream of the dam, respectively with a catchment area of 10.0km^2 and 5.45km^2. According to estimates, their annual average flows are respectively 0.73m^3 /s and 0.4m^3 / s. Plus discharged flow of 0.53m^3/s, the average flow at 1.6km downstream of the dam can reach 1.66m^3/s. As the annual average flow of confluence between the dam site and estuary is about 13.9m^3/s, plus discharged ecological flow, the flow at the estuary of Chipwi River can reach 14.4m^3/s, accounting for 26.7% of annual average flow at the estuary of Chipwi River.			
Terrestrial Ecology	- Permanent flooding of the river banks in the reservoir (steep slope vegetation) and degraded forest on the both banks but very small percentage of similar adjacent habitat on both sides of the river. - Reservoir for Chipwi Nge Hydropower Station is small and its area will increase by only 0.08km^2 after filling. It will almost not affect reptiles and mammals inhabiting around the reservoir.	- To minimize impacts that increase threats to forests and biodiversity (forest clearance for agriculture, hunting/ trapping wildlife, timber and harvest, forest fire, etc.) and its buffer zone. - Developing model of Community-based forest management (CBFM) - Strengthening forest patrolling and law enforcement - Environmental education for project workers and local public - Vegetation Recovery in Power Plant Area	There are habitats for small animals to habitat or migrate to the buffer area and upstream area. Therefore, the direct influence on these wild animals will be slight and implementation of EMP for Terrestrial ecology and watershed management plan propose in section 11.2.7.1 will be done. The residual impacts will be minor.	Implement monitoring program for impacts on Endangered wildlife species in Project areas (Power Plant, Reservoir Area and Watershed).
Water Quality	During operation period, reduced downstream flow, and the reduced turnover of water in the reservoir in the dry season, when there will be only limited replenishment by rain-driven inflow from upstream. The risks are that:	- Mitigating these impacts will be implementing Watershed Management to reduce inputs of silt and other pollutants; removing trees and shrubs from	Chipwi Nge Hydropower Station is a daily regulation type with frequent water exchange. It is expected that the impoundment will have little impact on	Water quality monitoring will be done in the reservoir and downstream as monthly basis.

	a) water in the reservoir could become de-oxygenated in the dry season, especially if the present vegetation is left in place to decompose, which could affect fish and other organisms living in the water; and b) there could be major increases in turbidity if at some stage in the future the sediment that accumulates in the reservoir over the long-term, is pumped downstream.	the reservoir before impounding. - Implement watershed management plan discussed in section 11.2.7.1.	eutrophication situation of water in the reservoir. Therefore, the residual impacts will be minor.	
Flood Risk	The water level in the reservoir may increase rather quickly due to high intensity of precipitation and increased flows in the tributaries and surface runoff. In such situations, steps given below shall be followed in order to prevent any adverse impacts on dam embankment, reservoir area and its surrounding, settlements located in the downstream.	The total annual mean sediment discharge at the dam site is 869,000 t and the reservoir capacity below normal pool level is 789,000 m^3. Therefore, the ratio of reservoir capacity below normal pool level to annual sediment discharge (volume) is comparatively small, indicating that there exist relatively severe deposition. The calculation result shows a fast deposition rate and the total deposition is about 690,000 m^3. To mitigate the deposition effects on the reservoir operation, one orifice with the size of 5m×6m is placed in the dam body to discharge flood and sediment. This orifice will be put into use for sediment flushing when the incoming sediment load is high.	This is a very low probability event, that can be monitored, if there are signs of pending dam failure. The return period of design flood for Chipwi Nge HPP is 50 years, return period of checking flood is 500 years, and the corresponding flood peak values are 1710m^3/s and 2540m^3/s, respectively. At water level of 746m, the dam orifices discharge capacity is 2547m^3/s; at the dam top level of 747.5m, the corresponding discharge capacity is 3345m^3/s. The discharge capacity is adequate, and risk of flood overtopping is very low.	- Standard practice Requires constant monitoring of incoming river discharge and dam condition. - A flood warning system, involving installation of sirens in Chipwi town, backed-up with a phone communication system with community wardens, will be implemented.
Dam Safety	The main safety risk of Chipwi Nge HPP can be assessed from the aspects of dam stability, structure strength, flood discharge and energy dissipation, and seismic risk.	The initial dam safety review should be carried out two years after construction is substantially complete and then every five years afterwards. Dam safety reviews should be carried out by an	It is very unlikely that a concrete dam will fail as this has not occurred since 1930s. This is a very low probability event.	Prepare a Disaster Preparedness Plan (DPP) with activities and responsibilities to minimize loss of life and property damage. Set up emergency

		internationally recognized, independent dam safety engineer who was not involved in the design of the project. Normally this review would look at previous inspections, instrumentation reports and annual inspection reports, along with a comprehensive site inspection. To protect the intake of water conveyance structure against sediment blocking, sediment flushing outlet for flood discharge shall be used at the beginning and the end of flood season each year for sand removal.		warning system to inform people of likely dam failure and emergency actions to save lives and communities.
Solid Waste	Due to improper disposal of domestic wastes from the office, accommodation and canteen of hydropower plant and accommodation facilities cause environmental impact.	The domestic waste incineration disposal pit is provided adjacent to living quarters, and green bins are arranged in living quarters, office area and production area so that the wastes can be collected separately, stacked in a centralized manner and processed at specified locations. The domestic waste incineration disposal pit is provided adjacent to living quarters, and green bins are arranged in living quarters, office area and production area so that the wastes can be collected separately, stacked in a centralized manner and processed at specified locations.	There is no residual impacts will be expected.	Domestic waste from office, canteen and accommodation during operation phase will be managed according to related Municipal Legislation. The waste management plan will be implemented easily and no further monitoring plan will be required.
Aquatic (Fish)	After the power plant is completed, water flow of about 15.7km long river reach from the downstream to the powerhouse will decline sharply which in turn will cause	The fishes of Chipwi Nge river are widely distributed in the Nmaihka River basin. Comparing to the scales of these two	According to comprehensive analysis on fish distribution, migrating habits and spawning habits in	Monitor: Fish species present and their distributions. Estimate population densities and record other features, such

	reduction of plankton and benthos. Fishes in this river reach will also decrease. Affected by the reduction of water volume in this river section, the Spawning sites will transfer to the upstream or rapids environment of Nmaihka River. As for migratory fishes, blocking- affects of the dam may cause failure of life history of some individuals; for fish without obvious migration features and resident fishes, long-term consequences of breaking of the ecological environment may lead to reduction of diversity of fish community heredity and affect population survival.	rivers, the project reduces only their scope of habitats and the reduction is very small. Thus, reduction of water flow in the water reduction river reach has a limited impacts on fishes.	the Chipwi Nge, fishes in the river are resident with short migration distance. Proper ecological environment can be found in the lower and upper reaches of the dam and the life history can be completed. The residual impact will be minor.	as breeding status

11.4 Environmental supervision

(1) Organizational structure

Environmental supervision is an important part of the environmental management, and it is featured as independence relatively, the owner entrusts the companies and departments with relevant qualifications independently according to the contract and relevant design documents.

(2) Environmental supervision in the construction period

According to the construction environmental requirements, it is necessary to review the construction management plan, construction program, construction schedule, construction changes and completion applications from an environmental point of view. Specific comments will be proposed to the environmental plans and environmental measures proposed by the constructors.

Supervise the implementation of the environmental protection measures in the construction processes, and issue instructions of modifications specific to the circumstances which violate environmental requirements or may harm the environment.

Participate in project design disclosures and on-site routine meetings, and summarize the environmental protection works in all construction stages.

Supervise and inspect the self-inspection of environmental protection works carried out by all constructors. Review the environmental quality reports submitted by the constructors, supervise the utilization and operation of the environmental protection funds, and participate in acceptance in different stages and at the completion time. Sign on the environmental comments on the payment applications according to the implementation of environmental protection measures and the construction of environmental protection facilities, environmental conditions at the construction area, and the environmental protection acceptance results in different stages.

Do a good job at supervision logs to maintain its integrity and accuracy, and establish environmental supervision archives to well manage the environmental management results and information. Submit monthly reports, annual reports and annual summaries to the project environmental management departments.

(3) Environment supervision in the operation periods

Supervise and inspect the implementation of environmental planning and operation of environmental protection measures, with focuses on the operations of ecological and environmental protection facilities, and supervise and inspect ecological and environmental monitoring works in the reservoir and downstream areas. Corrective and adjustment opinions are timely proposed if any problems are found.

11.4.1 Organization and Implementation

Electric Power Generation Enterprise, Ministry of Electricity and Energy (MOEE) is the Executing Agency (EA) for the project and has the overall responsibility for ensuring that all environmental standards and procedure are followed. The environmental law and rules are set by the Ministry of Natural Resources and Environmental Conservation (MONREC). The Chipwi Nge Hydropower Company is responsible for implementing EMP and environmental monitoring during operation phase. Prior to the project construction, the MOEE will set up an environmental management unit (EMU) for environmental management and operation, including environmental supervision of contractors. The EMU will ensure implementation of the environmental management plan and the environmental monitoring plan during operation of the Project. The EMU will be staffed by a project manager and with technical personnel. During operation the Power Plant Operator (Chipwi Nge Hydropower Company) will be responsible for the implementation of the EMP.

The EMU will coordinate all environmental monitoring activities as given in the EMP with Environmental Mnagement Department. The EMU will ensure that the EMP is updated periodically during the operation period. An independent environmental supervision consultant, as part of the Implementation Supervision Consultant, will supervise and monitor environmental procedures. The EMU will submit environmental monitoring reports (including physical data) to the MONREC twice annually during construction and annually, after completion of construction.

Environmental Management Department

It is planned to establish an environmental managemnet department. The organization structure for implementation and management of EMP and monitoring at Chipwi Nge Hydropower Project is proposed as shown in Figure 11.4.1-1.

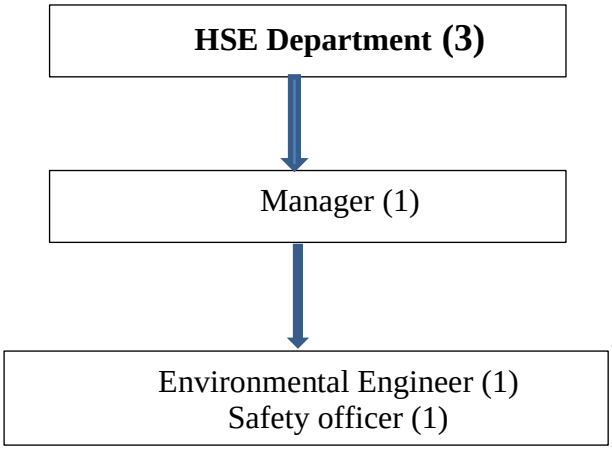


Figure 11.4.1-1 Structure of Environmental Management Department in Power Plant.

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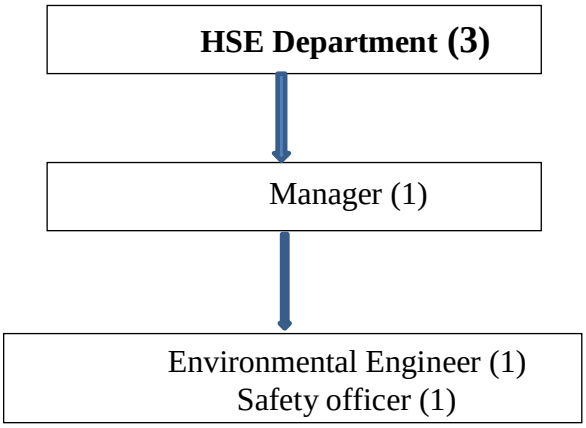
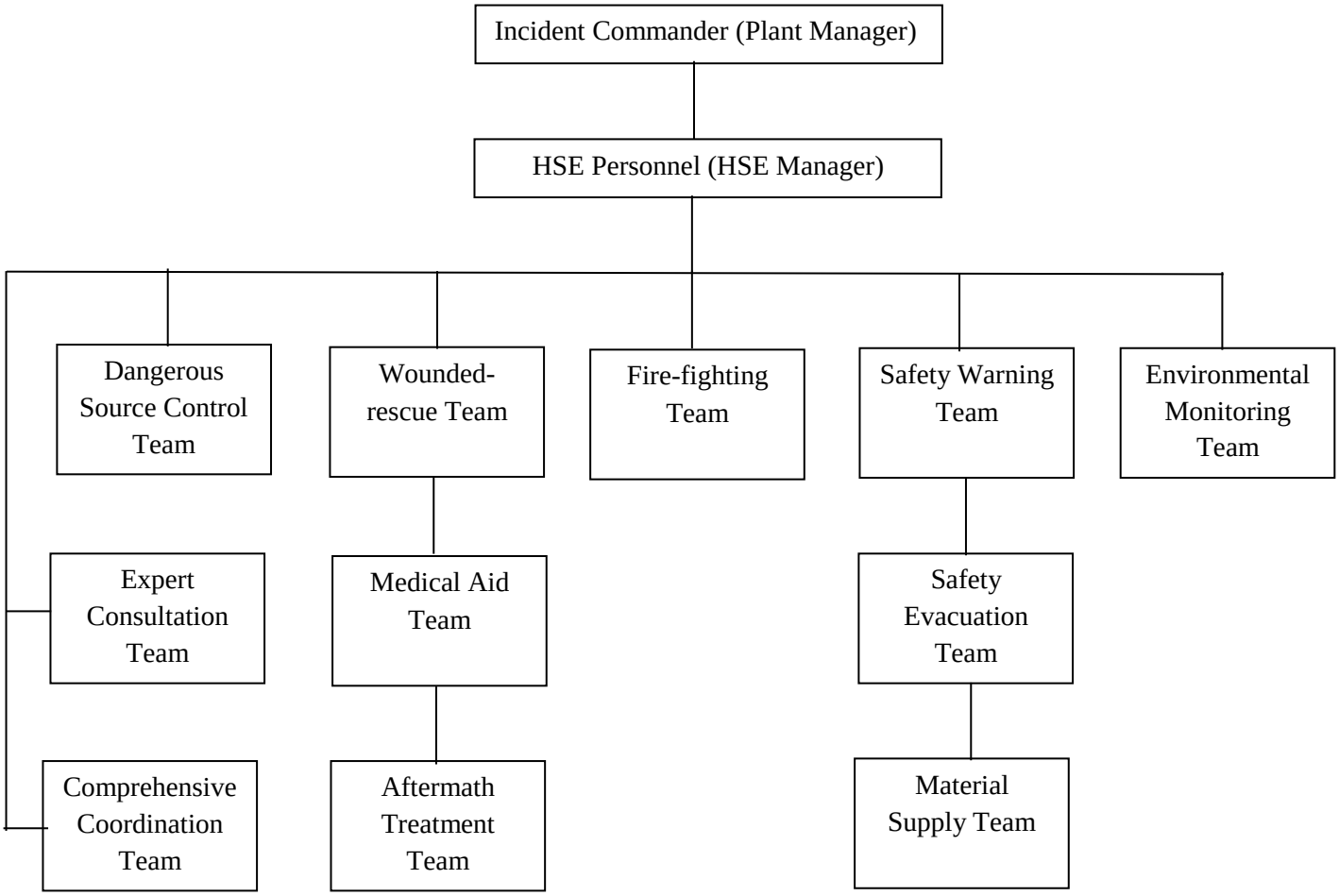


Structure of Environmental Management Department in Power Plant

Roles and Responsibilities of EMD during Operation Phase

Roles	Responsibilities
HSE Manager	- Establishing the Project's overall environmental direction and policy - Ensuring the implementation and effectiveness of the EMP - Ensuring investigation of all environmental incidents are reviewed and that reports are submitted on time - Ensuring the implementation of the recommended actions in the investigation of all environmental incidents - Managing resources for all environmental programs
Environmental Engineer/ Environmental Officer	- Assisting the management in publicising and implementing corporate and local policies, objectives and programs on environmental issues - Coordinating the overall environmental matters at the project site - Maintaining key environmental-related documents and information - Communicating/ liaising with the local authorities on environmental issues - Overseeing the investigation of environmental incidents/ problems and verifying the completion of corrective actions in accordance with the current regulatory requirements - Following-up on corrective actions to mitigate environmental impacts - Setting-up reporting systems and verifying compliance with the permit approval conditions issued by the regulators - Coordinating the implementation of environmental programs, including monitoring of the project site environmental performance - Performing periodic internal environmental audits and inspections to ensure compliance with the legal environmental requirements - Developing the program for new recruits to familiarize them with the site's environmental commitments and programs

Safety Officer	- Following-up on corrective actions to mitigate environmental impacts - Coordinating the implementation of environmental programs, including monitoring of the project site environmental performance - Performing periodic internal environmental audits and inspections to ensure compliance with the legal environmental requirements - Developing the program for new recruits to familiarize them with the site's environmental commitments and programs



Organization Structure for Emergency Response Plan

The Dam area of Chipwi Nge HPP has 4 personnel and some securities responsible for daily duties. The main tasks include dam water level monitoring, dam deformation observation, guarding of dam buildings and dam emergency disposal, etc.

(4) Environmental supervision work system

Environmental supervisors will stay at the site to carry out a dynamic management for environmental protection works involved in construction activities. Environmental supervision works mainly include site visits, supplemented by the necessary environmental monitoring. According to the distributions of pollution sources and construction sites, the environmental supervision engineers carry out daily inspections of construction areas. If there are any environmental pollution problems found from inspections, Environmental Supervision Directives will be issued to the contractors to ask them to solve within a time limit, or to solve immediately in emergency situations. Environmental supervision engineers regularly check and accept the works, and will issue a notice of default to require the contractors to modify within a time limit.

(5) Implementation of environmental supervision works

In the construction processes of the power station project, to ensure the properly and orderly conduct of environmental protection and water & soil conservation works, a quality management leadership team headed by chief supervisor, and an environmental protection and water & soil conservation works management mechanism is established in the supervision center, with quality control objectives determined, corresponding supervision planning and supervision rules prepared, supervisors staffed according to the characteristics of the construction activities, and job responsibilities and work systems formulated.

During the construction processes of the power station project, all relevant parties have always implemented the laws, rules and regulations on environmental protection issued by China and Myanmar government and the contract requirements, which has effectively prevented water and soil erosion and water sources pollution, properly handled the garbage, waste debris, waste water and sewage, protected the health of construction workers and the residents living in surrounding environment, minimized the negative impacts caused by construction activities on surrounding environment, and satisfied the requirements of environmental protection and soil and water conservation .

11.5 Environmental monitoring

11.5.1 Monitoring purposes and tasks

Environmental monitoring objectives and main tasks are:

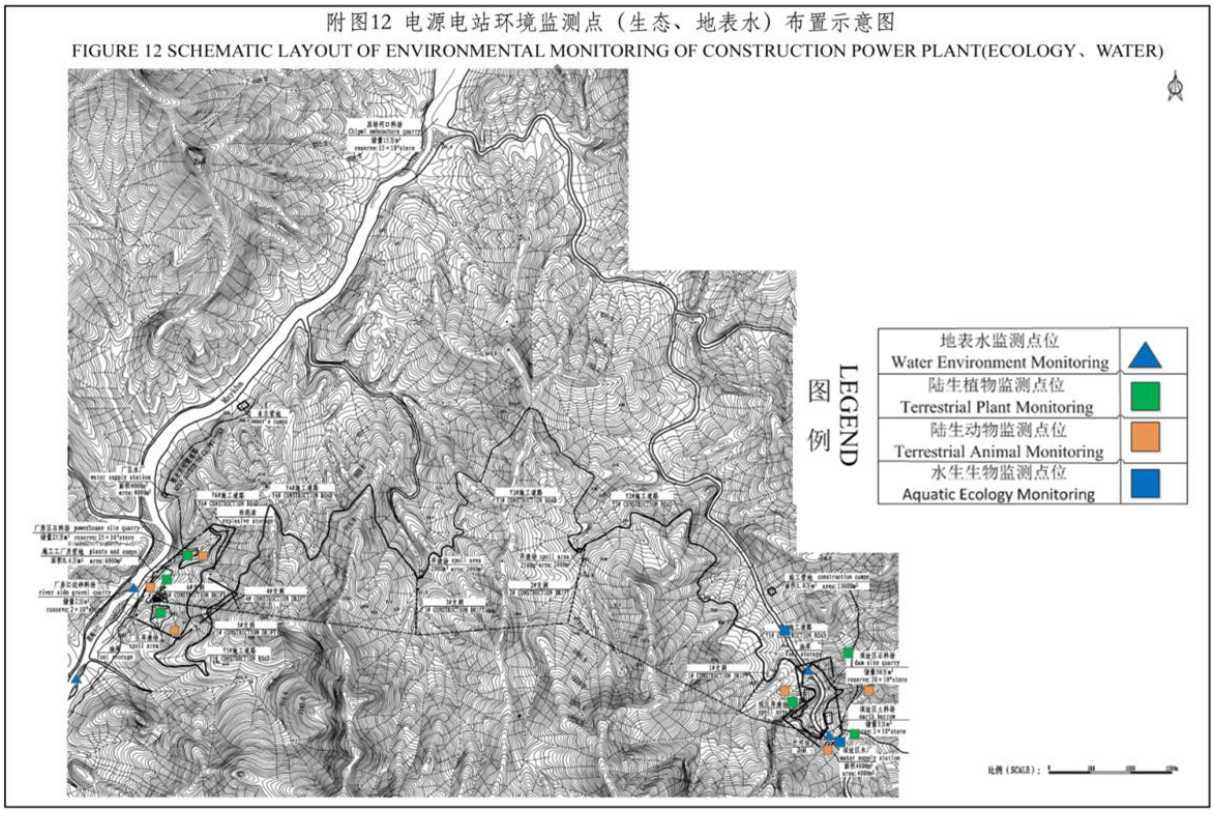
1) Provide basic information for environmental protection of this project. Carry out systematic and continuous monitoring and investigation to the ecological environment prior to and after the construction activities, so as to provide reliable data and information for environmental pollution control and environmental management during construction and operation, and for the environmental protection works and environmental impact assessment specific to the gradual development of the watershed.

2) Provide a scientific basis for the project’s regional ecological environment improvement. There are no any complete and systematic environmental monitoring systems in Chipwi River, and the monitoring results from the power station’s environmental monitoring system can provide a scientific basis for the development research and watershed ecological environment improvement.

11.5.2 Monitoring scope

11.5.2.1 Construction Phase

The monitoring scope is determined according to the characteristics of construction activities and local environment with the impacts of the project activities on the local environment taken into account, including: water environmental monitoring, atmospheric monitoring, sound environmental monitoring, terrestrial monitoring, aquatic monitoring, soil and water conservation monitoring and population health monitoring. The layout of the environmental monitoring is as the followingfigure.



(1) Water quality monitoring

1) Surface water quality

Setting of monitoring sections: There are totally 4 monitoring points， including intake of diversion tunnel; 1000m downstream of the dam; 100m upstream of the tail water of powerhouse; 1000m downstream of the tail water of powerhouse.

There are totally 19 monitoring items: pH, water temperature, suspended matter, dissolved oxygen, 5d biochemical oxygen demand, potassium permanganate index, ammonia nitrogen, nitrate, total nitrogen, total phosphorus, plumbum, chromium (hexavalence), cyanide, cadmium, petroleum, volatile phenol, arsenic, hydrargyrum, intestinal bacteria of human excrement.

Monitoring frequency and time: monitoring once before construction; monitoring once for high water period, level period and low water period respectively during construction period each year.

Monitoring technical requirement: According to relevant rules in Technical Specifications Requirements for Monitoring of Surface Water and Waste Water (HJ/T91-2002).

2) Production sewage

Setting of monitoring points: There are totally 4 monitoring points, including 2 at discharge exits for waste washing water of machinery parking lots (dam site area and powerhouse area); 2 at discharge exits for waste water of concrete mixing system (dam site area and power house area) respectively.

Monitoring items: pH value, suspended matter and flow are selected as obligatory items; petroleum should be the additional item for monitoring the discharge exits for waste washing water of machinery parking lots; other items could be added or deleted according to the variation of pollutants in construction sewage.

Monitoring frequency: once each quarter during construction period.

Monitoring method: According to relevant rules in Technical Specifications Requirements for Monitoring of Surface Water and Waste Water (HJ/T91-2002).

3) Domestic sewage

Setting of monitoring points: one for each discharge exit for domestic sewage of camp buildings (dam site area and power house area) respectively.

Monitoring items: chemical oxygen demand, 5d biochemical oxygen demand, ammonia nitrogen, total coliform, and flow, etc.

Monitoring frequency: once each quarter during construction period.

4) Sources of drinking water

Setting of monitoring points: one for each intake of drinking water for camp buildings (dam site area and power house area) respectively.

Monitoring items: primary items in Water Quality Standard for Drinking Water Sources (CJ3020-93).

Monitoring frequency: once each month during construction period.

(2) Ambient air quality

Setting of monitoring points: one for each camp building (totally 2 camp buildings). Monitoring items: sulfur dioxide, total suspended particles, nitrogen dioxide (totally 3 items).

Monitoring frequency: once each quarter during construction period.

Monitoring method: according to the rules in Technical Specification for Environmental Monitoring.

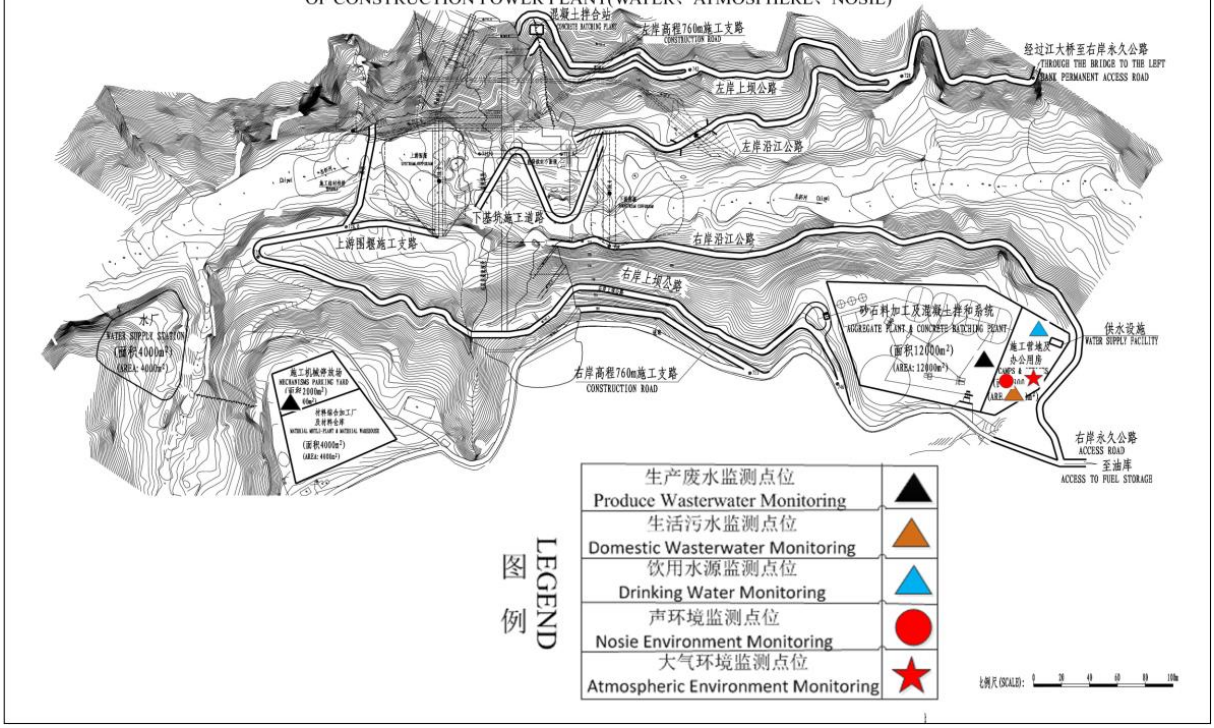
(3) Noise

Setting of monitoring points: one for each camp building (totally 2 camp buildings). Monitoring frequency: once each quarter.

Monitoring method: according to the rules in Technical Specification for Environmental Monitoring.

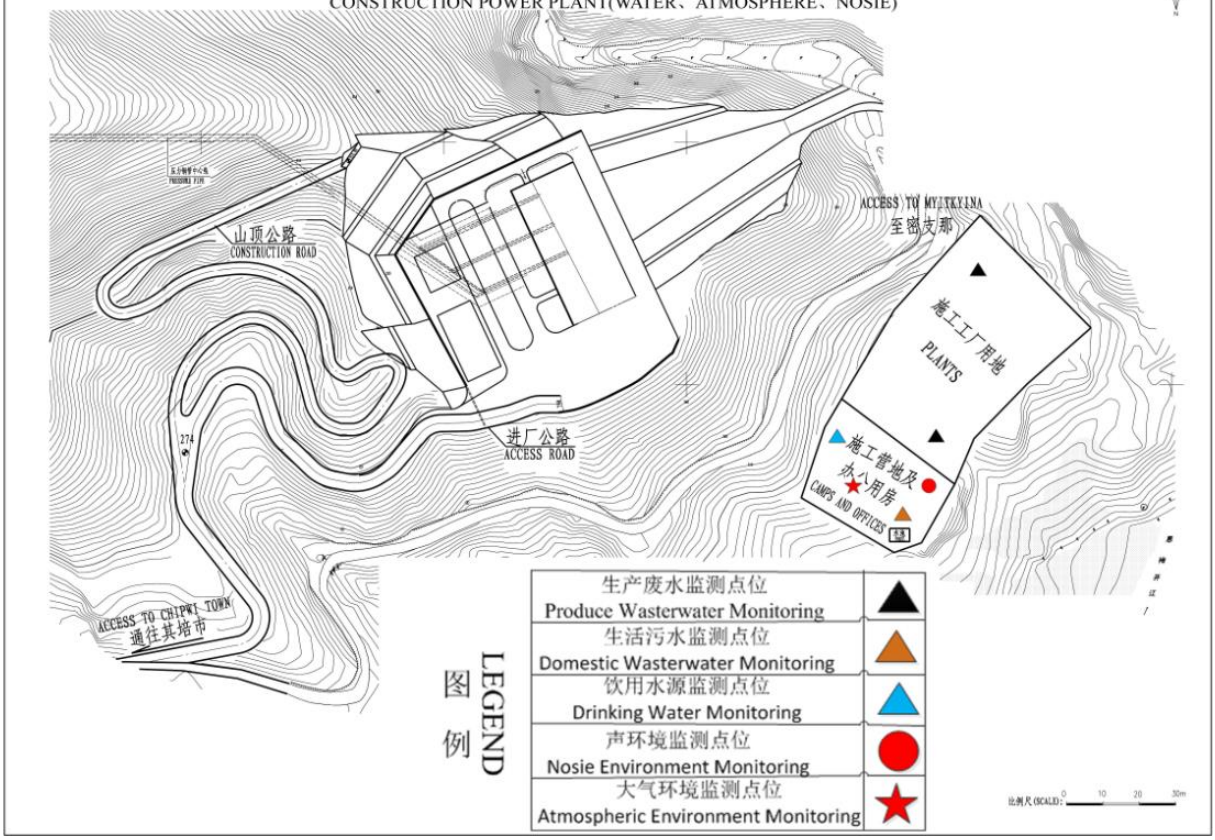
附图13 电源电站坝址区环境监测点（水、气、声）布置示意图

FIGURE 13 SCHEMATIC LAYOUT OF ENVIRONMENTAL MONITORING OF DAM SITE OF CONSTRUCTION POWER PLANT(WATER、ATMOSPHERE、NOSIE)



附图14 电源电站厂址区环境监测点（水、气、声）布置示意图

FIGURE 14 SCHEMATIC LAYOUT OF ENVIRONMENTAL MONITORING OF POWERHOUSE OF CONSTRUCTION POWER PLANT(WATER、ATMOSPHERE、NOSIE)



(4) Terrestrial

1) Terrestrial plant monitoring

Setting of monitoring points: 6 monitoring points at the dam site and powerhouse site, and two sample plots for trees, shrubs and grass at each monitoring point.

Monitoring items: phytobiocoenose characteristics, including coverage, structure, biomass and plant species.

Monitoring time and frequency: a total of five times, including once prior to commencement of the project; once at the third year since commencement of the project; and once respectively at the first year, third year and fifth year since operation.

2) Terrestrial animals monitoring

Setting of monitoring points: coordinated with the terrestrial plant monitoring, 6 monitoring points at the dam site and powerhouse site, and some line-transects are available representing different types of ecosystems at each monitoring point.

Monitoring items: the quantity, distribution and habitat conditions of mammals, birds, amphibians and reptiles.

Monitoring time and frequency: a total of five times, including once prior to commencement of the project; once at the third year since commencement of the project; and once respectively at the first year, third year and fifth year since operation.

(5) Aquatic monitoring

Setting of monitoring points: one monitoring point respectively at the reservoir tail and at 2km from the dam.

Monitoring items: mainly fish population structure and amount of resources.

Monitoring time and frequency: a total of five times, including once prior to commencement of the project; once at the second year since commencement of the project; and once respectively at the first year, third year and fifth year since operation. Investigate the aquatic ecological conditions once for high water period, level period and low water period respectively during the investigation year.

(6) Water and soil erosion monitoring

Setting of monitoring points: spoil yard, borrow site, construction site, adit, roadside of construction roads, etc.

Monitoring content: amount of soil erosion, hazard of soil erosion, benefits of soil and water conservation, etc.

Monitoring method: ground monitoring or investigation monitoring.

Monitoring period: construction period and recovery period of forest and grass.

(7) Population health monitoring

Contents of monitoring: mainly focusing on malaria, dengue fever and other infectious diseases within the construction area, and quarantine will be provided to the construction workers at epidemic seasons and high risky areas according to the monitoring conditions of infectious diseases.

Scope of monitoring: construction workers within the construction area.

Monitoring time: quarantine will be provided to the construction workers annually in the construction periods.

11.5.2.2 Operation Phase

Table 11.5-1 shows the Environmental Mornitoring Plan for the operation stage of the project. There are not expected to be major environmental impacts during this stage, so there is no need for extensive environmental monitoring. Monitoring in relation to the hydrological changes downstream of the tailrace only requires simple checks, because if Chipwi Nge Hydropower Company mitigates these impacts by operating to maintain minimum environmental flow in the dry season it is very unlikely that there will be noticeable the changes in flow. Water quality monitoring is more extensive because de-aerated and polluted water could affect the priority fish species and other aquatic organisms; but this can be reduced over the longer term (say after the first two years) if the data up to that point shows consistently good quality water, with no values that exceed the water quality standards of Myanmar.

There is also some monitoring related to the mitigation and enhancement proposed for aquatic ecology (Fish) and terrestrial ecology. For aquatic ecology the monitoring is required: firstly to assess the fish populations to be captured and translocated so that the exercise can be planned in detail; and secondly to review the success of the operation over the longer-term. For terrestrial ecology the monitoring is required to record the progress of implementation of the afforestation plan and the Watershed Management Plan, to identify where remedial action may be needed. Responsibility for the monitoring is assigned to Environmental Managemnet Department of Chipwi Nge Hydropower Company as the constant party throughout these periods, and because much of the proposed action is intended to enhance the habitats for the priority species, rather than to address negative impacts with specific causes.

Table 11.5-1 Monitoring Plan in Operation Phase

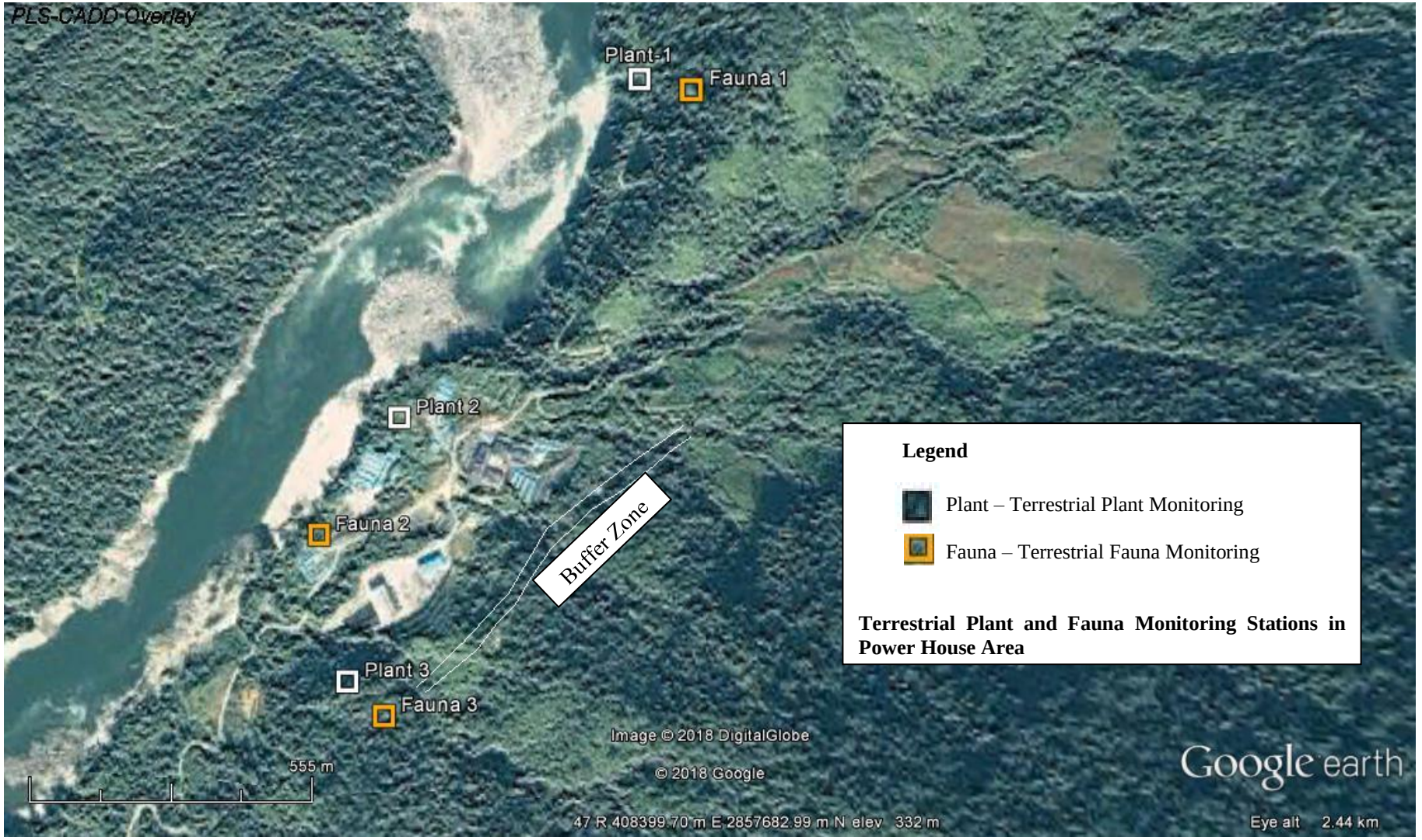
No.	Impact	Monitoring	Parameters	Monitoring Location	Monitoring Method	Frequency	Source of Budget	Institutional Responsibility
1	Terrestrial Ecology To ensure compliance with Forest Law (1992) and the protection of wildlife, wild plant and Conservation of Natural Area Law (1994) Watershed Area	The planted area will need to be regularly monitored so that dead seedlings can be replaced and other remedial action (weed removal, disease treatment, etc) planned and implemented as necessary. Need to be regular monitoring of the key expected improvements in order to record progress and plan refocusing if needed	Monitor: - seedling deaths, indications and presence of pests and disease, invasive species, human encroachment, farming and other unauthorised activities - phytobiocoenose characteristics, including coverage, structure, biomass and plant species. - Monitor: the key parameters in which improvements are needed: soil conservation, vegetation cover and the presence of the key faunal species (reservoir and river water quality will also be monitored as described above)	- Cover the whole planted buffer zone in reservoir area and power house area - 6 monitoring points at the dam site and powerhouse site, and two sample plots for trees, shrubs and grass at each monitoring point. - The overall WMP area, and in particular those locations targeted for specific activities.	- Conduct walkover surveys of features that can be recognized visually (seedling survival, encroachment) and smaller scale investigations of other aspects (pests, disease). Record locations on maps to plan remediation. Monitoring methodologies will be developed in detail during the planning stage for the WMP.	Every six months for the next five years. Surveys every six months, plus shorter-term records of aspects like faunal sightings when appropriate	Environmental Protection Investment budget (see in Table 11.5-1)	Environmental Management Department will be responsible for implementation through contract with ecology experts from third party Environmental Consultant Firm, and co-ordinate with Department of Forestry.
2	Aquatic Fauna (Fish) Habitat loss and population	The translocation area in Chipwi River should then be surveyed annually for the first four years after translocation to monitor survival and population expansion	Monitor: Fish species present and their distributions. Estimate population densities and record other features, such as breeding status	1 km downstream of dam and 1 km upstream of dam	Use similar netting techniques to capture samples of fish in the translocation area	Five surveys: one baseline before translocation and then annually post-translocation	Environmental Protection Investment budget (see in Table 11.5-1)	Environmental Management Department will be responsible for implementation through contract with ecology experts from third party Environmental Consultant Firm.

3	Water Quality (To monitor changes in downstream and reservoir)	Regularly monitor water quality in the reservoir and downstream of the Chipwi River and outlet of power plant and downstream of Maykha River.	Monitor: Temperature, pH, DO, BOD5, Turbidity, Conductivity, Total Suspended Solids, Ammonia, Nitrate, Total phosphorus, PO_4-P, Total nitrogen, Fecal Coliform bacteria, Total Coliform Bacteria)	Water Quality Monitoring Point – 5 stations (1 station in upstream of dam, 1 station in the reservoir, 1 station in downstream of dam, 1 station in upstream of power house and 1 station in downstream of power house) (surface, mid depth and bed)	Portable water quality meter (temp, pH, TSS, turbidity, DO) Sub-surface sampling bottle to collect water samples for laboratory analysis of BOD5, Ammonia, Nitrate, Phosphorus, Fecal and Total Coliforms and the rest parameter.	Every 6 months for 5 years	Additional cost USD 50,820 and Environmental Protection Investment budget (see in Table 11.5-1)	Environmental Management Department will be responsible for implementation through contract with water quality experts from third party Environmental Consultant Firm.
4	Hydrology (minimum flow)	To control flows, to sustain the minimum flow of river conduct a survey of downstream river users to determine whether any rapid daily increases in flow and water depth are observed.	Conduct: Informant interviews to determine: a) whether daily changes in river flow and depth have been observed; and b) the nature and timing of any changes observed.	At riverside locations used for washing and bathing in the river mouth of Chipwi River, 16 km downstream from tailrace and 3km downstream of the power plant outlet. Interview at least 100 persons separately.	Interview a sample of downstream river users. Asking if they have noticed any daily changes in flow and depth since Chipwi HPP began operations. If the answer is yes, ask what changes have been observed and when. Assess whether these correlate with Chipwi Nge dam discharges.	Every Six Months for 5 years.	Environmental Protection Investment budget (see in Table 11.5-1)	Environmental Management Department
5	Air Quality	Monitor ambient air quality at power house and in nearby residential areas (Chipwi town hospital), at reservoir aarea	Monitor: CO_2, SO_2, PM2.5, PM10, NO_2 and Methane	One location in power house, one location in Chipwi Town Hospital and one location in Reservoir area.	Use portable air quality equipment that US EPA approved.	Annual for five years.	Environmental Protection Investment budget (see in Table 11.5-1)	Environmental Management Department will be responsible for implementation through contract with air quality experts from third party Environmental Consultant Firm
6	Noise To ensure compliance with Occupation Health and Safety requirements of IFC, Nation Environmental Quality (Emission) Guideline	Monitor noise level at perimeter of power plant & in nearby office and worker accommodation building.	Monitor noise level.	One location in perimeter of power plant house, one location in office and one location in accommodation building.	Use Portable sound level meters for measuring noise levels	Every 6 months for 5 years	Environmental Protection Investment budget (see in Table 11.5-1)	Environmental Management Department will be responsible for implementation through contract with noise quality experts from third party Environmental Consultant Firm

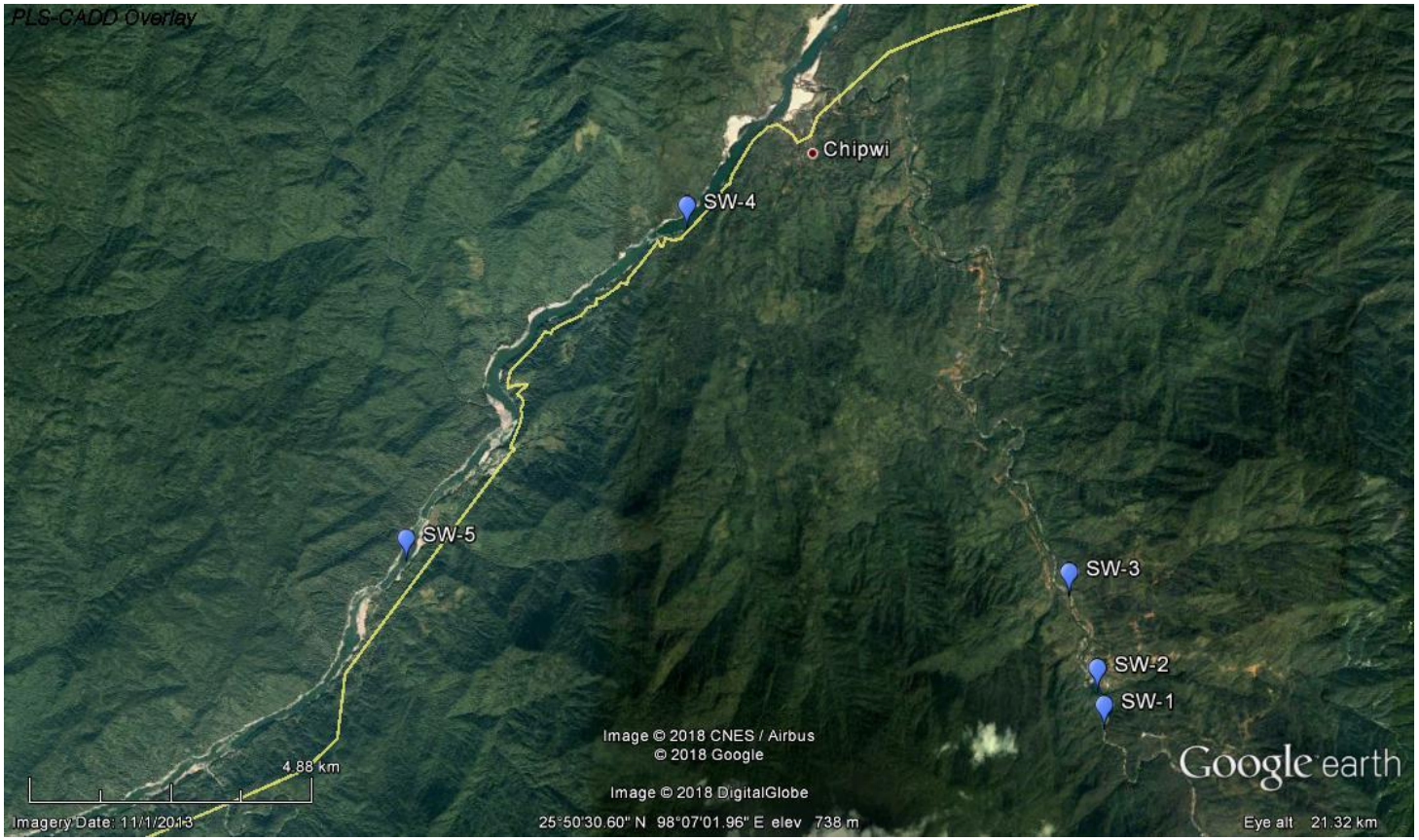
7	Health and Safety To ensure compliance with the Health and Safety Plan	Mainly focusing on malaria, dengue fever and other infectious diseases within the construction area, and quarantine will be provided to the project workers at epidemic seasons and high risky areas according to the monitoring conditions of infectious diseases.	Mainly focusing on malaria, dengue fever and other infectious diseases within the project area and Chipwi Town and downstream villages if access and required.	All work places, Chipwi Town and downstream villages if access and required.	Observation, inspection and reporting. Mobile clinic shall be provided.	Annually	Environmental Protection Investment budget (see in Table 11.5-1)	Environmental Management Department will be responsible for implementation through coordination with Township Health Care Department.

The layout of the environmental monitoring in operation phase is as the followingfigures.

Air Quality Monitoring Stations


PLS-CADD Overlay
Plant-1
Fauna 1
Plant 2
Fauna 2
Buffer Zone
Plant 3
Fauna 3
Legend
Plant – Terrestrial Plant Monitoring
Fauna – Terrestrial Fauna Monitoring
Terrestrial Plant and Fauna Monitoring Stations in Power House Area
555 m
Image © 2018 DigitalGlobe
© 2018 Google
Google earth
47 R 408399.70 m E 2857682.99 m N elev 332 m
Eye alt 2.44 km


PLS-CADD Overlay
Plant 6
Fauna 6
Fauna 4
Plant 4
AQN 3
Fauna 6
Plant 6
Legend
Plant – Terrestrial Plant Monitoring
Fauna – Terrestrial Fauna Monitoring
AQN – Ambient Air and Noise Monitoring
Terrestrial Plant and Fauna Monitoring Stations in Reservoir Area
440 m
Image © 2018 DigitalGlobe
25°48'28.10" N 98°10'56.65" E elev 729 m
Google earth
Eye alt 3.04 km



Surface Water Quality Monitoring Stations

11.5.3 Implementation of monitoring works

During the progress of this construction power station, the employer has carried out water environmental monitoring and water & soil erosion monitoring according to the preliminary investigations, but the monitoring points and monitoring indicators are not complete corresponding to the planning and design; it is necessary to further strengthen environmental monitoring in the operation period of the construction power station.

Ministry of Electricity and Energy (MOEE) is the Executing Agency (EA) for the project and has the overall responsibility for ensuring that all environmental standards and procedure are followed. The environmental law and rules are set by the Ministry of Natural Resources and Environmental Conservation (MONREC). The EMU will be staffed by a project manager and with technical personnel. During operationperiod, the Power Plant Operator (Chipwi Nge Hydropower Company) will be responsible for the implementation of the EMP.

The EMU will coordinate all environmental monitoring activities as given in the EMP. The EMU will ensure that the EMP is updated periodically during the construction period. The Environmental Management Department will submit environmental monitoring reports (including physical data) to the MONREC twice annually during operation period.

11.6 Environmental protection investment

11.6.1 Descriptions of preparation

In principle, the estimated investment in environmental protection should be based on the relevant Myanmar norms and standards, but because Myanmar doesn't have relevant norms and standards, the estimates are prepared according to relevant China norms and standards.

Given that environmental protection is an integral part of the main structural works in this project, the preparation of estimates of environmental protection investment corresponds to the estimates of investment in main structural works, of which the basis, price level, baseline year and major material prices are as same as the items used in the estimates of investments in main structural works, and relevant industrial norms or rules shall prevail if there are some contents not involved in the main structural works.

11.6.2 Basis of preparation

(1) "Rules for Preparation of Budget in Hydropower Engineering Design" (2007 edition)

(2) "Circular Issued by the State Planning Commission and the State Environmental Protection Administration on Regulating the Environmental Impact Consulting Costs" (*Jijiage* [2002] No. 125);

(3) "Circular Issued by the State Planning Commission and the Ministry of Finance on Aquatic Wildlife Conservation Cost standards and Related Issues" (*Jijiage* [2000] No. 393);

(4) "Procedures of Preparation of Estimates of Investments in Environmental Protection in Water Resources and Hydropower Engineering" (SL359-2008);

(5) "Regulations of Preparation of Budgets (Estimates) of Investments in Water and Soil Conservation in Development and Construction Projects" (Ministry of Water Resources, *Shuizong* [2003] No. 67);

(6) "Regulations of Engineering Survey and Design Costs" (State Planning Commission and Ministry of Construction, *Jijiage* [2002] No. 10);

(7) "Quota for Estimates of Investments in Hydropower Construction Project" (*Dianshuigui*[1997] No. 031);

(8) "Quota for Estimates of Investments in HydropowerEquipment Installation Project"

(*Guojingmao*[2003] No. 38);

11.6.3 Investment estimates

The environmental protection investment is estimated as 20.8445 Million Yuan (Equivalent to 3,334,400 USD) in Chipwi Nge Hydropower Station, of which the investment is 4.2685 Million Yuan (≈685,840 USD) specific to environmental protection, and the investment is 16.5760 Million Yuan (≈2,652,160 USD) specific to water and soil conservation. The specific breakdown of investment is detailed in Table 11.6-1. The environmental management and monitoring cost during operation period is shown in Table 11.6-2.

Table 11.6-1 Table of estimates of environmental protection investment

No.		Unit	Unit price(Yuan)	Number	Investment (‘0000 Yuan)	
Part I Environmental protection measures						
Part II Environmental monitoring					73.9	
1.	Water quality monitoring	Point · time	2000	138	27.6	A total of 29 is considered
2.	Ambient air quality monitoring	Point · time	2500	18	4.5	
3.	Noise monitoring	Point · time	1000	18	1.8	
4.	Terrestrial monitoring				10	
1)	Terrestrial plant monitoring	Time · year	10000	5	5	
2)	Terrestrial animal monitoring	Time · year	10000	5	5	
5.	Aquatic monitoring	Time · year	20000	15	30	
6.	Water and soil erosion	Point · time				Included in the water protection investment
Part III Environmental equipment and installation					10.72	
1.	Environmental protection equipment				10.72	
1)	Trash bin	No.s	800	9	0.72	
2)	Septic tanks	No.s	30000	2	6.00	
3)	Temporary toilet	No.s	20000	2	4.00	
4)	Mixing plant dedusting equipment					Included in the project investment
Part IV Temporary environmental protection measures					141.865	
1.	Wastewater and sewage treatment				23.26	
1)	Alkaline wastewater treatment	‘0000 m^3	8000	6.23	11.98	Including 70000 Yuan infrastructure investment
2)	Oily wastewater treatment	‘0000 m^3	10000	3.28	8.28	Including 50000 Yuan infrastructure investment

Table 11.6-1 Table of estimates of environmental protection investment(continued)

No.		Unit	Unit price(Yuan)	Number	Investment (‘0000 Yuan)	
3)	Foundation pit wastewater treatment				3	
2.	Noise protection				0.04	
1)	High noise protection for construction workers					Included in the project investment
2)	Transport vehicle noise warnings	No.s	100	4	0.04	
3.	Solid waste disposal				55.54	
1)	Rubbish and excrement removal	Person/month	5	830	12.04	29 months considered
2)	Garbage landfill	‘0000 m^3	100	653	6.53	
4.	Ambient air quality protection				4.2	
1)	Watering	Months	3000	14	4.2	14 months considered
5.	Population health protection				58.825	
1)	Construction workers cleaning and disinfecting	hm^3	3000	2.7	22.68	29 months considered
2)	Temporary clinic	No.s	50000	2	10	
3)	Construction workers quarantine	Person · time	120	830	9.96	
4)	Rodent and mosquito killing costs	Person · year	15	830	3.735	3 years considered
5)	Drugs to prevent malaria and other diseases	Person · year	50	830	12.45	3 years considered
6.	Ecological protection				3.5	
1)	Public education	Year	10000	3	3	
2)	Warning sign	No.s	500	10	0.5	
Total costs of Part I ~ Part IV					226.49	
Part V Independent environmental protection costs					176.21	
1.	Environmental management costs in construction period				43.59	
1)	Environmental management recurrent costs				9.06	4% of the total of I ~ IV considered
2)	Acceptance costs of environmental protection facilities				30	
3)	Environmental protection publicity costs				4.53	2% of the total of I ~ IV considered
2.	Environmental supervision costs	Person/month	5000	1	14.5	29 months considered
3.	Research, survey and design costs				118.12	
1)	Environmental impact assessment costs				100	

Table 11.6-1 Table of estimates of environmental protection investment(continued)

No.		Unit	Unit price(Yuan)	Number	Investment ('0000 Yuan)	
2)	Environmental survey and design costs				18.12	6% of the total of I ~ IV considered
Total costs of Part I ~ Part V					402.69	
Basic reserve funds					24.16	6% of the total of I ~ V considered
Special environmental investment					426.85	
Special soil and water conservation investment					1657.6	
Environmental protection investment					**2084.45**	
		Equavalent US Dollar			**3,334,400.072**	

Table 11.6-2 Estimated budget for environmental management and monitoring during operation period

No.	Managemnet and Monitoring Item	Parameters	Monitoring Location	Frequency	Budget (USD per year)	Institutional Responsibility
1	Terrestrial Ecology To ensure compliance with Forest Law (1992) and the protection of wildlife, wild plant and Conservation of Natural Area Law (1994) Watershed Area	Monitor: - seedling deaths, indications and presence of pests and disease, invasive species, human encroachment, farming and other unauthorised activities - phytobiocoenose characteristics, including coverage, structure, biomass and plant species. - Monitor: the key parameters in which improvements are needed: soil conservation, vegetation cover and the presence of the key faunal species (reservoir and river water quality will also be monitored as described above)	- Cover the whole planted buffer zone in reservoir area and power house area - 6 monitoring points at the dam site and powerhouse site, and two sample plots for trees, shrubs and grass at each monitoring point. - The overall WMP area, and in particular those locations targeted for specific activities.	Annually for the next five years.	1,900	Environmental Management Department will be responsible for implementation through contract with ecology experts from third party Environmental Consultant Firm, and co-ordinate with Department of Forestry.
2	Aquatic Fauna (Fish) Habitat loss and population	Monitor: Fish species present and their distributions. Estimate population densities and record other features, such as breeding status	1 km downstream of dam and 1 km upstream of dam	Five surveys: one baseline before translocation and then annually post-translocation	1,600	Environmental Management Department will be responsible for implementation through contract with ecology experts from third party Environmental Consultant Firm.

3	Water Quality (To monitor changes in downstream and reservoir)	Monitor: Temperature, pH, DO, BOD5, Turbidity, Conductivity, Total Suspended Solids, Ammonia, Nitrate, Total phosphorus, PO_4-P, Total nitrogen, Fecal Coliform bacteria, Total Coliform Bacteria)	Water Quality Monitoring Point – 5 stations (1 station in upstream of dam, 1 station in the reservoir, 1 station in downstream of dam, 1 station in upstream of power house and 1 station in downstream of power house) (surface, mid depth and bed)	Annually for the next five years.	1,750	Environmental Management Department will be responsible for implementation through contract with water quality experts from third party Environmental Consultant Firm.
4	Hydrology (minimum flow)	Conduct: Informant interviews to determine: a) whether daily changes in river flow and depth have been observed; and b) the nature and timing of any changes observed.	At riverside locations used for washing and bathing in the river mouth of Chipwi River, 16 km downstream from tailrace and 3km downstream of the power plant outlet. Interview at least 100 persons separately.	Every Six Months for 5 years.	400	Environmental Management Department
5	Air Quality	Monitor: CO_2, SO_2, PM2.5, PM10, NO_2 and Methane	One location in power house, one location in Chipwi Town Hospital and one location in Reservoir area.	Annual for five years.	3,550	Environmental Management Department will be responsible for implementation through contract with air quality experts from third party Environmental Consultant Firm
6	Noise To ensure compliance with Occupation Health and Safety requirements of IFC, Nation Environmental Quality (Emission) Guideline	Monitor noise level.	One location in perimeter of power plant house, one location in office and one location in accommodation building.	Every 6 months for 5 years	1,350	Environmental Management Department will be responsible for implementation through contract with noise quality experts from third party Environmental Consultant Firm
7	Health and Safety To ensure compliance with the Health and Safety Plan	Mainly focusing on malaria, dengue fever and other infectious diseases within the project area and Chipwi Town and downstream villages if access and required.	All work places, Chipwi Town and downstream villages if access and required.	Annually	1,200	Environmental Management Department will be responsible for implementation through coordination with Township Health Care Department.
8	Awareness training for health and safety	Training	All workers	Annually	600	Environmental Management Department

11.7 Decommissioning

The term decommissioning is used to describe the range of actions necessary to remove or make safe components of a project, and to restore the area occupied by the project to other beneficial uses. In the case of the Chipwi Nge Hydropower Project, the requirements for decommissioning cover: (a) the dam and other permanent structures; and (b) the construction facilities and infrastructure that will be redundant once the dam, power plant, etc have been built and are ready for operation. This ESMP covers only the construction and operation phase because the hydropower plant will operate for many years in to the future, and may incorporate other uses during that period (eg irrigation, drinking water supply).

Chipwi Nge Hydropower Project is constructed and operated as Joint Venture Agreement with Ministry of Electricity and Energy (MOEE) and the Chipwi Nge Hydropower Company Ltd. was established and the main responsibility of the company is as operator. After completion of agreement, the operator company will handover to MOEE.

12 Commulative Impacts

12.1 Hydropower planning in the river basin

According to the characteristics of Ayeyawady River basin above Myitkyina and the requirements of national economic development of Myanmar on the river development, hydropower development in the upper reaches is done for purpose of power generation as well as flood control and improving the shipping and irrigation conditions in the lower reaches etc. Based on comprehensive analysis and comparison with respect to integrated utilization efficiency, technical conditions and economic indexes etc., the recommended scheme for cascade development of Ayeyawady River basin above Myitkyina is proposed as follows:

Nmaihka River and Ayeyawady River: *Yenan (1010m) – Kaunglanhpur (875m) – Pisa (665m) – Wutsok (525m) – Chipwi (400m) – Myitsone (245m)*;

Malikha River: *Laza (370m)*

The location of plan and Chipwi Nge Hydropower project is shown in Figure 12.1-1.

According to the hydropower planning of the river basin and the preliminary work conditions of Chipwi Nge Hydropower Station, recommended scheme for cascade hydropower development of Ayeyawady River basin above Myitkyina specifies the total installed capacity 21,600MW and the annual power generation 111.09 billion kW·h.

In the light of MOA, it is planned to complete the development of hydropower project in upper reaches of Ayeyawady River within 15 years. According to the development conditions and the preliminary works, Myitsone and Chipwi stations will be developed in near term; Wutsok, Pisa, Kaunglanhpur and Laza stations are ranked amongst the second batch of projects to be developed while Yenan Station is the third batch.

But, the other hydropower projects within the river basin have not yet started and the information of other hydropower projects that plan to construct on the tributaries of Nmaihka and Malikha River were not known.

Possible Impacts

Given that there is a lack of consolidated information on the environment of the basin, particularly aquatic and terrestrial biodiversity, water quality, and land cover/land use, more detailed studies are needed.

Studies should also be undertaken to assess the potential to conserve certain rivers or reaches of rivers in an unregulated state to maintain some of the local natural fish diversity.

The main environmental impacts from the hydropower developments will include, but not be limited to:

- A possibility of using the reservoirs for improved flood control;
- A possibility of using the reservoirs to secure higher flows in dry periods;
- Build-up of sediment in reservoirs;
- Erosion in reservoirs and downstream river stretches because of water level fluctuations;
- Riparian vegetation and habitat destruction along the banks of reservoirs and rivers;
- Reduction in fish populations and diversity in reservoirs and affected rivers, and largely reduction in fish migration;
- Potential loss in terrestrial biodiversity and habitats, and increase in landscape fragmentation.

Mitigation measures to minimize environmental impacts from the proposed hydropower developments in the Ayeyarwady river basin must include operational rules for the projects,

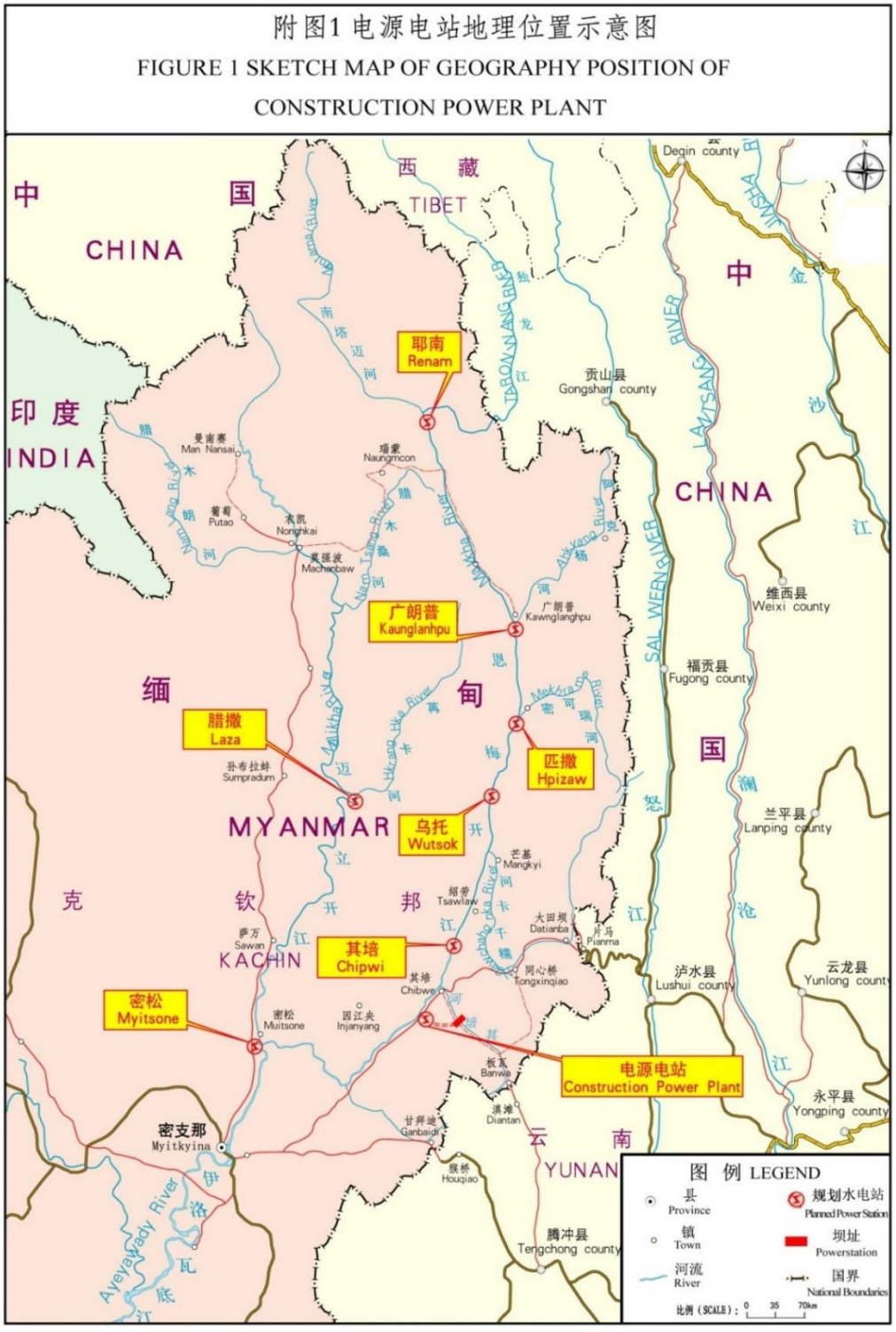


Figure 12.1-1. The location of plan and Chipwi Nge Hydropower project in Ayeyarwady River Basin.

taking into account environmental issues and close coordination by hydropower operators, Ministry of Natural Resources and Environmental Conservation and downstream water users to ensure coordinated resource management. The Project's mitigation measures will minimize impacts to the environment and livelihoods. Hydropower development in the Ayeyarwady river basin will also have potential cumulative impacts because of the increase in transport; irrigation development; erosion; expansion into forested lands; urban growth; tourism and tourism-related trade; illegal mining and logging; and exploitation of forest, water, and biodiversity resources and multiplier effects related to increased work force and camp followers. Policy development will be required to manage these cumulative impacts and set up best practices including, but not limited to, (i) the development of integrated water resources management for the basin, (ii) institutional arrangements for river basin organization coordination, and (iii) river basin watershed conservation programs.

13 Assessment conclusions and recommendations

13.1 Assessment conclusions

The overall assessment on environmental impact of the construction power plant is concluded as follows:

Main positive impacts: the main tasks of the construction power station is originally to supply construction power for developing Myitsone and Chipwi Hydropower Stations at Ayeyawady River. At present, because of the changes of external conditions, it shall provide power to ChipwiTown and Myitkyina after the adjustments. The construction of the power station will provide sufficient power to Chipwi Town and Myitkyina, so as to solve the long-term power deficiency problems locally; it may improve regional power and traffic infrastructure conditions and facilitate production and livelihood of local people to provide facilities for poverty alleviation and well-off; it may increase local fiscal revenue and promote sustainable development of regional social economy. At the same time it will play an important role in developing the water resources of Ayeyawady River.

Main negative impacts: project construction, reservoir inundation, occupation of land and dam blockage may affect the integrity of regional ecosystem, terrestrial animals and plants, aquatic lives, etc. Construction of this project will intensify soil erosion of the construction area in a short period. This station provides diversion generation that will result in flow reduction of the natural channel between the dam behind and power house (15.7km), and this may affect aquatic ecologic environment of that river section. However, it has been considered that an ecological flow of 0.53m^3/s discharging through release hole during operation period. Directly discharging the waste (polluted) water without treatment during construction period could affect the water quality of Chipwi River.

In addition, noises, waste gases and waste debris generated during the construction periods will impact on the surrounding environment; the construction activities will impact on the health of construction workers. These impacts are only limited to construction periods, and they will be reduced or mitigated with the construction progress and implementation of environmental protection measures.

For negative impacts described above, measures of environment protection provided include: water and soil conservation, ecologic environment protection, construction waste (polluted) water treatment, solid waste treatment, atmospheric environment protection, population health protection, etc.

To sum up, these negative impacts on environment by project construction and operation will be minimized after measures of environment protection being provided and there are not restrict factors that may affect project decision in respect of environment protection.

13.2 Suggestions

(1) It is recommended to strengthen publicity of hydropower development in Myanmar, Kachin, to introduce the cases which hydropower development drives local economic development and improves the living standards, so as to further address the concerns of local residents.

(2) It is recommended to further improve environmental monitoring, tracking and evaluation in the operation stage of the power station.

14. Comments from Environmental Conservation Department

14.1 Comments on the First Draft EIA Report

The Environmental Conservation Department (ECD), Ministry of Environmental Conservation and Forestry (MOECAF) issued first notification regarding the comments for the draft EIA Report on Environmental Impact Assessment for Development of Chipwi Nge Hydropower on March 2016. MOECAF required CSPDR to investigate and monitor the baseline and public participation of the project zone again.The project proponent prepared the second draft final EIA report and submitted to MOEE. MOEE forwarded this report to ECD on 1 June 2017 with reference letter MOEE Letter Electric-2 (Chipwi Nge) (5241)/2017.

14.2 Comments from the Review Team on the Second Draft EIA Report

The review team meeting on draft ESIA report held in Environmental Conservation Department (ECD) on 8 March 2018. Environmental Conservation Department issued notification letter EIA-1/7 (213/2018) regarding the comments for the draft ESIA Report on Environmental Impact Assessment for Development of Chipwi Nge Hydropower on 28 February 2018. The project proponent prepared the final EIA report which corresponds to the terms and conditions as shown in Table 14.1.

14.3 Additional Comments from the Environmental Conservation Department

The Department of Electirc Power Planning issued the notification letter 682/101/Hydro-Renew/Planning (Electricity) regarding the comments for the fifth revised ESIA Report on Environmental Impact Assessment for Development of Chipwi Nge Hydropower on 15 October 2020. According to this letter, the project proponent prepared the final EIA report which corresponds to the terms and conditions as shown in Table 14.2.

Table 14.1 Correspondence to the Comments from ECD (Second Draft ESIA Report)

သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန

Chipwe Nge Hydropower Co., Ltd. မှ ကချင်ပြည်နယ် ချီဖွေမြို့နယ်ရှိ ၉၉မဂ္ဂါဝပ် ချီဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်း၏
အတွက် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာအပေါ်
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၏
စိစစ်တွေ့ရှိချက်နှင့် သုံးသပ်အကြံပြုချက်များအား ရှင်းလင်းတင်ပြခြင်း

၈-၃-၂၀၁၈
(ကြာသပတေးနေ့)

စဉ်	စိစစ်တွေ့ရှိချက်	သုံးသပ်အကြံပြုချက်	ပြန်လည်ရှင်းလင်းချက်
၁။	**အကျဉ်းချုပ်အစီရင်ခံစာ**		
	အခန်းအလိုက်သဘောထားမှတ်ချက်များအတိုင်း ပြန်လည်ပြင်ဆင်မှုများရှိသဖြင့် အကျဉ်းချုပ်အစီရင်ခံစာ အား ပြန်လည်ပြင်ဆင်တင်ပြရန် မြန်မာ ဘာသာဖြင့် ပြုစုထားသည့် အကျဉ်းချုပ်အစီရင်ခံစာ တင်ပြရန်။		မြန်မာ ဘာသာဖြင့် ပြုစုထားသည့် အကျဉ်းချုပ်အစီရင်ခံစာကို ဖြည့်စွက် ဖေါ်ပြထားပါသည်။
၂။	**ကတိကဝတ်**		
	ဖော်ပြထားမှုမရှိပါ။	ပတ်ဝန်းကျင်ထိခိုက်မှုဆိုင်ရာလုပ်ထုံးလုပ်နည်း အပိုဒ် (၆၂)အရ - စီမံကိန်းအဆိုပြုသူမှ EIA အစီရင်ခံစာပါ EMP တွင်ဖော် ပြထား သော ပတ်ဝန်းကျင်ထိခိုက်မှု လျော့ပါးစေရေး လုပ်ငန်းများကို အကောင်အထည် ဖော်ဆောင်ရွက်မည် ဖြစ်ကြောင်း၊ စီမံကိန်းသည် ပတ်ဝန်းကျင် ဆန်းစစ်ခြင်း အစီရင်ခံစာပါ ကတိကဝတ်များ၊ ပတ်ဝန်းကျင် ထိခိုက်မှု လျော့ချရေး လုပ်ငန်းများနှင့် အစီအစဉ်များကို အပြည့်အဝ အစဉ်အမြဲလိုက်နာ ဆောင်ရွက်မည်ဖြစ် ကြောင်း ကတိကဝတ်အားဖော်ပြရန်၊ - အစီရင်ခံစာရေးသားပြုစုသူမှ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း သည် တိကျမှုနှင့်ပြည့်စုံမှုရှိကြောင်း၊ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ် ခြင်းဆိုင်ရာ လုပ်ထုံး လုပ်နည်းအပါအဝင် သက်ဆိုင်ရာဥပဒေများကို တိကျစွာ လိုက်နာ၍ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းကို ဆောင်ရွက်ခြင်းဖြစ်ကြောင်း ကတိကဝတ်ကို ဖော်ပြရန်၊ - စီမံကိန်းအဆိုပြုသူနှင့် အစီရင်ခံစာရေးသားပြုစုသူတို့	ဖြည့်စွက်ဖေါ်ပြထားပါသည်။ ဖြည့်စွက်ဖေါ်ပြထားပါသည်။

		လိုက်နာ ဆောင်ရွက်မည့် ကတိကဝတ်များကို သီးခြားခွဲခြား လက်မှတ်ရေးထိုး ဖော်ပြရန်၊	
၃။	**မူဝါဒ၊ ဥပဒေနှင့် အဖွဲ့အစည်းဆိုင်ရာ မူဘောင်**		
	Page 26 to 27 main esia report တွင် မြန်မာနိုင်ငံ၏ Environmental policies and laws များအကြောင်း၊ မြန်မာနိုင်ငံမှ လက်မှတ်ထိုးထား သော international conventions များကိုဖော်ပြထားသည်။ Appendix III page 5-15 တွင် existing Myanmar laws relating to environment, social environment, Myanmar's commitment to international agreements on environmental issues, laws and regulations related to land tenure and land use စသည်တို့ကို ဖော်ပြထား သော် လည်း စီမံကိန်းမှလိုက်နာ ဆောင်ရွက်မည်ဟု ဖော်ပြထားခြင်း မရှိကြောင်း၊ စီမံကိန်းမှလိုက်နာဆောင်ရွက်မည့် ဥပဒေပါ ပုဒ်မများ၊ ပုဒ်မခွဲများအား ဖော်ပြထားမှုမရှိကြောင်း စိစစ် တွေ့ရှိရသည်။	- အဆိုပြုစီမံကိန်းမှ လိုက်နာဆောင်ရွက်ရမည့် ဥပဒေ၊ နည်းဥပဒေ များ၊ လုပ်ထုံးလုပ်နည်းများ၊ စံချိန်စံညွှန်းများနှင့် နိုင်ငံတကာစည်းကမ်းသတ်မှတ်ချက်များထည့်သွင်းဖော်ပြရန်။ -ကုမ္ပဏီ၏ ပတ်ဝန်းကျင်ထိန်းသိမ်းရာမူဝါဒ/ မူဘောင်များ ရှိပါက ထည့်သွင်းဖော်ပြရန်။ -အဆိုပြုစီမံကိန်းမှလိုက်နာရမည့် တည်ဆဲပတ်ဝန်းကျင်ထိန်း သိမ်းရေး ဥပဒေနှင့် နည်းဥပဒေများ၊ အပြည်ပြည်ဆိုင်ရာ ကွန်ဗင်းရှင်းများ၊ စာချုပ်များနှင့် သဘောတူညီချက်များ၊ အမျိုးသားနှင့် အပြည် ပြည်ဆိုင်ရာ စံချိန်စံညွှန်းများနှင့် လမ်းညွှန်ချက်များ အပါအဝင် မူဝါဒနှင့် ဥပဒေရေးရာမူ ဘောင်များ ထည့်သွင်းဖော်ပြရန်၊ -စီမံကိန်း၏ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် လူမှုရေးဆိုင်ရာ စံချိန်စံညွှန်းများ၊ -ကျန်းမာရေးအပေါ် ထိခိုက်စေနိုင်မည့် စီမံကိန်းလုပ်ငန်းများ အတွက် ကျန်းမာရေးဆိုင်ရာ စံချိန်စံညွှန်းများ။ -အဆိုပြုစီမံကိန်းမှလိုက်နာရမည့် ပြည်ထောင်စုသမ္မတ မြန်မာနိုင်ငံတွင် ထုတ်ပြန်ထားသော လူမှုပတ်ဝန်းကျင်၊ လူမှုဖူလုံရေး၊ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး ကိစ္စရပ်များနှင့် ပတ်သတ်သည့်ဥပဒေများ စည်းမျဉ်းစည်းကမ်း များ အနက်မှ စီမံကိန်းနှင့်သက်ဆိုင်သည့် ဥပဒေများ၊ စည်းမျဉ်းစည်းကမ်းများကို အစီရင်ခံစာတွင် ထည့်သွင်း	အဆိုပြုစီမံကိန်းမှ လိုက်နာဆောင်ရွက်ရမည့် ဥပဒေ၊ နည်းဥပဒေများ၊ လုပ်ထုံးလုပ်နည်းများ၊ စံချိန်စံညွှန်း များနှင့် နိုင်ငံတကာစည်းကမ်းသတ်မှတ်ချက်များ Main ESIA Report အခန်း ၃ နှင့် Appendix III SIA Report အခန်း ၁ တွင် ကိုထပ်မံ ထည့်သွင်းဖော်ပြထားပါသည်။

		ဖော်ပြရန်။ -စီမံကိန်းမှလိုက်နာဆောင်ရွက်မည့် နိုင်ငံတကာ လမ်းညွှန်ချက်များ အားဖော်ပြရန် လိုအပ်ပါသည်။	
၄။	**စီမံကိန်းအကြောင်းအရာဖော်ပြချက်နှင့် အခြားနည်းလမ်းရွေးချယ်ခြင်း**		
	Page 38-45 တွင် စီမံကိန်းဆိုင်ရာ Engineering Drawing များ၊ Schematic Drawing engineering design/ layout ပုံများသာဖော်ပြထားပြီး စီမံကိန်း၏အနီးပတ်ဝန်းကျင်၊ powerhouse, resivoir များကိုရှင်းလင်းစွာမြင်ရသော layout ပုံများ၊ မြေပုံများ၊ ဓာတ်ပုံများ မပါရှိကြောင်း စိစစ်တွေ့ရှိရသည်။ Page 38	-စီမံကိန်း ဇရိယာနှင့် ဆက်စပ်ပတ်သက်နေသော ပတ်ဝန်းကျင် အနေအထား၊ ဘေးပတ်ဝန်းကျင်ရှိ မြေအသုံးချမှုများနှင့် လူနေထိုင်သည့်နေရာများကို အလွယ်တကူသိရှိစေနိုင်ရန် ပတ်ဝန်းကျင်အခြေအနေများ ပါဝင်သော ခြုံငုံဖော်ပြနိုင်သော တည်နေရာ ပြမြေပုံများ၊ ဓာတ်ပုံများ၊ google image များကို ဖော်ပြပေး ရန်။ -စီမံကိန်းအစိတ်အပိုင်း တစ်ခုချင်းအတွက် (Dam/powerhouse, spillway/ etc.) တည်နေရာ၊ အဆောက်အဦးများ၊ သိုလှောင်ရုံများ၊ ချဉ်းကပ်လမ်းများ၊ နယ်နိမိတ်များ၊ မြေမျက်နှာသွင်ပြင် ကိုရှင်းလင်းစွာမြင်ရသော မြေပုံများ၊ ဓာတ်ပုံများ၊ google image များကို ဖော်ပြပေးရန်။ -Access routes များနှင့်ပတ်သက်သော အချက်အလက်များ (length, width, amount of vegetation removed, route drainage) နှင့် location များကိုမြေပုံ ဓာတ်ပုံများနှင့်တကွ ဖော်ပြရန်။ -Transmission Line များနှင့်ပတ်သက်သော အချက်အလက် များ (length, width, amount of vegetation removed, route drainage) နှင့် location များကိုမြေပုံ ဓာတ်ပုံများနှင့် တကွ ဖော်ပြရန်။ -စီမံကိန်းဇရိယာ၏ မြေအသုံးချမှုအခြေအနေ (သစ်တောကြိုးဝိုင်း/ ကြိုးပြင်ကာကွယ်တော၊ လယ်/ယာမြေ၊	စီမံကိန်း ဇရိယာနှင့် ဆက်စပ်ပတ်သက်နေသော ပတ်ဝန်းကျင် အနေအထား၊ ဘေးပတ်ဝန်းကျင်ရှိ မြေအသုံးချမှုများနှင့် လူနေ ထိုင်သည့်နေရာများကို အလွယ်တကူသိရှိစေနိုင်ရန် ပတ်ဝန်း ကျင်အခြေ အနေများ ပါဝင်သော ခြုံငုံဖော်ပြနိုင်သော တည် နေရာ ပြမြေပုံများ၊ ဓာတ်ပုံများ၊ google image များကို အခန်း ၄ တွင် ထပ်မံဖော်ပြထားပါသည်။ Transmission Line များနှင့်ပတ်သက်သော အချက်အလက်များကို အခန်းငယ် ၄.၇.၃ တွင် ဖော်ပြထားပါသည်။ စီမံကိန်းဇရိယာ၏ မြေအသုံးချမှုအခြေအနေ များကို Main ESIA Report အခန်း ၄.၇ တွင် ဖော်ပြထားပါသည်။
	Transmission Line များနှင့်ပတ်သက်၍ ‘The power station has three loops of 110KV outgoing lines, one to the construction substation of Chipwi, one to the constraction		Operation phase တွင် ထားရှိမည့် အလုပ်သမားအရေအတွက် နှင့် worker accommodation အတွက် စီစဉ်ထားရှိမှု၊ domestic waste၊ Sewage များကို စွန့်ပစ်မည့်နည်းလမ်း များကို အခန်းငယ် ၄.၇.၃ တွင် ဖော်ပြထားပါသည်။

	substation of Myitsone, and another for standby (reserved for Waxiao)' ဟုဖော်ပြထားသည်။ စာမျက်နှာ (၄၉) - စီမံကိန်းဇရိယာသည် ငလျင်ပြင်းအား ၈ အထိရှိနိုင်သော ဇုန်အတွင်း ရှိကြောင်းဖော်ပြထားသည်။ အဆိုပြုစီမံကိန်း၏ seismic zone mapping နှင့် seismic activities/ event mapping တို့ကိုဖော်ပြသင့် ပါသည်။ (previous ECD comment) ငလျင်များသည့် ဇရိယာဖြစ်သဖြင့် တည်ဆောက်မည့် ဆည်၊ ရေသွယ် မြောင်းများ၊ စက်ရုံတို့၏ ဒီဇိုင်း အချက်အလက်များသည် ငလျင်ဒဏ်ကို ခံနိုင်ရည်ရှိကြောင်းနှင့် ဘေးကင်းစိတ်ချ ရကြောင်း ပြည်တွင်း မှတ်ပုံတင် ဆောက်လုပ်ရေး အင်ဂျင်နီယာ (Professional Engineer – PE), Geotechnical Engineer တို့၏ အတည်ပြုချက်၊ အကြံပြုချက်များရယူ သင့်ပါသည်။ (previous ECD comment) Response: ငလျင်နှင့် သက်ဆိုင်သော ကာကွယ်မှုများကို FS အစီရင်ခံစာ၏ Chapter 3 တွင်ဖော်ပြထားပြီး ဖြစ်ပါ သည်။	အခြားမြေအသုံးချမှု) နှင့် မြေယာပိုင်ဆိုင်မှုအခြေအနေများ၊ သစ်တောမြေ ပါရှိ/ မရှိဖော်ပြရန်နှင့် ပါရှိပါက သစ်တောဦးစီးဌာန ခွင့်ပြုချက်ရယူထား သည်ကို ဖော်ပြရန်။ -Operation phase တွင် အလုပ်သမားမည်မျှထားရှိမည်ကို ဖော်ပြရန်နှင့် worker accommodation အတွက် စီစဉ်ထားရှိမှု၊ domestic waste၊ Sewage များကို စွန့်ပစ် မည့်နည်း လမ်းများကို ဖော်ပြရန်။ -Feasibility Study တွင်ဖော်ပြထားပြီးဖြစ်သော်လည်း ငလျင်ဒဏ်ခံ နိုင်ရည်ရှိမှုဆိုင်ရာ တဖက်ပါတောင်းဆိုထား သော အချက်အလက်များ ကို EIA report တွင် ထပ်မံထည့်သွင်း ဖော်ပြရန်။ -ရေအားလျှပ်စစ်ထုတ်ယူမည့် နည်းစနစ်အား ရှင်းလင်းစွာ ဖော်ပြရန်။ (hydro peaking ပြုလုပ်မည့် အစီအစဉ်ရှိ/ မရှိဖော်ပြရန်)	ငလျင်ဒဏ်ခံ နိုင်ရည်ရှိမှုဆိုင်ရာအချက်အလက်များ ကို Main ESIA Report အခန်း ၄.၅ ၊ အခန်း ၁၁.၂.၇.၄ - Environmental Management Plan for Dam Safety နှင့် အခန်း ၈.၂.၂ Reservoir Induced Earthquake Risk Analysis တွင် ဖြည့်စွက် ဖေါ်ပြထားပါသည်။ ရေအားလျှပ်စစ်ထုတ်ယူမည့် နည်းစနစ်အား အခန်း ၄ တွင် ဖော်ပြထားပါသည်။
၅။	**လက်ရှိပတ်ဝန်းကျင်အကြောင်းအရာများဖော်ပြချက်**		
	စီမံကိန်းလုပ်ငန်းကြောင့် တိုက်ရိုက်/ သွယ်ဝိုက် ထိခိုက်နိုင်ခြေရှိသော နယ်ပယ်များအား လေ့လာ သတ်မှတ် ဖော်ပြထားခြင်းမရှိပါ။	လုပ်ကွက်နှင့် လုပ်ကွက်အနီးပတ်ဝန်းကျင်အခြေအနေကို လေ့လာတင်ပြရာတွင် အဆိုပြုစီမံကိန်းကြောင့် ဖြစ်ပေါ်နိုင် သော သက်ရောက်မှုများအပေါ် မူတည်၍ ၎င်းတို့အား	**Scope of EIA study ကို Main ESIA Report အခန်း ၂.၅ တွင် အောက်ပါအတိုင်း ဖော်ပြထားပါသည်။** **2.5 Assessment scope**

		တိုက်ရိုက်ဖြစ်စေ၊ သွယ်ဝိုက်၍ဖြစ်စေ ပတ်သတ်ထိခိုက်နိုင်ခြေရှိသော ဇရိယာ ကို ခြုံငုံမိစေမည့် အကျယ်အဝန်း (Scope of EIA study) ကို သတ်မှတ်ဖော်ပြရန်နှင့် ထိဇရိယာအတွင်းရှိ ပတ်ဝန်း ကျင်ဆိုင်ရာ အချက်အလက်များ ကို data ကောက်ယူတင်ပြရန်။	This engineering environmental impact assessment covers the hub engineering, reservoir area, and water-reduced river reach. Investigation and assessment scope of different environmental factors should be determined according to impact mechanism and impact degree. Considering the fact that Chipwi Nge Hydropower Station is located at Nmaihka River, and its tail water basically does not affect the water environment and aquatic ecology of the River, the assessment of Chipwi Nge Hydropower Station's impacts on hydrological regime, water environment, and aquatic ecology is only limited to the mouth of Chipwi River. See Table 2.5-1 for the assessment scope of each environmental factor. **Table 2.5-1 Scope of Environmental Impact Assessment of Chipwi Nge Hydropower Station** **Environmental factor** / **Assessment scope** Hydrological regime: From the end of reservoir of Chipwi Nge Hydropower Station to the mouth of Chipwi River, plant tail water involving Nmaihka River section Water environment: From the end of reservoir of Chipwi Nge Hydropower Station to the mouth of Chipwi River, plant tail water involving Nmaihka River section Atmospheric environment: Construction management area extends 2km both to the upstream and downstream of the river valley. Acoustic environment: Construction management area and 200m around the boundary of construction management area Terrestrial ecology: From the end of reservoir of Chipwi Nge Hydropower Station to the area below Grade I watershed at the two sides of the mouth of Chipwi River, and 500m around the plant Aquatic organism: From the end of reservoir of Chipwi Nge Hydropower Station to the area below Grade I watershed at the two sides of the mouth of Chipwi River, plant tail water involving Nmaihka River section

			Social environment: Kachin State ယခုစီမံကိန်းအတွက် EIA baseline data များကို ၂၀၁၉ ခုနှစ် Januarry – May တွင် ကောက်ယူခဲ့ပြီး EIA report ကို ၂၀၁၃ ခုနှစ်တွင် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဝန်ကြီး ဌာနသို့ တင်သွင်းခဲ့ပါသည်။ ထို့အပြင် REM Company အနေဖြင့် ၂၀၁၆ ခုနှစ်တွင် လက်ရှိပတ် ဝန်းကျင်အခြေအနေများကို ထပ်မံကောက်ယူခဲ့ပါသည်။ ကောက်ယူခဲ့သောအချက်အလက်များမှာ - လေထုအရည်အသွေး နှင့် ဆူညံသံ - ၂ နေရာ - Power House အနီး - ချီဘွေမြို့နယ်ဆေးရုံဂင်း (ထိုနေရာသည် Power house နှင့် dam အကြားတွင်ရှိပြီး Sensitive Receptor ဖြစ်ပါသည်။ Terrestrial Flora and Fauna ၁) ရေကာတာ (Dam) နှင့် မေခမြစ်ဂအထိ (nearly 16 km section) - ချီဘွေမြစ်ကမ်းနှစ်ဖက် နှင့် dam axis မှ dam အထက်ပိုင်း ၁.၅ ကီလိုမီတာခန့် ၂) Power House area –0.5 km radius area Aquatic Fauna (Fish) - Along the Chipwi River between dam axis and mouth of May Kha River ဆည်နှင့်မေခမြစ်ဂ အကြားတွင် မည်သည့် ကျေးရွာမှမရှိပါ။ powerhouse အနီးပတ်ဝန်းကျင်၊ နှင့် downstream တို့တွင်လည်း ကျေးရွာများမရှိဘဲ တောင်ယာတဲများသာ ရှိပါသည်။

		-ဆည်နှင့် powerhouse အနီးပတ်ဝန်းကျင်၊ upstream, downstream တို့ရှိ ကျေးရွာများနှင့် ချီဘွေမြစ်၊ မေခမြစ်တို့၏ အကွာအဝေးများကို ဖော်ပြရန်နှင့် မြေပုံ/ google image/layout ပုံများထဲတွင် ထည့်သွင်းဖော်ပြရန်	
	Air quality ကို parameter (၉ခု) အတွက် 100 m northeast of powerhouse and ချီဘွေမြို့ပေါ်ရှိ ဆေးရုံဝန်းအတွင်း (၂) နေရာတွင် (၁) ကြိမ်စီ (၂၄ နာရီကြာ) တိုင်းတာ၍ result ကို page 7 တွင် ဖော်ပြထားသည်။ -100 m northeast of powerhouse SO_2 emission မှာ EQEG ထက်ကျော်လွန်နေကြောင်း ဖော်ပြထားသည်။	-တိုင်းတာထားသော parameter (၉ခု) တို့အပြင် EQEG (၁.၁ ထုတ်လွှတ်အခိုးအငွေ့) ပါ parameter များအားလုံး တိုင်းတာဖော်ပြရန်။ -ဆည်၏ အနီးပတ်ဝန်းကျင်နှင့် powerhouse ၏ အနီးပတ်ဝန်းကျင်များတွင် ၎င်းနေရာကို ကိုယ်စားပြုနိုင်သော Sample အရေအတွက်ဖြင့် Air quality baseline data ကောက်ယူရန်။	လေထုအရည်အသွေးအတွက် ယခုလက်ရှိတိုင်းတာထားသော parameter 9 မျိုးတွင် EQEG (1.1 ထုတ်လွှတ်အခိုးအငွေ့) မှ parameter များ အနက် O_3 (Ozone) သာမပါရှိဘဲ ကျန် parameter များပါဝင်ပါသည်။ လိုအပ်ပါက O_3 (Ozone) ကို Environemntal Monitoring တွင် ထည့်သွင်း တိုင်းတာသွားပါမည်။ ဆည်၏ အနီးပတ်ဝန်းကျင်နှင့် powerhouse ၏ အနီးပတ်ဝန်းကျင်များတွင် လေထုအရည်အသွေးကို ၆ လ တစ်ကြိမ် စောင့်ကြပ် ကြည့်ရှုပါမည်။
	Noise level ကို Air quality တိုင်းတာသည့် နေရာများဖြစ်သော 100 m northeast of powerhouse နှင့် ချီဘွေမြို့ပေါ်ရှိဆေးရုံဝန်းအတွင်း (၂) နေရာတွင် (၁)ကြိမ်စီ (၂၄ နာရီကြာ) တိုင်းတာ၍ result ကို page 11 တွင်ဖော်ပြထားသည်။	ထိခိုက်ခံစားရမည့် receptors များဖြစ်သော powerhouse ၏ အနီးပတ်ဝန်းကျင်ရှိ အနီးဆုံးကျေးရွာများ၊ powerhouse အတွင်းရှိ အလုပ်သမားအိမ်ရာများ၊ ရုံးခန်းနေရာများ ၌ Noise level ကိုတိုင်းတာဖော်ပြရန်။	Powerhouse ၏ အနီးပတ်ဝန်းကျင်တွင် ကျေးရွာများ မရှိဘဲ ၎ကဲ့သို့အိမ်ရာသာ ရှိပါသည်။ Powerhouse အတွင်းရှိ အလုပ်သမားအိမ်ရာများ၊ ရုံးခန်းနေရာများ ၌ Noise level ကို နေ့စဉ် စောင့်ကြပ်ကြည့်ရှုတိုင်းတာဖော်ပြပါမည်။
	Water quality ကို 200 m west of powerhouse,	Sampling point တစ်နေရာတွင်ကောက်ယူသည့် sample	Sampling point တစ်နေရာတွင်ကောက်ယူသည့် sample

	upstream of dam, 1.3 km downstream of power plant, ချီဘွေမြို့အနီး မေခမြစ် နှင့် Powerhouse မှ wastewater များမြစ်အတွင်းသို့ စွန့်ထုတ်သည့်နေရာစုစုပေါင်း ၄ နေရာတိုင်းတာထားသည်။ Parameter 32 မျိုးတိုင်းတာထားသည်။ 10th, 11th and 14th, 2016 တွင်တိုင်းတာထားသည်။	အရေအတွက်ကိုဖော်ပြရန်။ -downstream of dam တွင် ဆည်အောက်ဖက်ရှိရေ၏ အရည်အသွေး အားကိုယ်စားပြုနိုင်သော Sampling point location များ (၁) နေရာမကတိုင်းတာရန် နှင့် တစ်နေရာတွင်လည်း ရေနမူနာ (၁)ခုထက်မက တိုင်းတာရန်။ -upstream of dam တွင် Sampling point 1 နေရာ (3 samples at each sampling point) ထပ်မံတိုင်းတာရန် - downstream of dam တွင် Sampling point 1နေရာ (3 samples at each sampling point) ထပ်မံတိုင်းတာရန်။	အရေအတွက် နှစ်ကြိမ်ကောက်ယူပြီး Parameter 32 မျိုးအတွက် စုစုပေါင်း ရေနမူနာ ၃ လီတာ ကောက်ယူခဲ့ပါသည်။ Environmental Monitoring လုပ်ငန်းစဉ်တွင် ECD မှ အကြံပြုထားသော အောက်ပါလုပ်ငန်းစဉ်များကို လုပ်ဆောင်ပါမည်။ -upstream of dam တွင် Sampling point 1 နေရာ (3 samples at each sampling point) ထပ်မံတိုင်းတာရန် - downstream of dam တွင် Sampling point 1နေရာ (3 samples at each sampling point) ထပ်မံတိုင်းတာရန်။
	-Floristic survey ကို ဆည်နှင့် powerhouse အနီးပတ်ဝန်းကျင်တွင် ကောက်ယူ၍ list of plant species ကို page 10-12 တွင်ဖော်ပြထားသည်။ အပင်မျိုးစိတ် (၁၀၁)မျိုးတွေ့ရှိရကြောင်း ဖော်ပြထားသည်။ Systematic data collection method with quadrat system ဖြင့် ကောက်ယူကြောင်း ဖော်ပြထားသည်။	-ကောက်ယူထားသည့် data များကို ဆည်နှင့် powerhouse ၏ ပတ်ပတ်လည်မည်သည့် ဇရိယာ အကျယ်အဝန်းအတွင်းမှ ကောက်ယူထားကြောင်း နှင့် ထိုဇရိယာသတ်မှတ်ကောက်ယူရသည့် အကြောင်းအရင်းကို (justification for scope of EIA study) ဖော်ပြရန်။ -ဆည်နှင့် Powerhouse ၏ ပတ်ပတ်လည်တွင်တွေ့ရှိရသော အပင်မျိုးစိတ်များကို ခွဲခြားဖော်ပြရန် -Systematic data collection method with quadrat system ဖြင့်ကောက်ယူကြောင်းဖော်ပြထားရာ sample plot layout နှင့် location ကိုမြေပုံ/ လုပ်ကွက် layout ပုံ/ google image များထဲတွင်ဖော်ပြရန် -အပင်နှင့် တိရိစ္ဆာန်မျိုးစိတ်များ၏ ပေါများမှု (specie population)၊ ပြန့်နှံ့မှု၊ ရှားပါးမှု၊ မျိုးသုဉ်းရန် အန္တရာယ်ရှိမှု၊ ထိခိုက်လွယ်မှု၊ စီးပွားရေး/ ဆေးဝါး/ အာဟာရတန်ဖိုးရှိမှု၊ local dependency on forest products စသည်တို့ကို လည်းကောင်း၊ တန်းဖိုးထားရမည့် သို့မဟုတ် ထိရှလွယ်သည့်	- Data များကို power house ၏ ၃ ကီလိုမီတာ ပတ်ပတ်လည် အကျယ်အဝန်းမှ ကောက်ယူထားပြီး ဆည်အတွက် ၅၀၀ မီတာ ပတ်ပတ်လည် အကျယ်အဝန်းမှ ကောက်ယူထားပါသည်။ ထိုအကျယ်အဝန်းများကိုလည်း google image များဖြင့် ဖော်ပြထားပြီးဖြစ်ပါသည်။ Justification: The proposed Chibwenge Dam site is covered with degraded forest and the forest type was found as secondary forest type. At present, the only remaining viable wildlife habitats are on the steep and relatively inaccessible slopes of undisturbed forests outside the project area. The areas of the dams and power plants are not significant for wildlife migration, breeding, or feeding. - power house နှင့် ဆည်၏ ပတ်ပတ်လည်တွင် တွေ့ရှိရသော အပင်မျိုးစိတ်များကို ပြန်လည်ခွဲခြားဖော်ပြထားပါသည်။

		နယ်မြေများကို လည်းကောင်း ရှင်းလင်းဖော်ပြရန်။	- Systematic data collection method with quadrat system ဖြင့်ကောက်ယူထားသည့် sample plot layout များကို google earth ပေါ် တင်လိုက်သည့်အခါ အလွန်သေးငယ်သဖြင့် zoom ဆွဲကြည့်မှသာမြင်နိုင်သောကြောင့် ကောက်ယူထား သည့် quadrat များအားလုံးကို google image တွင် ဖော်ပြရန်မ လွယ်ကူပါ။ ထို့ကြောင့် quadrat location အမှတ်များကို lat & long တန်ဖိုးများဖြင့် ပြန်လည်ဖြည့်စွက်ဖော်ပြ ထားပါသည်။ - အပင်နှင့် တိရစ္ဆာန်များ၏ ပေါများမှု၊ မျိုးသုဉ်းရန် အန္တရာယ်ရှိမှုများကို IVI တန်ဖိုးများ၊ IUCN Status များဖြင့် report ထဲတွင် ဖော်ပြထားပြီးဖြစ်ပါသည်။ power house အနီးတွင် စီးပွားရေးအရ စိုက်ပျိုးထား သော လိမ္မော်စိုက်ခင်းနှင့် ကျွန်းစိုက်ခင်း နှစ်ခုသာရှိပါ သည်။ ထိုစိုက်ခင်းနှစ်ခုကိုလည်း google image နှင့် habitat map တွင် ထည့်သွင်း ဖော်ပြထား ပြီးဖြစ်ပါသည်။
	Terrestrial fauna and aquatic ကို Chibwenge dam site and Power House area တွင် ကောက်ယူထားကြောင်းနှင့် result ကို page 20-95 တွင်ဖော်ပြထားသည်။ -19 mammal species at Chibwenge dam site and Power House area (7 mammal species are threatened species under IUCN Red List, 3 species were endangered species and another 4 species were record as vulnerable species) -78 bird species (2 vulnerable species -37 butterfly species	-စီမံကိန်းလုပ်ငန်းများကြောင့် အပင်၊ တိရိစ္ဆာန်တို့၏ အခြေအနေများပြောင်းလဲနိမ့်ကျခြင်း ရှိမရှိ နှိုင်းယှဉ်နိုင်ရန် လေ့လာရန် ဆည်နှင့် Powerhouse ၏ ပတ်ပတ်လည်ဇရိယာ၊ နယ်နိမိတ်မည်မျှ အတွင်း Terrestrial fauna and aquatic fauna (fishes) survey ကိုပြုလုပ်မည် (scope of EIA study) ဖော်ပြရန်။ -ကောက်ယူထားသည့် data များသည် ဆည်နှင့် powerhouse ၏ ပတ်ပတ်လည်မည်သည့် ဇရိယာအ ကျယ်အဝန်းအတွင်းမှ ကောက်ယူထားကြောင်းနှင့် ထိုဇရိယာ သတ်မှတ်ကောက်ယူရသည့် အကြောင်းအရင်းကို (justification for scope of EIA study) ဖော်ပြရန်။ -ဆည်နှင့် powerhouse ၏	- Terrestrial fauna လေ့လာခြင်းများကို ဆည်အတွက် ချီဘွေမြစ်၏ ၅၀၀ မီတာ ပတ်ပတ်လည်အတွင်းနှင့် power house အတွက် ၃ ကီလိုမီတာ ပတ်ပတ်လည်အ တွင်းတွင် လေ့လာမှုများ ပြုလုပ်ခဲ့ပါသည်။ Aquatic fauna (fishes) survey ကို ချီဘွေမြစ်၏ ၅၀၀ မီတာ ပတ်ပတ်လည် အကျယ်အဝန်းအတွင်းနှင့် power house ၏ ၃ ကီလိုမီတာ ပတ်ပတ်လည် အကျယ်အဝန်းအတွင်း ပြုလုပ်ထား ပါသည်။ Power house အနီး မေခမြစ်အတွင်းတွင်မူ စစ်ရေးအခြေအနေများအရ လေ့လာမှုများ လုပ်ခွင့်မရပါ။ ထို့ကြောင့် interview survey အရသာ သိရှိခဲ့ရပါသည်။ - Justification for Fauna survey: The proposed Chibwenge Dam site is covered with degraded forest

	-(စာမျက်နှာ ၉၀-၉၁) 13 fish species at upstream and 15 species at downstream – Fish population မှာ small population size သာဖြစ်ကြောင်း -IUCN Red List species များမတွေ့ရှိရကြောင်း၊ -တွေ့ရှိရသော ငါးမျိုးစိတ်များမှာ long-distance longitudinal migratory fish species များမဟုတ်ကြောင်းဖော်ပြထားသည်။ -According to the interview result, the fishes were not main sources for the consumotion of the local people ဟုဖော်ပြထားသည်။	ပတ်ပတ်လည်တွင်တွေ့ရှိရသော Terrestrial fauna and aquatic fauna မျိုးစိတ်များကို ခွဲခြားဖော်ပြရန်။ - Terrestrial fauna and aquatic fauna species population and abundancy, distribution, wildlife movement, migratory route ဆိုင်ရာ အချက်အလက်များကို လေ့လာ ဖော်ပြရန် လိုအပ်ပါသည်။ -Mammals များထဲတွင် endangered species, critically endangered species များပါရှိနေသဖြင့် project operation phase, decommissioning phase and post decommissioning phase များတွင် စီမံကိန်းလုပ်ငန်းများကြောင့် ထိုမျိုးစိတ်များ၏ အကောင်ရေလျော့နည်းသွားခြင်း မရှိစေရန် ၎င်း တို့၏ habitat, breeding site, migratory route, movement များအား ထိခိုက်မှုမရှိစေရေး conservation ပြုလုပ်မည့် အစီအစဉ်ကို ဖော်ပြရန်။ -ကောက်ယူထားသည့် fish species data များသည် ဆည်နှင့် powerhouse ၏ ပတ်ပတ်လည်မည်သည့် ဇရိယာအ ကျယ်အဝန်း အတွင်းမှ ကောက်ယူထားကြောင်းနှင့် အဆိုပါ ဇရိယာအား စီမံကိန်းကြောင့် impact ဖြစ်နိုင်သော အကျယ်အဝန်း အဖြစ် သတ်မှတ်ရသည့် Justification ကိုဖော်ပြရန်။	and the forest type was found as secondary forest type. At present, the only remaining viable wildlife habitats are on the steep and relatively inaccessible slopes of undisturbed forests outside the project area. The areas of the dams and power plants are not significant for wildlife migration, breeding, or feeding. - Justification for aquatic fauna: Chipwi River is a mountain steam type of river. Its water level can sharply rise after rainstorms and then quickly fall. Bedrock or gravel is distributed on the bottom. Chipwi River is shallow and low in the content of suspended matters so the people can see the bottom. Due to small flow, water transportation is at a lower level, so the river bottom is relatively stable. There are more deposition of rotted terrestrial plant leafs in stone gaps where aquatic hold plants, zoobenthos and periphytic algae breed. Due to the lower water temperature, dissolved oxygen is often saturated. Small fish species adaptive to rapids are dominant, such as small species of cobitidae and barbinae. - Based on the field survey, the areas of the dams and power plants are not significant for wildlife migration, breeding, or feeding. - ဆည်နှင့် power house ၏ ပတ်ပတ်လည်တွင် တွေ့ရှိရသော Terrestrial fauna မျိုးစိတ်များကို ပြန်လည်ခွဲခြားဖော်ပြထားပါသည်။ Aquactic fauna မျိုးစိတ်များကို မြစ်၏ အထက်ပိုင်းနှင့် အောက်ပိုင်းများ

			တွင်သာလေ့လာခဲ့ရပြီး မေခမြစ်အ တွင်းတွင်မူ စစ်ရေးအခြေအနေများကြောင့် လေ့လာ ခွင့်မရခဲ့ပါသဖြင့် interview view survey အရသာ လေ့လာခဲ့ရပါသည်။ ထို့ကြောင့် aquatic fish မျိုးစိတ်များကို မြစ်အထက်ပိုင်းနှင့် မြစ် အောက်ပိုင်းသာ ခွဲခြားဖော်ပြထားခြင်း ဖြစ်ပါသည်။ Interview survey ဖြင့် မေခမြစ်အတွင်း ကောက်ယူရရှိသော ငါးမျိုးစိတ်များမှာလည်း ချီဘွေ မြစ်အတွင်းတွေ့ရှိရသော ငါးမျိုးစိတ်များ ဖြစ်ကျသည့် အတွက် သီးခြားခွဲခြား၍ မဖော်ပြထား ခြင်းဖြစ်ပါသည်။ - စက်ရုံနှင့် ချီဘွေဆည်၏ ပတ်ဝန်းကျင်ရှိ သစ်တောများ မှာ အဆင့်အတန်းနိမ့် သစ်တောနှင့် secondary forest များသာဖြစ်ကျသည့်အတွက် terrestrial fauna များနေထိုင်ကျက်စားခြင်း နဲပါးပါ သည်။ တောရိုင်း တိရစ္ဆာန်များ ကျက်စားနိုင်သည့် နေရာများမှာလည်း စီမံကိန်းဧရိယာနယ်နမိတ်အပြင်ဖက်တွင်ရှိသည့် သွား လာရခက်ခဲပြီး မတ်စောက်သောတောင်ပေါ်များတွင်သာ ကျန်ရှိ နေပါသည်။ The areas of the dams and power plants are not significant for wildlife migration, breeding, or feeding because the site is covered with degraded forest and the forest type was found as secondary forest type. - Endangered and critically endangered species of Mammal အတွက် conservation action များကို conservation status ခေါင်းစဉ်အောက်တွင် IUCN ၏ conservation action များဖြင့် ဖော်ပြထားပါသည်။ The areas of the dams and power plants are not significant

			for wildlife migration, breeding, or feeding. - Aquatic fauna (fishes) survey ကို ချီဘွေမြစ်၏ ၅၀၀ မီတာ ပတ်ပတ်လည် အကျယ်အဝန်း အတွင်းနှင့် power house ၏ ၃ ကီလိုမီတာ ပတ်ပတ်လည် အကျယ်အဝန်းအတွင်း ပြုလုပ်ထားပါ သည်။ အဆိုပါ ဇရိယာများမှာ buffer zone များသာဖြစ်ကျပါသည်။ ထို buffer zone များသည် focus လုပ်မည့် landscape, habitat နှင့် species conservation များပေါ်မူတည်၍ ပြောင်းလဲနိုင်ပါသည်။ Justification: Buffer zones may not be the sites of active biodiversity conservation or impact zone/area, but their establishment provides an additional layer of protection to existing areas of biodiversity importance, and they are often fundamental to achieving conservation of those areas. ချီဘွေမြစ်နှင့် မေခမြစ်အတွင်းတွင် REM မှ Baseline data ကောက်ယူချိန်တွင် ချီဘွေမြစ် (dam အထက်ပိုင်းနှင့် အောက်ဖက်တွင်) အတွင်းလေ့လာမှုများ အရ ငါးမျိုးစိတ် ၁၃-၁၅ မျိုးခန့်၊ အကောင်အရေအတွက် အနည်းငယ်သာ လေ့လာတွေ့ရှိရပါသည်။ မေခမြစ်အတွင်းတွင် စစ်ရေး အခြေအနေအရ လေ့လာမှုများလုပ်ခွင့်မရပါ။ ထို့ကြောင့် Interview Survey အရသာ သိရှိခဲ့ရပါသည်။ ချီဘွေမြစ်နှင့် မေခမြစ်အတွင်းတွင် REM မှ Baseline data ကောက်ယူချိန်တွင် ချီဘွေမြစ် (dam အထက်ပိုင်းနှင့် အောက်ဖက်တွင်) အတွင်းလေ့လာမှုများ အရ ငါးမျိုးစိတ် ၁၃-၁၅ မျိုးခန့်၊ အကောင်အရေအတွက် အနည်းငယ်သာ လေ့လာတွေ့ရှိရပါသည်။ မေခမြစ်အတွင်းတွင် စစ်ရေး အခြေအနေအရ

			လေ့လာမှုများလုပ်ခွင့်မရပါ။ ထို့ကြောင့် Interview Survey အရသာ သိရှိခဲ့ရပါသည်။ ချီဘွေမြစ်နှင့် မေခမြစ်အတွင်းတွင် REM မှ Baseline data ကောက်ယူချိန်တွင် ချီဘွေမြစ် (dam အထက်ပိုင်းနှင့် အောက်ဖက်တွင်) အတွင်းလေ့လာမှုများ အရ ငါးမျိုးစိတ် ၁၃-၁၅ မျိုးခန့်၊ အကောင်အရေအတွက် အနည်းငယ်သာ လေ့လာတွေ့ရှိရပါသည်။ မေခမြစ်အတွင်းတွင် စစ်ရေး အခြေအနေအရ လေ့လာမှုများလုပ်ခွင့်မရပါ။ ထို့ကြောင့် Interview Result အရသာ သိရှိခဲ့ရပါသည်။ ချီဘွေငယ်ရေအားလျှပ်စစ် စီမံကိန်းသည် ၂၀၁၃ ခုနှစ် တွင်တည်ဆောက်ပြီး ဖြစ်ပါသည်။ အဆိုပါ ငါးမျိုးစိတ်များ မှာ ဒေသတွင်းငါးမျိုး စိတ်ဖြစ်ပြီး Torretial Flow Habitat တွင် နေထိုင်ပေါက်ဖွားနိုင်ပါသည်။ အဆိုပါငါးများ အပေါ် သက်ရောက်နိုင်မှုမှာ ဆည်နှင့် မေခမြစ်၀ (၁၆ ကီလိုမီတာ) အတွင်းတွင် ရေနည်း ချိန်တွင် Fish Population အပေါ် အဓိကသက်ရောက်မှု ဖြစ်ပါသည်။ သို့ရာတွင် အဆိုပါငါးမျိုးစိတ်များမှာ မေ ခမြစ်အတွင်းတွင်လည်း ပေါများပါသည်။ အဆိုပါဆည်ကြောင့် ဆည်အထက်ပိုင်း နှင့် အောက်ဖက်ငါးများကူးဖြတ်မသွားလာနိုင်ခြင်း၊ ဆည် အောက်ဖက် ၁၆ ကီလိုမီတာမှ မေခမြစ်၀အထိ ငါးအကောင်ရေလျော့နည်းခြင်း စသည့် ထိခိုက်မှု အနည်းငယ်သာရှိပြီး စီမံကိန်းမှ ရရှိမည့် အကျိုးအမြတ် နှင့် နိုင်းယှဉ်လျင် မပြောပနိုင်၍သာ လျှပ်စစ် နှင့် စွမ်းအင် ၀န်ကြီးဌာနမှ ခွင့်ပြုကာ တည်ဆောက်ခဲ့ခြင်းဖြစ်ပါသည်။ ချီဘွေမြို့တွင် နေထိုင်သော လူများနှင့် စစ်ရှောင်စခန်း တွင်လာရောက် နေထိုင်သော ဒေသတွင်း နေထိုင်သော လူများ၏အဓိက အသက်မွေး၀မ်းကြောင်း များ၊ Flora and
		-ချီဘွေမြစ်နှင့် မေခမြစ်အတွင်း စီမံကိန်းကြောင့် impact ဖြစ်နိုင်သောဇရိယာအတွင်းရှိ Fish migratory route, spawning ground နေရာများဆိုင်ရာ အချက်အလက်များကို လေ့လာဖော်ပြရန်။ -အချက်အလက်များ၊ references များဖော်ပြရန် -Questionnaire (page 31-70, 128-133) တွင်	

		အဆိုပါကိစ္စနှင့် ပတ်သက်၍ မေးခွန်းမရှိပါသဖြင့် မည်သည့် အချက်အလက်ကို အခြေခံကာ ထိုသို့ ကောက်ချက်ချထားကြောင်း ဖော်ပြရန်။	Fauna Survey တွင် လည်း မေးမြန်း ချက်များကို အခြေခံကာ ကောက်ချက်ချ ထားခြင်း ဖြစ်ပါသည်။
၆။	**ထိခိုက်နိုင်မှုများ**		
	Appendix IV : Potential Environmental Impact Assessment, Mitigation and Enhancement Measure တွင် ထိခိုက်နိုင်မှုများနှင့် လျော့ပါးစေရေး ဆောင်ရွက်ရမည့် အစီအစဉ်များကိုဖော်ပြထားသည်။ အဆိုပြု စီမံကိန်းသည် တည်ဆောက်ရေး လုပ်ငန်းများပြီးစီးပြီး ယခုအခါတွင် လျှပ်စစ်ဓာတ်အား ထုတ်လုပ် လျှက်ရှိသော Operation Period ရောက်ရှိနေပြီဖြစ်ပါသဖြင့် စီမံကိန်း၏ Operation Phase, Decommissioning Phase, Post Decommissioning phase များအတွက် ထိခိုက်မှုဆန်းစစ်ခြင်းနှင့် လျော့ပါးစေရေးဆောင်ရွက်မည့် အစီအစဉ်များကို အဓိကထား စိစစ်တင်ပြဆွေးနွေးသွားမည် ဖြစ်ပါသည်။ ထိခိုက်နိုင်မှု လျော့ပါးစေရေးဆောင်ရွက်မည့် အစီအစဉ်များကို ကုန်ကျစရိတ်၊ အချိန်၊ လူအင်အား၊ လိုအပ်သော ပစ္စည်းကိရိယာစသည်ဖြင့် အသေးစိတ်ဖော်ပြရန်။		
	Environmental Geology ဆည်၏ တဖက်တချက်စီတွင် လျှုမြောင်များရှိခြင်းကြောင့်	-dam safety ပေါ်တွင် impact ရှိကြောင်းဖော်ပြထားရာ	

	ဆည်၏ safety ပေါ်တွင် impact ရှိကြောင်းကို 'It is prone to downward collapse, slip and solifluction under rain effects. Its coverage towards gullies and Chipwi River will easily cause mudslides. The mudslides will affect reservoir sedimentation and dam safety' ဟုဖော်ပြထားရာ (Appendix IV စာမျက်နှာ ၅) Powerhouse တည်ဆောက်ထားသော နေရာတွင်လည်း stability ploblem ရှိကြောင်းဖော်ပြထားသည်။(Appendix IV စာမျက်နှာ ၅) တည်ဆောက်မည့်ဆည်၊ ရေသွယ်မြောင်းများ၊ စက်ရုံတို့၏ ဒီဇိုင်းအချက်အလက်များသည် ငလျင်ဒဏ် ကိုခံနိုင်ရည်ရှိ ကြောင်းနှင့် ဘေးကင်းစိတ်ချရကြောင်း ပြည်တွင်းမှတ်ပုံတင် ဆောက်လုပ်ရေး အင်ဂျင်နီယာ (Professional Engineer- PE), Geotechnical Engineer တို့၏ အတည်ပြုချက်၊ အကြံပြုချက်များ ရယူသင့်ပါသည်။ (previous comment) ငလျင်အတွက် risk analysis ပြုလုပ်ရာတွင် အသုံပြုထားသော seismic intensity grade ဆိုင်ရာ Guidelines/Standards များအားဖော်ပြပေး ရပါမည်။(previous comment) Response: FS study တွင်ဖော်ပြထားပြီးဖြစ်ကြောင်း။	မည်သည့်အတိုင်းအတာထိ impact ရှိနိုင်ကြောင်း တိကျစွာဖော်ပြရန်နှင့် အဆိုပါ impact ကို ကာကွယ်နိုင်ရန် မည်သို့စီမံဆောင်ရွက်သွားမည်ကို EMP နှင့် mitigation measures များတွင် ချိတ်ဆက်ဖော်ပြရန်။ -Power house တည်ဆောက်ထားသောနေရာတွင်လည်း stability problem ရှိကြောင်းဖော်ပြထားရာ မည့်သည့် အတိုင်းအတာ အထိ impact ရှိနိုင်ကြောင်း တိကျစွာဖော်ပြရန် နှင့် အဆိုပါ impact ကိုကာကွယ်နိုင်ရန် မည်သို့စီမံ ဆောင်ရွက်သွား မည်ကို EMP နှင့် mitigation measures များတွင် ချိတ်ဆက် ဖော်ပြရန်။ -Feasibility Study တွင်ဖော်ပြထားပြီး ဖြစ်သော်လည်း ငလျင်ဒဏ်ခံနိုင်ရည်ရှိမှုဆိုင်ရာ အချက်အလက်များကို EIA report တွင်ထည့်သွင်းဖော်ပြရန်။	၆.၉ Environmental geology ခေါင်းစဉ်အောက်တွင် impact အတိုင်းအတာကို ဖော်ပြထားပြီး ၁၁.၁.၂.၈ Geological environment protection ခေါင်းစဉ်အောက်တွင် အောက်ပါအတိုင်း ဖော်ပြထားပါသည်။ Specific to unstable slopes or rocks, appropriate measures have been provided in the design. The #1, #2 and #4 dangerous rocks are treated with the measures including removal, anchoring and shotcrete. **Dam Safety** According to the Seismic Safety Assessment Report for the dam site area of the adjacent Chipwi hydropower station, the dam site is located at an area with relatively stable regional structure. With 1:4000000 *seismic peak acceleration zonation map of China* (2001), it is analyzed that the seismic peak acceleration over 10% in the area is 0.20g for 50 years with a basic earthquake intensity of Ⅷ. Main structures are ranked grade 3, and the design of earthquake intensity employs Ⅷ. Earthquake resistance protection of the project is category C. The #1, #2 and #4 dangerous rocks are treated with the measures including removal, anchoring and shotcrete in the power station project.

	Soil Erosion (operation phase) (Appendix IV စာမျက်နှာ ၆) impact assessment for soil erosion မှာ construction phase အတွက်သာ ဖော်ပြထားသည်။ Operation phase ၏ soil erosion နှင့် နန်းပို့ချခြင်းနှင့် ပတ်သက်၍ (စာမျက်နှာ ၃၃) impact due to sedimentation တွင် In Chipwi Nge Hydropower Station, annual average sediment discgarge is 724,000 t and annual average total discharge bed load discharge is 145,000 t and annual average total discharge is 869,000 t ဟုသာဖော်ပြထားသည်။	-Operation phase တွင် ချီဘွေမြစ် (ဆည်နေရာ) နှင့် မေခမြစ်(ရေအားလျှပ်စစ်စက်ရုံ) နှစ်နေရာလုံးတွင်မြစ်ကြောင်း အတွင်း ပို့ချနေသည့် သဲနန်းများ အရေအတွက် နှင့် စုပုံလာနိုင်ခြေတို့ ၏ ခန့်မှန်းချက်များကို ဖော်ပြရန် နှင့် Erosion and sedimentation ဆိုင်ရာ impact assessment ကို dam site and power house နှစ်နေရာလုံးအတွက် assessment ပြုလုပ်ဖော်ပြရန်။ -ချီဘွေမြစ်(ဆည်နေရာ) နှင့် မေခမြစ်(ရေအားလျှပ်စစ်စက်ရုံ) နှစ်နေရာလုံးတွင်မြစ်ကြောင်းအတွင်း ပို့ချနေသည့် သဲနန်းများ အရေအတွက် နှင့် စုပုံလာနိုင်ခြေတို့ ၏ ခန့်မှန်းချက်များကို ဖော်ပြရန်။ -dam site ၏ Erosion and sedimentation ဆိုင်ရာ အချက်အလက်များ (ဥပမာ annual sediment discharge) များကို data ကောက်ယူတွက်ချက်ဖော်ပြရန်။ - Erosion and sedimentation ကြောင့် downstream of dam တွင်ဖြစ်လာနိုင်သော impact များကိုကောက်ယူထားသော baseline data များကိုအခြေခံ၍ ဆန်းစစ်ဖော်ပြရန်။	The water and soil conservation works in the main structural area include slope protection measures for #1-6 permanent openings, plant, tailrace, dam, reservoir and diversion tunnel. The design slope protection measures don't only guarantee the safety, but also brings good soil and water conservation effects. ချီဘွေမြစ်(ဆည်နေရာ) တွင် လက်ရှိ Hydrology Station တစ်ခုရှိပြီး ပျက်စီးသွားသည့်အတွက် ပြတ်လည်ပြင်ဆင်ပြီး မြစ်ကြောင်းအတွင်း ပို့ချနေသည့် သဲနန်းများ အရေအတွက် နှင့် စုပုံလာနိုင်ခြေတို့ ၏ ခန့်မှန်းချက်များကို တွက်ချက်ရန် အတွက် hydrology and sedimentation data များကို ကောက်ယူသွား ပါမည်။ **Annual sediment deposition during operation period** The total annual mean sediment discharge at the dam site is 869,000 t and the reservoir capacity below normal pool level is 789,000 m^3. Therefore, the ratio of reservoir capacity below normal pool level to annual sediment discharge (volume) is comparatively small, indicating that there exist relatively severe deposition. The calculation result shows a fast deposition rate and the total deposition is about 690,000 m3. To mitigate the deposition effects on the reservoir operation, one orifice with the size of 5m×6mis placed in the dam body to discharge flood and sediment. This orifice will be put into use for sediment flushing when the incoming sediment load is high. It should be noted that no sediment deposition is found in the tailrace area of the power plant.

		-Construction phase တွင်ဖြစ်ပေါ်ခဲ့သော မြေပျက်စီးမှုများကို ပြန်လည်ကုစားမည့် အစီအစဉ်တိုင်းဆောင်ရွက်ပြီးစီးမှု များကို ဖော်ပြရန်။	ထို့အပြင် သဲနုန်းများ ပို့ချမှုကို လျော့ချ ကာကွယ်ရန်အ တွက် watershed ထိန်းသိမ်းမည့် အစီအစဉ် များကို အခန်း **11.2.7.1 Terrestrial Ecology (Biodiversity) and Watershed Management Plan** အခန်းတွင် ဖေါ်ပြထား ပါသည်။ Construction phase တွင်ဖြစ်ပေါ်ခဲ့သော မြေပျက်စီး မှုများကို ပြန်လည်ကုစားမည့် အစီအစဉ်တိုင်းဆောင်ရွက် ပြီးစီးမှု များကို အခန်း 11.1.2.3 Water and soil conservation တွင် ဖေါ်ပြထားပါသည်။
	Hydrological impacts (Appendix IV စာမျက်နှာ ၆) ဆည်နှင့်မြစ်ဝကြား 15.7 km ရှည်သော water reduction section ဖြစ်လာမည် ဖြစ်ကြောင်း၊ water reduction section တစ်လျှောက် မြစ်ဘေးတွင် scatter settlements များရှိကြောင်း၊ ဒေသခံများ သည် ချိုဘွေမြစ်ထက် အနီးအနားရှိ ချောင်း မှရေကိုသာ ယူကြောင်း၊ water reduction section တစ်လျှောက် irrigation and water supply အတွက် ရေသုံးစွဲမှုမရှိကြောင်း ဖော်ပြထားသည်ချိုဘွေမြစ်ပေါ် ရှိ ဆည်၏ Downstream discharge ecological flow နှင့်ပတ်သက်၍ အောက်ပါအတိုင်း ဖော်ပြထားသည်။ -discharged ecological flow of the dam is 0.53m3/s.	water reduction section တစ်လျှောက်မြစ်ဘေးရှိ settlements များ၏ မြစ်နှင့်အကွာအဝေးကို ဖော်ပြရန်၊ -မြစ်ကြောင်းတစ်လျှောက်ကျေးရွာများ နှင့် လူနေအိမ်များကို ရှင်းလင်းစွာမြင်ရသော map, google image, aerial photos များဖော်ပြရန် - water reduction section မြစ်ကြောင်းတစ်လျှောက်ရှိ ကျေးရွာများနှင့် လူနေအိမ်များ၏ domestic and irrigation water use အတွက် မည်သည့်နေရာမှ ရယူသုံးစွဲသည် နှင့် ပတ်သက်သော data များဖော်ပြရန်။ -ဆည်၏အောက်ဘက်တွင် average natural flow (40.1 m^3/s) အောက် ရေစီးဆင်းမှု လျော့နည်းသွားခြင်း၊ ရေစီးဆင်းမှုပုံစံ ပြောင်းလဲသွားခြင်းကြောင့် မြစ်၏ ဘူမိ၊ တိရိစ္ဆာန်၊ အပင်တို့၏ ဖွဲ့စည်းတည်ဆောက်ပုံ၊ habitat နှင့် ဂေဟစနစ်ဝန်ဆောင်မှုများ၊ ငါးများနှင့် Downstream ရေအသုံးပြုသူများအပေါ် သက်ရောက်မှုများ (area of influence, extent of impact, duration	water reduction section (16km) ဆည်မှ ချိုဘွေမြစ် နှင့် မေခမြစ်ဆုံ တလျှောက်တွင် မည်သည့်ကျေးရွာမှ မရှိပါ။ Main ESIA report အခန်း 6.3 Aquatic Organisms, 7.6 Water Resources Utilization, 7.6.1 Impact on use of water resources, 7.6.2 Impact on downstream water use တွင် ဆန်းစစ်ဖေါ်ပြထား ပါသည်။ Calculation of runoff The average monthly runoff of the hydropower plant at the dam site is calculated using the hydrological measurement of Dongying Station. Using the time series of Dongying hydrological station during 1959～1987 (measurement is unavailable in some years), the ratio of monthly distribution of runoff was calculated. The monthly runoff at the dam site was therefore obtained using such distribution ratio at Dongying station, according to rainfall at the dam site. The monthly (and annual) runoff at the dam site is shown in in Table 1.

-Average flow 1.6km in the downstream can reach 1.66m3/s
(due to in flow from two gullies)
- flow at the estuary of Chipwi River can reach 14.4m3/s, accounting for 26.7% of annual average flow at the estuary of Chipwi River.

Recipient river နှင့်ပတ်သက်၍ -
Desgined diversion flow is 26.46 m^3/s, accounting for only 1.2% of annual average flow of Nmaigka River at the powerhouse. It has little impact on hydrological regime of Nmaihka River waterway above the powerhouse ဟုဖော်ပြထားသည်။
(စာမျက်နှာ ၈)

များကိုဖော်ပြလျက်) ကိုဆန်းစစ်ဖော်ပြရန်။
-Downstream flow discharge မှာ မြစ်၏ ဂေဟစနစ် ကျန်းမာရေးနှင့် ecosystem services များ ယခင်ကအတိုင်း ဆက်လက်ထောက်ပံ့နိုင်ရေးအတွက် လုံလောက်သော discharge flow ဖြစ်ကြောင်း ဆန်းစစ်ဖော်ပြရန်၊
-မြစ်၏ ကျန်းမာရေးနှင့် မြစ်တိမ်ကောပျက်စီးသွားခြင်းမှ ရှောင်ရှားနိုင်ရေး၊ မြစ်ကြောင်းကိုထိန်းသိမ်းထားရန်နှင့် ငါးများ ရွှေ့ပြောင်းသွားလာနိုင်ရန် အတွက် ဆည်၏ အောက်ဘက် downstream ၏ အနည်းဆုံး ရေစီးဆင်း မှုလိုအပ်ချက်များ နှင့် အရည်အသွေး သတ်မှတ်အဆင့်များကို သိရှိစေ ရန်အတွက် ပတ်ဝန်းကျင်ဆိုင်ရာ စီးဆင်းမှုအကဲဖြတ်ခြင်းများ (environmental flow assessment) ပြုလုပ်၍ တင်ပြရန်၊
-ဆည်၏ အထက်ဘက်ရှိ ရေဝေရေလဲ ဒေသအား ထိန်းသိမ်းမည့် အစီအစဉ်များဖော်ပြရန်။
-ချီဘွေမြစ်၏ hydrological data များသာဖော်ပြထားသဖြင့် Receipent river (မေခမြစ်) ၏ hydrological data (original flow, increased flow) များကိုလည်းဖော်ပြရန်။
-ရေလွှဲများ မေခမြစ်အတွင်းသို့ discharge လုပ်ခြင်းကြောင့် မေခမြစ်အပေါ်တွင် impact အနည်းငယ်သာရှိမည်ဟု ရေးသားထားရာImpact ဖြစ်နိုင် မဖြစ်နိုင် ကို appropriate modeling, mapping, impact assessment methodologies များကို အသုံးပြု၍ အချက်အလက်များကို အခြေခံတိကျစွာ ဆန်းစစ်ဖော်ပြရန်။
-Peak flow season ၌ မေခမြစ်အတွင်း increased flow volume ကြောင့် flood risk ရှိမရှိကို historical high flood levels, ရေကြီးမှုဖြစ်ပေါ်ခဲ့သည့် အကြိမ်အရေအတွက်

Table 1 Monthly runoff of the dam site of the hydropower plant

Month	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Flow	10.2	9.65	11.6	10.7	18.4	75.9	104	85.6	65.1	49.9	23.1	13.6	40.1
Runoff	0.27	0.24	0.31	0.28	0.49	1.97	2.80	2.29	1.69	1.34	0.60	0.36	12.6
Ratio	2.2	1.9	2.5	2.2	3.9	15.6	22.1	18.1	13.4	10.6	4.7	2.9	100

Flow: m^3/s; runoff: hundred million m^3; ratio: %

Downstream flow discharge အတွက် monthly average flow ၏ 10 % ဖြစ်သော 0.53m^3/s ကို Environmental Flow အဖြစ် တွက်ချက် ဒီဇိုင်းထုတ်ထားပါသည်။ လုံလောက်သော discharge flow ဖြစ်ကြောင်းကို Main ESIA report အခန်း **6.1 Hydrological regime** တွင် ဇယားများဖြင့် တွက်ချက်ဖော်ပြထားပါသည်။
(environmental flow assessment) သည် ဆည်မ တည်ဆောက်မှီ မဖြစ်မနေ ပြုလုပ်ရသော assessment ဖြစ်ပါသည်။ ယခုစီမံကိန်းတွင်လည်း environmental flow assessment ပြုလုပ်ကာ ဒီဇိုင်းလုပ်ပြီးတည် ဆောက်ထားခြင်း ဖြစ်ပါသည်။
Main ESIA report အခန်း **6.1 Hydrological regime** တွင်ဖော်ပြထားပါသည်။

Estimation of Design Flood

The estimation of design flood at Chipwi Nge HPP follows the steps of:

4) Estimate design storm: Convert the annual maximum storm in 1 day into 24hr storm, and then calculate the design storm

		များအပေါ် ခြေခံ၍ ဆန်းစစ်ဖော်ပြရန်။ Downstream communities များကိုရေစီးဆင်းမှု နည်းသွားခြင်း များသွားခြင်းဆိုင်ရာ ထိခိုက်နိုင်မှုများနှင့် ပတ်သတ်၍ awareness raising များပြုလုပ်ပေးရန်။ -Transportation အတွက်မြစ်ကြောင်းအား အသုံးပြုနေခြင်းရှိ မရှိနှင့် ရှိပါက အဆိုပြုစီမံကိန်းကြောင့် river traffic and access of vessels အပေါ် ထိခိုက်မှုများကို ဆန်းစစ်ဖော်ပြရန် နှင့် လျော့နည်းစေရေးဆောင်ရွက်မည့် နည်းလမ်းများကို ဖော် ပြရန်။ -Inundation and flood ဆိုင်ရာ downstream ထိခိုက်နိုင်မှု များကို ဆန်းစစ်၍ လျော့နည်းစေရေးဆောင်ရွက်မည့် နည်းလမ်း များကိုဖော်ပြရန်။	volume for 1hr and 6hr according to the distribution ratio for 1hr and 6hr of the basin near Yunnan province in China; 5) Estimate design area rainfall (volume): According to the Manual, taking the reduction coefficient of spot and area in the 4thzone as the reduction coefficient of spot and area of storm of catchment area cc of the hydropower project, calculate the design area rainfall (volume); 6) Estimate design area rainfall (hydrograph): obtain the design area rainfall process by referring to the design hydrograph in the 4thzone. Considering the well-conserved vegetation of Chipwi Nge River basin and the landform of mountainous areas, referring to the values applied in the neighbor area of Yunnan province, the initial loss of25mmand the infiltration rate of4.5mm/h were adopted. Similarly, the routing parameters of the 6th and 8thzones of Yunnan province are adopted. Design flood with various frequencies of Chipwi Nge is then estimated using parameters obtained. The results are shown inTable2. Downstream communities များကိုရေစီးဆင်းမှု နည်းသွားခြင်း များသွားခြင်းဆိုင်ရာ ထိခိုက်နိုင်မှုများနှင့် ပတ်သတ်၍ awareness raising များကို ပြုလုပ်ပေးပါမည်။ ချီဘွေမြစ်သည် တောင်ကြားအတွင်း ဖြတ်သန်းစီးဆင်း သောမြစ်ငယ်ဖြစ်ကာ ရေကြောင်းသွားလာမှုအတွက် အသုံးပြုခြင်းမရှိပါ။ မေခမြစ်သည်လည်း ရေစီးကြမ်းသည့် အတွက် Transportation အတွက်မြစ်ကြောင်းအား အသုံးပြု နေခြင်းမရှိပါ။ Inundation and flood ဆိုင်ရာ downstream ထိခိုက်နိုင်မှု လျော့နည်းစေရေးအတွက် Main ESIA Report အခန်း

Frequency	0.2%	0.5%	2%	3.33 %	5%	10%	20%
Flood peak (m^3/s)	2540	2200	1710	1500	1320	958	489
Flood peak modulus ($m^3/s \cdot km^2$)	6.11	5.29	4.11	3.61	3.17	2.30	1.18

			11.2.7.8 Environmental Management Plan for Flood Risk တွင်ဖော်ပြထား ပါသည်။
	Water quality (operation phase) -No industrial and domestic pollution is in the reservoir of Chipwi Nge Hydropower station, so there will be almost no waste water to enter the reservoir.(page 11) ရေအရည်အသွေး၊ ရေထဲတွင် nutrient များလာပြီး ရေလှောင်ကန်နှင့် downstream တွင် ရေအရည်အသွေး ကျဆင်းသွားနိုင်ခြင်းနှင့်ပတ်သတ်၍ 'Chipwi Nge Hydropower Station is daily regulation one with frequent water exchange. It is expected that the impoundment will have little impact on eutrophication of water in the reservoir.' ဟုဖော်ပြထားသည်။ Reduction of discharged flow in the section from the dam site and estuary will affect dilution and self-purification capacity of the water. (page 11) Constriction and operation of Chipwi Nge Hydropower Station will not affect significantly water quality in the river. (page 11)	-ရေလှောင်ကန်ထဲတွင် အောက်ဆီဂျင်လျော့နည်းလာခြင်းနှင့် anaerobic breakdown of organic matter ဖြစ်လာနိုင်ခြင်းနှင့် nutrients nitrate phosphate များများလာခြင်းကြောင့် ဆည်အတွင်း နှင့် downstream ရှိ ရေအရည်အသွေးအပေါ် ထိခိုက်နိုင်မှုများကိုဆန်းစစ်ဖော်ပြရန်။ -မြစ်ကြောင်း အတွင်း ရေပမာဏ အလွန်နည်းသွားခြင်းကြောင့် ရေလျော့နည်းသွားသည့် section တစ်လျှောက်မြစ်၏ dilution and self-purification capacity ကျဆင်း၍ မြစ်၏ water quality အပေါ်ထိခိုက်မှုနှင့် water quality ကျသွားခြင်းကြောင့် aquatic habitat and ecosystem services of rivers, fisheries, downstream water users များအပေါ်ထိခိုက်နိုင်မှုများကို ဆန်းစစ်ဖော်ပြရန်။ -receipient river (မေခမြစ်) ၌ powerhouse spillway မှ ရေ များ မြစ်ထဲ discharge ပြုလုပ်ခြင်းကြောင့် downstream water quality အပေါ် ထိခိုက်နိုင်မှုများကိုဆန်းစစ်ဖော်ပြရန်။	Water quality အပေါ်ထိခိုက်နိုင်မှုများကို လျော့ပါးစေရေးအတွက်ဆောင်ရွက်မည့်နည်းလမ်းများကို အခန်း **11.2.7.3 Environmental Management Plan for Water Quality** တွင်ဖော်ပြထားပါသည်။ အဆိုပါ ထိခိုက်နိုင်မှုများကို လျော့ပါးစေရေးအတွက် ဆောင်ရွက်မည့်နည်းလမ်းများကို အခန်း **11.2.7.2 Environmental Management Plan for Hydrology and Environmental Flow and 11.2.7.7 Environmental Management Plan for Aquatic Ecology (Mainly fish)** တွင်ဖော်ပြထားပါသည်။ Power House spillway မှ ရေများသည် လျှပ်စစ်ထုတ်ယူရန်အတွက် တာဘိုင်လည်ရန်အတွက် သုံးပြီး အအေးခံကာ မေခမြစ်အတွင်းသို့ discharge လုပ်ခြင်းသည် water quality အပေါ် ထိခိုက်နိုင်မှု မရှိပါ။

	Solid waste Solid waste ကြောင့်ဖြစ်ပေါ် နိုင်သော impact များကို ဖော်ပြရာတွင် construction phase အတွက်သာ ဖော်ပြတားသည်။ (စာမျက်နှာ ၉)	Plant maintainance workers' camp, warehouse, site office စသည်တို့ကို reservoir area and powerhouse area နှစ်နေရာတို့တွင် ထားရှိ မရှိကိုဖော်ပြရန်နှင့် ထားရှိပါက အဆိုပါ နေရာများမှ ထွက်ရှိလာသော waste များကို မည်သို့ storage, disposal and manage ပြုလုပ်မည်နှင့် relevant impact များကို ဆန်းစစ်ဖော်ပြရန် လုပ်ငန်းခွင်တွင် ထားရှိမည့် အလုပ်သမား အရေအတွက်ကိုဖော်ပြရန်။	Operation phase တွင် ထားရှိမည့် အလုပ်သမားအရေအတွက် နှင့် worker accommodation အတွက် စီစဉ်ထားရှိမှု၊ domestic waste၊ Sewage များကို စွန့်ပစ်မည့်နည်းလမ်းများကို အခန်းငယ် ၄.၇.၃ တွင် ဖော်ပြထားပါသည်။
	Air quality and GHG emission အဆိုပြုစီမံကိန်းကြောင့် GHG emission နှင့် ပတ်သတ်၍- Chipwi Nge reservoir area however, is very small and degraded forest and orchard, has soil layer and highly weathered layer and low influx of organic material. Chipwi Nge Hydropower Project is not favourable for contribution to the greenhouse gas emissions. As a result, Chipwi Nge Hydropower Project will not contribute to the climate change. ဟုဖော်ပြထားသည်(စာမျက်နှာ ၁၂) Air pollution (operation phase) နှင့်ပတ်သတ် ၍ (စာမျက်နှာ ၁၄) တွင် – During operation period the air pollution is expected to be very limited, and the main source will be vehicle emission and dust from traffic on unpaved	ရေဝပ်ဧရိယာ အတွင်းရှိ vegetation cover area, soil organic matter ပမာဏပေါ်မူတည်၍ break down of vegetation in the reservoir ကြောင့် ဖြစ်ပေါ်လာသော GHG emission ကိုတွက်ချက်ဖော်ပြရန်၊ -Clearing of vegetation, soil degradation တို့ကြောင့် carbon storage များဆုံးရှုံးကာ GHG emission ထွက်ရှိခဲ့မှုကို ယခင် construction phase နှင့် future carbon storage များဆုံးရှုံးကာ GHG emission ထွက်ရှိနိုင်မှုကို တွက်ချက် ဖော်ပြရန်။ - Powerhouse လည်ပတ်ခြင်း၊ စီမံကိန်းယာဉ်များနှင့် dust from traffic စသော emission source များအားလုံးကိုဖော်ပြ၍ ၎င်း source များမှ Operation phase, decommissioning phase စသဖြင့် စီမံကိန်းသက်တမ်း တစ်လျှောက် ထုတ်လွှတ်နိုင်သော ထုတ်လွှတ်အခိုးအငွေ့ အမျိုးအစားအလိုက် ပမာဏ နှင့် ဖြစ်ပေါ်နိုင်သော ပတ်ဝန်း ကျင်ဆိုင်ရာ ထိခိုက်မှုများကို ဆန်းစစ်ဖော်ပြရန်။	GHG emission ကြောင့် **Climate Change** ဖြစ်ပေါ်နိုင်သည့် **CO_2 and Methane** တို့ကို Operation phase monitoring တွင် တိုင်းတာဖော်ပြပါမည်။ ရေအားလျှပ်စစ်စီမံကိန်း၏ Operation Phase တလျှောက်လုံးတွင် ရေအားကို အသုံးပြု၍တာဘိုင်များ လည်ပတ်ခြင်းသည် အဆိပ်အတောက်ဖြစ်စေသော အခိုးအငွေ့များ ထွက်ပေါ်ခြင်း မရှိပါ။ Power House လည်ပတ်ခြင်းကြောင့် လေထုအပေါ်တွင် ဆိုးရွားစွာ မထိခိုက်နိုင်ကြောင်း နိုင်ငံတကာ ရေးအားလျှပ်စစ် ပညာရှင်အများက လက်ခံထားပြီး ဖြစ်ပါသည်။ Operation Phase တွင် စီမံကိန်းအတွက် အသုံးပြုမည့် ယာဉ်အရေ အတွက်မှာလည်း

	roads. In addition, there might be some dust from construction sites before they are properly re- vegetated ဟုဖော်ပြထားသည်။ - အဆိုပြု စီမံကိန်းတွင် Coal ကျောက်မီး သွေးကို လောင်စာအဖြစ် သုံးခြင်းကြောင့် ဒေသခံများမှ ပူပန်မှုရှိကြောင်း ဖော်ပြထား သည်(page 85)	-Coal ကျောက်မီးသွေးကို လောင်စာအရင်းအမြစ်အဖြစ် အသုံးပြုခြင်းကြောင့် ထွက်ရှိမည့် အမှုန်အမွှား၊ CO_2 နှင့် အခြား emission parameters များကိုတိုင်းတာဖော်ပြရန်နှင့် အနီးပတ်ဝန်းကျင် ထိခိုက်မှုများကိုဆန်းစစ်၍ လျော့ချမှု နည်း လမ်းများကို ဖော်ပြရန်။	အနည်းငယ်သာ ရှိပြီး လေထုအရည်အသွေး ကို ပြောပလောင်အောင် မထိခိုက် နိုင်ပါသဖြင့် Operation phase, decommissioning phase စသဖြင့် စီမံကိန်း သက်တမ်းတစ်လျှောက် ထုတ်လွှတ်နိုင်သော ထုတ်လွှတ်အခိုး အငွေ့ အမျိုးအစားအလိုက် ပမာဏ နှင့် ဖြစ်ပေါ်နိုင်သော ပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှုများကို ဆန်းစစ်ရန် မလိုဘဲ လေထုအရည်အသွေးကို စောင့်ကြပ်ကြည့်ရှုမည့် အစီအစဉ်များ ကိုသာ တင်ပြထားပါသည်။ Coal ကျောက်မီးသွေးကို လောင်စာအဖြစ် သုံးခြင်းကြောင့် ဒေသခံများမှ ပူပန်မှုရှိကြောင်းကို Public Consultation တွင် မေးမြန်းခြင်းကို ထည့်သွင်း ဖေါ်ပြထားခြင်းသာဖြစ်၍ ရှုပ်ထွေးမှု များဖြစ်မည်စိုး၍ ထိုအချက်ကို ထည့်သွင်းမဖေါ်ပြတော့ပါ။
	Aquatic flora and fauna Main esia report (page 90) (page 17 ျappendix IV) တွင် အဆိုပြုစီမံကိန်း ကြောင့် Aquatic flora and fauna အပေါ် ထိခိုက်နိုင်မှုများကို ရေးသားထား သော်လည်း အချက်အလက်များကို အခြေခံ၍ impact assessment ပြု လုပ်ထားခြင်းမျိုးမဟုတ်ကြောင်း၊ ပြည့်စုံ လုံလောက်မှု မရှိကြောင်း စိစစ်တွေ့ရှိ ရသည်။ ၁၅.၇ km water reduction section တစ်လျှောက်	ချီဘွေမြစ်တွင်ကျက်စားနေသော ရေစီးနှုန်းမြန်သည့် habitat တွင်ကျက်စားနေထိုင်သည့် ငါးမျိုးစိတ်များ (Schizothorax, pareuchiloglanis, glyptothorax and pseudechenes) အပေါ် ဆည်တည်ဆောက်ခြင်းကြောင့် ရေစီးနှုန်းနေးသွား သဖြင့် ထိခိုက်နိုင်မှုကို base line data များ၊ ငါးမျိုးစိတ်များ၏ ဝိသေသလက္ခဏာ များအပေါ် အခြေခံ၍ ဆန်းစစ်တင်ပြရန်။ 'The project construction has little impact on schizonthorax, pareuchiloglanis, glyptothorax and pseudechenes adaptive to rapids habitat.' ဟုသာ ဖော်ပြ ထားသည်။	6.3 Aquatic organisms After the power plant is completed, water flow of about 15.7km long river reach from the downstream to the powerhouse will decline sharply to reduce plankton and benthos. Fish resources in the river reach also will reduce. Fishes in the river reach are widely distributed in the Nmaihka River basin. The power plant construction only reduces their scope of habitats and the reduction is very small. Reduction of water flow in the water reduction river reach has a limited influence on fishes. Dam construction will divide the complete river ecology system into two parts, the upstream and the downstream, to cause fragmentation of river habitat which will affect exchange between aquatic organisms. Fishes in

	benthos, planktons, fish resources များလျော့နည်း သွားမည်ဖြစ် ကြောင်း။ The power plant construction only reduces their scope of habitats and the reduction is very small. Reduction of water flow in the water reduction river reach has a limited influence on fishes. ဟုဖော်ပြထားရာ (page 90) reservoir for Chipwi NgeHydropower Station has a backwater river reach of 0.75km long and downstream water reduction reach of about 15.7km. influencing reach is shorter, so the project construction will almost not play a significant impact on fish resources in the river system of Nmaihka River. ဟုဖော်ပြထားသည်။ (page 90 main esia report, page 17 appendix IV)	-ငါးမျိုးစိတ်များ၏ spawing grounds များကို ဆန်းစစ်ချက် လုပ်နိုင်မှုအပေါ် ထိခိုက်မှုကိုဆန်းစစ်ဖော်ပြရန် (loss of access to suitable spawning sites and overall impact on the population of fish) -Migratory fishes များအတွက် ၎င်းတို့၏ Migratory route များအတားအဆီးဖြစ်ခြင်းကြောင့် ဖြစ်ပေါ်လာမည့် impact များကိုဆန်းစစ်ရန်။	the Chipwi River are widely distributed in the river system of Nmaihka River. In addition, reservoir for Chipwi Nge Hydropower Station has a backwater river reach of 0.75km long and downstream water reduction reach of about 15.7km. influencing reach is shorter, so the project construction will almost not play a significant impact on fish resources in the river system of Nmaihka River. ငါးမျိုးစိတ်များ၏ Reproduction habits အကြောင်းကို အခန်း၅.၃.၃ Aquatic Organism တွင် ဖော်ပြထားပါသည်။ Reproduction habits Based on the collected records about relevant fish habits and analysis with related species, a vast majority of species in the surveyed regions are fishes laying sticky, sinking types of eggs. For these species, their reproductive migratory distances are normally short and reproduction naturally completes in habitats. For prespawing migration, they generally move upward along the trunk for a short distance to lay eggs on flowing shoals with different bottom sediments or enter nearby mountain streams and lay eggs along them. Schizothorax, pareuchiloglani and catfishes mostly lay eggs in water environment of trunk and tributaries. Migratory fishes များအတွက် ၎င်းတို့၏ Migratory route များအတားအဆီးဖြစ်ခြင်းကြောင့် ဖြစ်ပေါ်လာမည့် impact များကို အခန်း၆.၃ Aquatic Organism အခန်းတွင် အောက်ပါအတိုင်း ဖော်ပြထားပါသည်။ Chipwi River for Chipwi Nge Hydropower Station is a fast-flowing mountain stream with average hydraulic slope of 5% to 6%. Schizothorax, pareuchiloglanis, glyptothorax and pseudecheneis of fishes suitable for rapid stream habitats are likely to inhabit in Chipwi River. After the reservoir filling, flow of river reach in the reservoir will decline so that water environment will be

			favorable to growth and breeding of aquatic organisms suitable for slow flow habitats. Fishes of Nmaihka river system are mainly the species suitable for rapids habitat. They will migrate to the upstream or rapids environment of Nmaihka River. Chipwi Nge Hydropower Station is subject to low-dam diversion development with a reservoir backwater length of about 0.75km. The project construction has little impact on schizothorax, pareuchiloglani, glyptothorax and pseudecheneis adaptive to rapids habitat. Direct impact on the water ecological environment by a hydropower project is damaging continuity of flow and causing fragmenting of ecological environment, which are common issues of all hydropower stations. As for migratory fishes, blocking-affects of the dam may cause failure of life history of some individuals; for fish without obvious migration features and resident fishes, long-term consequences of breaking of the ecological environment may lead to reduction of diversity of fish community heredity and affect population survival. According to comprehensive analysis on fish distribution, migrating habits and spawning habits in the Chipwi Nge, fishes in the river are resident with short migration distance. Proper ecological environment can be found in the lower and upper reaches of the dam and the life history can be completed. Reference to hundreds of small water diversion-type power stations, no fish passages are generally built in the absence of migratory fishes that require special protection. Chipwi River is a mountain stream type of river. Its water level can sharply rise after rainstorms and then quickly fall. Bedrock or gravel is distributed on the bottom. Chipwi River is shallow and low in the content of suspended matters so the people can see the bottom. Due to small flow, water transportation is at a lower level, so the river bottom is relatively stable. There are more deposition of rotted terrestrial plant leafs in stone gaps where aquatic hold

			plants, zoobenthos and periphytic algae breed. Due to the lower water temperature, dissolved oxygen is often saturated. Small fish species adaptive to rapids are dominant, such as small species of cobitidae and barbinae. အထက်ပါအချက်အလက်များကြောင့် ချီဘွေရေအား လျှပ်စစ်စီမံကိန်းကြောင့် Invasive Species များဝင်ရောက်လာနိုင်ချေ မရှိပါ။
	Terrestrial ecosystems/plants Main esia report page 91 တွင် ကုန်းမြေဂေဟစနစ်နှင့် ကုန်းတွင်း ပေါက်သော အပင်နှင့် သတ္တဝါများ အပေါ် ထိခိုက်နိုင်မှုများကိုဖော်ပြထားသော်လည်း baseline data အချက်အလက်များကို အခြေခံ၍ impact assessment ပြုလုပ်ထားခြင်း မျိုးမဟုတ်ကြောင်း၊ ပြည့်စုံလုံလောက်မှုမရှိကြောင်း တွေ့ရှိရ သည်။ -12.2hm^{2}of surface vegetation will be damaged, including 0.5hm^2 of orchard, 6.5hm^2 of economic forest, 0.7hm^2 of timber forest, 2.7hm^2 of grass land and 1.2hm2of shrub forest. – shrubs and weeds. Construction activities will not cause disappearance of species and substantial drop of the quantity. For the vegetation in the project area, damaged area will take a small proportion and the influence is at a lower level.	အောက်ဖော်ပြပါ ကုန်းမြေဂေဟစနစ် နှင့် ကုန်းတွင်း ပေါက်သော အပင် နှင့် သတ္တဝါ များအပေါ် ထိခိုက်နိုင်မှုများကို အချက်အလက် များအားအခြေခံ၍ quantitatively ဆန်းစစ် ဖော်ပြရန်- • တရားမဝင်သစ်ထုတ်လုပ်ခြင်းနှင့် တောရိုင်း တိရိစ္ဆာန်များ အား ကုန်သွယ်မှုတိုးမြှင့်လာခြင်း၊ • ကုန်းသတ္တဝါများ လူပ်ရှားသွားလာရန်နှင့် ရွှေ့ပြောင်းသွားလာရန်အတွက် အတားအဆီးများ ဖြစ်ခြင်းဆိုင်ရာ impact များ • စီမံကိန်းကြောင့် မျိုးစိတ်များ မျိုးသုဉ်းပျောက်ကွယ် နိုင်မှု အလားအလာ၊ Species diversity အပေါ် ထိခိုက်နိုင်မှုများ	အခန်း 5.3 Ecology environment တွင် ချီဘွေရေအား လျှပ်စစ်စီမံကိန်း ပတ်ဝန်းကျင်တွင်ရှိသော အပင်နှင့် သတ္တဝါများ၏ လက်ရှိအခြေအနေကို ဖော်ပြထားပါသည်။ 5.3 Ecological environment 5.3.1 Terrestrial plants Due to human disturbance and frequent hunting, there are rare large wild animals near the project area where are mainly monkeys, snakes and other small wild animals. Reservoir for Chipwi Nge Hydropower Station is small and its area will increase by only 0.08km^2 after filling. It will almost not affect reptiles and mammals inhabiting around the reservoir. Biological environment (Terrestrial Organism and Aquatic Organism) များအပေါ် ထိခိုက်နိုင်မှုများကို အခန်း 6.3 နှင့် 6.4 တွင် ဆန်းစစ်ဖော်ပြထားပါသည်။ - ချီဘွေငယ် ရေအားလျှပ်စစ်စီမံကိန်း တည်ဆောက်မှု ကြောင့် ဆောက်လုပ်ရေးလုပ်ငန်းခွင် (Dam site, power house, pipeline and access road) အတွင်းရှိ ကုန်း သတ္တဝါများ (frogs, common lizards, snakes, rodents and birds) များသည် ဆောက်လုပ် ရေးလုပ်ငန်းခွင် အတွင်းမှ အနီးအနားရှိ ကျက်စားရာဒေသများသို့ အလွယ်တကူ ရွှေ့ပြောင်း သွားလာနိုင်ပါသည်။

	ဆောက်လုပ်ရေးလုပ်ငန်းပြီးစီးချိန်မှစ၍ implementation of soil and water conservation, greening and landscaping measures ပြုလုပ်ပေးမည်ဟု ဖော်ပြထားသည်။ (Main ESIA report page 91) **Terrestrial animals** ထိခိုက်နိုင်မှုနှင့်ပတ်သတ်၍ – Due to disturbance of human activities, there is a small number of wild animals in the project area, which are mainly small ones such as snakes, rodents and birds.secondary forests and shrubs as the habitats. There are habitats for small animals to habitat or migrate in the edge of the construction area. Therefore, the direct influence on these wild animals will be slight. main animals in the construction area are frogs, common lizards, small birds and small mammals and have a small number. For the reason, activities of construction personnel will have little influence on wild animals in the area. စီမံကိန်းဝန်ထမ်းများမှ တောရိုင်း တိရိစ္ဆာန်များ ဝယ်ယူခြင်းကြောင့် wildlife trading များလာနိုင်ကြောင်း ဖော်ပြထား သည်။ လုပ်ကွက်နှင့် အနီး baseline data ကောက်ယူထားသည့် ဧရိယာအတွင်း 19	တည်ဆောက်ရေး လုပ်ငန်းများ ပြီးစီးပြီး ယခုအခါတွင် လျှပ်စစ်ဓာတ်အား ထုတ်လုပ်လျှက်ရှိသော Operational Period ရောက်ရှိနေပြီဖြစ်ပါသဖြင့် ဆောက်လုပ်ရေး လုပ်ငန်းများ ပြီးစီးချိန်မှစ၍ ဆောင်ရွက်မည် ဟု ကတိကဝတ်ပြု ဖော်ပြထား သော မြေ၊ရေ ပြန်လည်ကောင်းမွန်စေရေး ဆောင်ရွက်ပြီးစီး မှုများနှင့် သစ်ပင်ပြန်လည်စိုက်ပျိုး ပေးထားသည့် ပြီးစီးမှု အနေအထားများ (အပင်အမျိုးအစား၊ ဇက၊ စိုက်ပျိုးပေးထား သည့်နေရာ) တို့ကိုဓာတ်ပုံမှတ်တမ်း ဖြင့်တင်ပြရန်။ Construction phase လုပ်ငန်းများဆောင်ရွက်ခြင်းကြောင့် တော ရိုင်း တိရိစ္ဆာန်များ နှင့် ငှင်းတို့နေရင်း ဒေသများအပေါ် ထိခိုက်ခဲ့ မှုများ (နေရင်းဒေသများ ဆုံးရှုံးခြင်း၊ wildlife population and community structures ပြောင်းလဲသွားခြင်း၊ habitat အသစ်တွင် adapt ဖြစ်နိုင်မှုများ)ကို ပြန်လည်ကုစားမှု အစီအစဉ်တင်ပြရန်။ -operation phase နှင့် ကျန်ရှိသည့် စီမံကိန်းသက်တမ်း တစ်လျှောက်	ယခုရေအားလျှပ်စစ် စီမံကိန်းကြောင့် မျိုးစိတ်များ မျိုးသုဉ်းပျောက် ကွယ်နိုင်မှု အလားအလာ မရှိပါ။ တရားမဝင်သစ်ထုတ်လုပ်ခြင်းနှင့် တောရိုင်း တိရိစ္ဆာန်များ အား ကုန်သွယ်မှုတိုးမြှင့်လာခြင်း၊ လျော့နည်းရန် အတွက် နည်လမ်းများ ကို အခန်း ၁၁.၂.၇.၁ တွင် ဖေါ်ပြထားပါသည်။ ဆောက်လုပ်ရေးလုပ်ငန်းပြီးစီးချိန်မှစ၍ **implementation of soil and water conservation, greening and landscaping measures လုပ်ငန်းများကို အခန်း၁၁ 11.1.2.3 Water and soil conservation တွင်ဖော်ပြထားပါသည်။** လက်ရှိဆောင်ရွက်ထားသော အောက်ပါ သစ်ပင်ပြန် လည်စိုက်ပျိုး ပေးထားသည့် အနေအထားများကို အခန်း ၁၁.၂.၇.၁ တွင် ဖေါ်ပြထားပါသည်။ **Vegetation Recovery in Power Plant Area (area, quantity and kinds)** There is teak, banyan, plantain trees, banana trees, mango, rambutan, longan trees, flowers and grass spread over about 3 acres. Construction phase လုပ်ငန်းများဆောင်ရွက်ခြင်းကြောင့် တော ရိုင်း တိရိစ္ဆာန်များ နှင့် ငှင်းတို့နေရင်း ဒေသများအပေါ် ထိခိုက်ခဲ့ မှုများ (နေရင်းဒေသများ ဆုံးရှုံးခြင်း၊ wildlife population and community structures ပြောင်းလဲသွားခြင်း၊ habitat အသစ်တွင် adapt ဖြစ်နိုင်မှုများ)ကို ပြန်လည်ကုစားမှု အစီအစဉ် များကို အခန်း ၁၁.၂.၇.၁ **Terrestrial Ecology (Biodiversity) and Watershed Management Plan** တွင် ဖေါ်ပြထားပါသည်။

	mammal species (7 mammal species were listed as threatened species under IUCN Red List), 78 bird species (2 vulnerable species), 3 reptile species and 1 amphibian species, 37 butterfly species, 13 fish species at upstream and 15 species at downstream တွေ့ရှိရကြောင်း ဖော်ပြထားသည်။	• တရားမဝင်သစ်ထုတ်လုပ်ခြင်းနှင့် တောရိုင်းတိရိစ္ဆာန်များ အား ကုန်သွယ်မှုတိုးမြှင့်လာခြင်း၊ • ကုန်းသတ္တဝါများ လှုပ်ရှားသွားလာရန်နှင့် ရွှေ့ပြောင်းသွား လာရန်အတွက် အတားအဆီးများ ဖြစ်ခြင်း ဆိုင်ရာ impact များ • နေရင်းဒေသများ ဆုံးရှုံးခြင်းကြောင့် wildlife population species diversity အပေါ် ထိခိုက်မှုများကို ရေတို ရေရှည်အတွက် ဆန်းစစ်ဖော်ပြရန်	
	Acoustic impact Operation phase acoustic impact နှင့်ပတ်သတ်၍ စာမျက်နှာ ၁၃ appendix IV) တွင်ဖော်ပြထားသည်။	Powerhouse မှထွက်ရှိလာသော noise and vibration ကြောင့် အနီးအနားရှိ human settlements ၊ အလုပ်သမား အိမ်ရာများ၊ ရုံးများ (အနီးဆုံးhuman settlement များနှင့် အကွာအဝေးကို ဖော်ပြရန်) အပေါ်ထိခိုက်နိုင်မှုများကို ဆန်းစစ်ဖော်ပြရန်။	ချီဘွေငယ်ရေအားလျှပ်စစ်ဓါတ်အားစက်ရုံ၏ Power House နှင့် အလုပ်သမား အိမ်ရာများ၊ ရုံးများ၏အကွာအဝေးမှာ မီတာ ၁၅၀ ခန့်ရှိပါသည်။ August, 2016 တွင် power house အနီးတွင် ကောက်ယူသော Noise data များအရ National Environmental Quality (Emission) Guideline စံချိန်စံညွှန်း အောက်တွင်သာ ရှိပါသည်။ အနီးအနားရှိ human settlements မှာ ချီဘွေမြို့ဖြစ်ပြီး ၁၅ ကီလိုမီတာခန့် ဝေးပါသည်။ The only noise source of the project foreseen in operation phase will be generator and turbines located in the powerhouse. However, there will not be any considerable noise nuisance since they will be located in closed building. In addition, it will be somewhat an isolated facility where is located at a much fared distance of any residence area nearby the project.

	Dam safety (Feasibility study report တွင်ဖော်ပြထားကြောင်း ပြန်လည်တင် ပြလာသဖြင့် EIA report တွင်ထပ်မံဖော်ပြရန်) Flood နှင့်ပတ်သတ်၍ စာမျက်နှာ၃၇ တွင်ဖော်ပြထားသော်လည်း ထပ်မံဖြည့်စွက်ဖေါ်ပြရန်လိုအပ်သည်။ ငလျင်နှင့်ပတ်သတ်၍စာမျက်နှာ၃၉တွင် - According to the Seismic Safety Assessment Report for the dam site area of the adjacent Chipwi hydropower station, the dam site is located at an area with relatively stable regional structure, With 1 : 4000000 peak acceleration zonation map of China (2001) , it is analyzed that the seismic peak acceleration over 10% in the area is 0.02g for 50 years with a basic earthquake intensity of VIII. Main structure are ranked grade 3, and the design of earthquake ဖော်ပြထားသည်။	ဆည်ကျိုးနိုင်မှုနှင့် စိတ်ချရမှု (Dam collapse and safety)၊ ရေကြီးမှုတို့နှင့် ပတ်သတ်၍ hydrological, geotechnical data များ project design and construction material တို့အပေါ်အခြေခံ၍ Dam collapse and safety တွက်ချက်မှုများပြုလုပ်ကာ အဆိုပါဆည်နှင့် ဆက်စပ် infrastructures များသည် စိတ်ချရမှုရှိကြောင်း အထောက်အ ထားဖြင့်ဖော်ပြရန်။ Peak flow seasons နှင့် မမျှော်လင့်သောမိုးများခြင်း ရေကြီးခြင်းတို့ အတွက် ရေကြီးမှုကို ထိန်းချုပ်ရန် ဆည်၏ ရေထိန်းနိုင်မှု၊ ရေထုတ်လွှတ်မှုတို့ကို စနစ်တကျ ဆောင်ရွက်မည့် အစီအစဉ်များကိုဖော်ပြရန်။ -ဒေသတွင်းဖြစ်ပေါ်နိုင်ခြေရှိသော ငလျင်ပြင်းအားကို ပိုမိုခိုင်မာ သော reference များတွက်ချက်မှုများကို ပြည်တွင်း ပြည်ပ ပညာရှင်များထံမှ အကြံဉာဏ်၊ တွက်ချက်မှုများရယူ ကာ တွက်ချက်ဖော်ပြရန်။ -စီမံကိန်းများ၏ infrastructure များသည် ဒေသတွင်းဖြစ်ပေါ်နိုင်ခြေရှိသော ငလျင်ပြင်းအားကို ခံနိုင်ရည်ရှိသော structures များဖြစ်ကြောင်းနှင့် ငလျင်ပြင်းအားကို ခံနိုင်ရည်ရှိ အောင် ဆောင်ရွက်ထားရှိမှုများကို အချက်အလက်များ ဖြင့်တင်ပြရန်။	**Dam Safety** According to the Seismic Safety Assessment Report for the dam site area of the adjacent Chipwi hydropower station, the dam site is located at an area with relatively stable regional structure. With 1:4000000 *seismic peak acceleration zonation map of China* (2001), it is analyzed that the seismic peak acceleration over 10% in the area is 0.20g for 50 years with a basic earthquake intensity of Ⅷ. Main structures are ranked grade 3, and the design of earthquake intensity employs Ⅷ. Earthquake resistance protection of the project is category C. The #1, #2 and #4 dangerous rocks are treated with the measures including removal, anchoring and shotcrete in the power station project. အခန်း **11.2.7.4. Environmental Management Plan for Dam Safety** တွင် ဖော်ပြထားပါသည်။
	Groundwater Hydrology and Quality Land Use Change	-စီမံကိန်းကြောင့် မြေအောက်ရေပမာဏနှင့်အရည်အသွေး အပေါ် ထိခိုက်နိုင်မှုကိုဆန်းစစ်ဖော်ပြရန်။ -ယခင်ကဆောက်လုပ်ရေး လုပ်ငန်းများ ဆောင်ရွက်အသုံးပြုခဲ့သည့် မြေဇရိယာများအား စီမံခန့်ခွဲရေးနှင့် မည်သည့် အကျိုး သက်ရောက်မှုများက မည်ကဲ့သို့ ပြန်လည်ထူ	ရေအားလျှပ်စစ် စီမံကိန်းကြောင့် မြေအောက်ရေပမာ ဏနှင့် အရည်အသွေးအပေါ် ထိခိုက်နိုင်မှုမရှိပါ။ - ယခုစီမံကိန်းသည် စွမ်းအင်နှင့် လျှပ်စစ်ဝန်ကြီးဌာန နှင့် JV လုပ်ဆောင်ခြင်းဖြစ်၍ လုပ်ငန်းဖျက်သိမ်းပြီးပါက အစိုးရသို့ လွှဲပြောင်းပေးသွားမည် ဖြစ်ပါသည်။

	Forestry ပဋိပက္ခနှင့် လုံခြုံရေးဆိုင်ရာ သက်ရောက်မှုများ	ထောင်ရေး လုပ်ငန်းများပြုလုပ်မည်ကို အသေးစိတ်ဖော်ပြရန်။ - ရေဝေရေလဲဒေသများအား ထိန်းသိမ်းမည့် အစီအစဉ် (watershed conservation plan) ကိုဖော်ပြရန်။ စီမံကိန်း ကြောင့်ဖြစ်ပေါ်လာနိုင်သည့် ဒေသရပ်ရွာလူထုများ ကြား ပဋိပက္ခနှင့်လုံခြုံရေးဆိုင်ရာ သက်ရောက်မှုများ ၊ conflict as a result of reduced access to natural resources ကို ဆန်းစစ်ဖော်ပြရန်။	ရေဝေရေလဲဒေသများအား ထိန်းသိမ်းမည့် အစီအစဉ်ကို အခန်း ၁၁.၂.ဂ.၁ တွင် ဖော်ပြထားပါသည်။ စီမံကိန်း ကြောင့်ဖြစ်ပေါ်လာနိုင်သည့် ဒေသရပ်ရွာလူထုများကြား ပဋိပက္ခနှင့်လုံခြုံရေးဆိုင်ရာ သက်ရောက်မှုများအတွက် Guideline သော်လည်းကောင်း၊ EIA Procedure တွင် လည်းကောင်း လုပ်ဆောင်ရန် ဖော်ပြထားခြင်းမရှိပါ။
၇။	**Decommissioning Phase Impacts**		
	Decommissioning Phase တွင် ဆောင်ရွက်ရမည့် လုပ်ငန်းများနှင့်၍ page 18 appendix IV , Decommissioning Phase EMP ကို page 43 Appendix V တွင် လည်းကောင်း ဖော်ပြထား သော်လည်း တဖက်ပါအချက်များ ထပ်မံ ဖြည့်စွက်ဖော်ပြရန် လိုအပ်ကြောင်း စိစစ်တွေ့ရှိရသည်။ စီမံကိန်းသည်နှစ်ရှည်စီမံကိန်းဖြစ်သဖြင့် စီမံကိန်းဖြိုဖျက်ခြင်း၊ ပိတ်သိမ်းခြင်းပြု လုပ်ချိန်တွင်ပတ်ဝန်းကျင်အနေအထားများ၊ ဂေဟစနစ်များ၊ လူမှုပတ်ဝန်း ကျင်အနေအထားများသည်လက်ရှိအနေအထားနှင့် များစွာကွဲလွဲမှုရှိနိုင်သဖြင့် စီမံကိန်းပိတ်သိမ်းခြင်းပြုလုပ်ရန် (၃) နှစ်အလိုတွင် Decommissioning Phase EMP ကိုပြန်လည် revise လုပ်၍ပြန်လည်တင်ပြရန်။	အောက်ဖော်ပြပါ impact များကို ထပ်မံဖြည့်စွက်ဆန်းစစ်၍ လျော့ချမည့်နည်းလမ်းများကို အသေးစိတ်ဖော်ပြထားသော Decommissioning Phase EMP ကို ပြန်လည်တင်ပြရန်။ - Decommissioning လုပ်ငန်းများ ဆောင်ရွက်ခြင်းကြောင့် sedimentationဖြစ်မှု အနည်းဆုံးဖြစ်အောင် ဆောင်ရွက်မည့် အစီအစဉ်၊ -စီမံကိန်းရပ်ဆိုင်းမှု / ပိတ်သိမ်းမှုကာလအတွင်း ထိန်းချုပ်နိုင်သော၊ မထိန်းချုပ်နိုင်သော ရေထုတ်လွှတ်မှု -ရေအားလျှပ်စစ်စီမံကိန်းနှင့် ဆက်စပ်နေသည့် အခြေခံအဆောက်အဦးများ အားလုံးဖယ်ရှားရေး (ရေကာတာနံရံ၊ powerhouse, transmission line နှင့် အခြားဆက်စပ်အခြေခံအဆောက်အဦးများ) ဖြိုချခြင်းတို့၏ ပတ်ဝန်းကျင်နှင့် လူမှုသက်ရောက်မှုဖြစ်နိုင်ခြေများ -ရေအားလျှပ်စစ်စီမံကိန်းမှ အခြေခံအဆောက်အဦးအား လုံးဖယ်ရှားမှုနှင့် ဆက်စပ်နေသည့်စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု -စီမံကိန်းပြန်လည်ဖယ်ရှား ခြင်းဖြင့် ရေအောက်နှင့် ကုန်းမြေ	စီမံကိန်းသည်နှစ်ရှည်စီမံကိန်းဖြစ်သဖြင့် စီမံကိန်းဖြိုဖျက် ခြင်း၊ ပိတ်သိမ်းခြင်းပြု လုပ်ချိန်တွင်ပတ်ဝန်း ကျင်အနေအထားများ၊ ဂေဟစနစ်များ၊ လူမှုပတ်ဝန်း ကျင်အနေအထားများသည်လက်ရှိ အနေအထားနှင့် များစွာကွဲလွဲမှုရှိနိုင်သဖြင့် ပတ်ဝန်းကျင်ထိန်းသိမ်း ရေး ဦးစီးဌာနမှ အဆိုပြုထားသော တဖက်ပါ Impact များကိုဖြည့် စွက်ကာ စီမံကိန်းပိတ်သိမ်းခြင်း ပြုလုပ်ရန် (၃) နှစ်အလိုတွင် Decommissioning Phase EMP ကိုပြန်လည်တင်ပြပါမည်။

		သဘာဝ ပတ်ဝန်းကျင်များ သိသာထင်ရှားစွာပြောင်းလဲနိုင်မည့် အလားအလာ၊ - ယခင်က သိမ်းယူထားသည့် မြေများ ပြန်လည်ရ ရှိနိုင်မှုနှင့် ပြန်လည်ပေးအပ်ရေးလုပ်ငန်းစဉ်များ၊	
၈။	**Social economic impact**		
	Dam မှာ ချီဘွေမြို့ မှ ၁၅ km ဝေးကြောင်း၊ Power plant မှာချီဘွေမြို့ မှ 9km ဝေးကြောင်း ဖော်ပြထားသည်။ ချီဖွေမြို့နယ်၏ population , economic, transportation, education, health, cultural ဆိုင်ရာ အချက်အလက်များကို (page 21-26 appendix 3 chapter ii) တွင်ဖော်ပြထားသည်။ Project affected villages/ person များကိုရွေးချယ်သတ်မှတ်ရာတွင်ချီဘွေ မြို့ပေါ်ရှိ ရပ်ကွက် ၄ခုနှင့် power plant မှလူများ(၁၇ဦး) စုစုပေါင်း ၁၆၃ ဦးကို interview ပြုလုပ်ထားသည်။ -ချီဘွေမြို့ပေါ်ရှိ ရပ်ကွက်ကြီး ၄ခုနှင့် Power Plant မှလူများ (၁၇ဦး) စုစုပေါင်း ၁၆၃ ဦးကို စီမံကိန်းအပေါ် သဘောထား ထင်မြင်ချက်များကို interview ပြုလုပ် ကာ	အဆိုပြုစီမံကိန်းကြောင့် ထိခိုက်နိုင်သည့် (area of influence) သတ်မှတ်ဖော်ပြရန် ၊အဓိကထိခိုက်ခံစားရမည့် သူများ ဖြစ်သည့် ဆည်နှင့် အနီးပတ်ဝန်းကျင် (upstream downstream) ရှိကျေးရွာများ၊ powerplant နှင့် အနီးပတ်ဝန်းကျင် (upstream downstream) ရှိကျေးရွာများမှ ဒေသခံများ (ရွာကိုကိုယ်စားပြုနိုင် သောအရေအတွက်) ကိုဖိတ်ခေါ်၍ Socio economic survey ပြုလုပ်ရန်နှင့် ၎င်းအချက်အလက်များအပေါ် အခြေခံ၍ socioe economic impact assessment ပြုလုပ်၍ လျော့ချမည့် နည်းလမ်းများကိုဖေါ်ပြရန်။ -ဆည်နှင့် အနီးပတ်ဝန်းကျင် (upstream downstream) ရှိကျေးရွာများ၏ socio economic health ဆိုင်ရာ အချက်အလက်များဖော်ပြရန်။ (Figure 2.1, Figure 2.2 လုံလောက်မှုမရှိပါ။ -ဆည်နှင့်အနီးပတ်ဝန်းကျင် (upstream downstream) ရှိကျေးရွာများ၊ powerplant နှင့် အနီးပတ်ဝန်းကျင် (upstream downstream) ကျေးရွာများ၏ စိုက်ပျိုးရေးနှင့်အိမ်သုံးအတွက် ရေ ရယူသည့် အရင်းအမြစ်များအားစာရင်းပြုစုဖော်ပြရန်။	ချီဖွေငယ်စီမံကိန်းအား ကွင်းဆင်းဆောင်ရွက်ချိန်တွင် upstream and power plant ပတ်ဝန်းကျင်တွင် ကွင်းဆင်းရန် ကျေးရွာများမရှိပါ။ မရှိရခြင်းအကြောင်းအရင်းမှာ power plant အနီး မေခမြစ်ကမ်းနဘေးရှိရွာများသည် မိမိတို့အိမ် ပတ်ဝန်းကျင်တွင် ရွှေထွက်သဖြင့် ရွှေရှာဖွေရာမှနေထိုင်ရန် မြေမရှိတော့သဖြင့် ကျေးရွာများမရှိခြင်းနှင့် upstream ပတ်ဝန်းကျင်ရွာအချို့တွင် စစ်ဘေး ကြောင့်ကျေးရွာများ သာကျန်ရှိပြီး ချီဖွေ မြို့စစ်ရှောင်စခန်း တွင်နေထိုင်နေခြင်း တွေ့ရသည်။ သို့ဖြစ်ပါသဖြင့် ချီဖွေမြို့ပေါ် ရပ်ကွက်နှင့် စစ်ဘေးရှောင်စ ခန်း တွင်သာ ကွင်းဆင်းခဲ့ပါသည်။ ယခုအခါ ချီဖွေဒေသသည် လုံခြုံမှုအားနည်းသဖြင့်ထပ်မံ data ကောက်ယူရန် မသင့်ကြောင်းနှင့် REM အနေဖြင့် ESIA Report (၁)အတွက် baseline data ထပ်မံဖြည့်စွက်ကောက်ယူခြင်းကို ဆောင်ရွက်ခြင်း ဖြစ်သည်။ ဆည်နှင့်အနီးပတ်ဝန်းကျင် (upstream downstream) ရှိကျေးရွာများ၊ powerplant နှင့် အနီးပတ်ဝန်းကျင် (upstream downstream) ကျေးရွာများ၏ စိုက်ပျိုးရေးနှင့်အိမ်သုံးအတွက် ရေကို ရွာအနီးတွင် ရှိသော

	ရရှိလာသော data များကို page 97-115 အထိဖော်ပြထား သည်။ Social Impact Management Plan စာမျက်နှာများ ၁၁၂ predicted social impact and significant matrix မှာ အချက်အလက်များကို အခြေခံ၍ ထိခိုက်နိုင်မှု၏ပြင်းထန်မှုများကို သတ်မှတ်တွက်ချက်ထားခြင်းမဟုတ် ကြောင်း စိစစ်တွေ့ရှိရသည်။ Social conflict and dispute related to employment within local communities အတွက် recommended Mitigation and Enhance Measures များကို စာမျက်နှာ ၁၁၃ တွင် ဖော်ပြထားသည်။	-ဆည်နှင့်အနီးပတ်ပန်းကျင်(upstream downstream) ရှိကျေးရွာများ၊ power plant နှင့် အနီးပတ်ပန်းကျင်(upstream downstream) ရှိကျေးရွာများ၊ powerplant နှင့် အနီးပတ်ပန်းကျင်(upstream downstream)ရှိကျေးရွာများ ဒေသခံများ (ရွာကို ကိုယ်စားပြုနိုင်သော အရေအတွက်) ကိုဖိတ်ခေါ်၍ စီမံကိန်းအပေါ် သဘောထား ထင်မြင်ချက်များကို interview ပြုလုပ်ရန်။ -Page 100, 105, 106 ပါစီမံကိန်းနှင့်ပတ်သက်သော ဒေသခံတို့၏ ပူပန်တောင်းဆိုမှုများကို ဆောင်ရွက်ပေးမည့် ၊ဖြေရှင်းပေးမည့်အစီအစဉ်များကိုဖော်ပြရန်။ - ဒေသ၏ culture, traditional knowledge, vulnerable groups, religion, national race များအပေါ် ထိခိုက်နိုင်မှုများ ကို ဆန်းစစ်ဖော်ပြ၍ ထိခိုက်နိုင်မှုလျော့နည်း စေရေး ဆောင်ရွက်မည့် အစီအစဉ်များကိုဖော်ပြရန်။	တောင်ပေါ် စမ်းရေများ (Spring) ကိုသာ အဓိကထား ရယူပါသည်။ အထက်တွင် ရှင်းလင်းပြီး ဖြစ်ပါသည်။ Public Consultation Meeting မှ စီမံကိန်းနှင့်ပတ်သက်သော ဒေသခံတို့၏ ပူပန်တောင်း ဆိုမှုများကို CSR program များရေးဆွဲ၍ လည်းကောင်း၊ တစ်ချို့ လိုအပ်ချက်များကို MOEE နှင့် ဒေသဆိုင်ရာ အစိုးရ အဖွဲ့အစည်းများ နှင့် တိုင်ပင်ကာ စီမံကိန်းလည်ပတ်သည့် ကာလ တလျှောက်လုံး အကောင်အထည်ဖော် ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ ယခု ချီဘွေငယ်ရေအားလျှပ်စစ် စီမံကိန်းသည် လက်ရှိ တွင် ရေအားလျှပ်စစ် ထုတ်ယူလျှက်ရှိပြီး ချီဘွေ။ မြစ်ဆုံနှင့် မြစ်ကြီနားတို့ကို မီးပေးလျှက်ရှိပါသည်။ စီမံကိန်းတည် ဆောက်နေ ချိန်တွင်လည်း culture, traditional knowledge, vulnerable groups, religion, national race များအပေါ် ထိခိုက်မှုများမရှိဘဲ Local Residence များကို အလုပ်အကိုင် အခွင့်အလမ်းများ ပေးအပ်နိုင်ခဲ့ပါသည်။ ထိုကြောင့် ထိခိုက်နိုင်မှုလျော့နည်း စေရေး ဆောင်ရွက်မည့် အစီ အစဉ်များကိုဖော်ပြရန် မလိုပါ။ ချီဘွေငယ်ရေအားလျှပ်စစ် စီမံကိန်းသည် လက်ရှိတွင် လျှပ်စစ်မဲတ် အားထုတ်လုပ်နေသော အဆင့်တွင်ရောက်ရှိ နေပြီး ဖြစ်သဖြင့် social impact assessment ပြုလုပ်၍

		-ကောက်ယူထားသောဒေသ၏ socio economic data များ အဆိုပြုစီမံကိန်း၏ ဂိသေသများ၊ ထိခိုက်နိုင်မှုများကို အခြေခံ၍ social impact assessment ပြုလုပ်၍ ပြန်လည်တင်ပြရန် (page 112)	ပြန်လည်တင်ပြရန် ဆိုသည်မှာ မဖြစ်နိုင်ပါ။ Impact assessment သည် စီမံကိန်းမတည်ဆောက်မီ တွင် ကြိုတင်သိမြင်နိုင်သော ထိခိုက်နိုင်မှုများကို ဆန်းစစ်ကာ ထိခိုက်နိုင်မှုလျော့နည်းစေရေး ဆောင်ရွက်မည့် အစီအစဉ်များကို ရေးဆွဲကာ မတည်ဆောက်မီ Decision Maker များထံ တင်ပြကာ အတည်ပြုချက်ရယူခြင်း လုပ်ငန်းရပ်ဖြစ်ပါသည်။ There are 73 Chinese and Myanmar employees in the Chipwi Nge HPP during operation period, including 15 from China, 12 from EPGE, 42 from Myanmar and 4 dispatched workers.
	Page 114 တွင် စီမံကိန်းကြောင့်ဖြစ်ပေါ်လာနိုင်သော community health and safety ဆိုင်ရာ issues များနှင့် လျော့ချမည့်နည်းလမ်းများကိုဖော်ပြထား သည်။	-Opaeration phase တွင် ဒေသခံအလုပ်သမား မည်မျှခန့်ထား မည်ကိုဖော်ပြရန်၊	7.9 Personnel training International mature hydropower development and operational management experience will be introduced for construction of Chipwi Nge Hydropower Station, which will lay talent foundation for development of power industry development in Myanmar and improve the ability for independent construction, operation and management of power plant and grid. First, cooperation with local enterprises will train hydropower construction and management personnel for Myanmar. Second, local talents will be introduced for management and technical work during the operation of power plant after completion. Relying on hydroelectric development in the upper reaches of Ayeyawady River, electric power talents will be trained for Myanmar in batches and stages. It is planned to train 60 personnel in the first stage and 20 hydropower operation and management personnel in the first batch have completed trainings. From September to December in 2011, three-month theoretical and practical trainings were conducted for 20 Myanmar personnel in China's universities with rich teacher resources and large hydro basin development companies with mature experience. In
		-ဒေသခံအလုပ်သမားများအား capacity building and local awareness building ပြုလုပ်ပေးမည့် အစီအစဉ်အသေးစိတ်ကို ဖော်ပြရန်၊	
	The power station has three loops of 110kV outgoing lines, one to the construction substation of Chipwi, one to the construction substation of Myitsone, and another for standby		

			March 2013, 14 Myanmar employees sent by Myanmar Ministry of Electric Power completed theoretical and practical training for operation and maintenance before working for operation and maintenance of Chipwi Nge Hydropower Station. They have begun to work for operation and maintenance for the power plant. ယခု EIA မှာ Hydropower အတွက် ဖြစ်၍ ၊ အဆိုပါအချက်အလက်များကို Transmission Line EIA တွင် သီးခြားဖော်ပြရမည်ဖြစ်ပါသည်။
		-Access route , transmission line များ ကျေးရွာနံဘေးမှ ဖြတ်၍ ဖောက်လုပ်မည့်အနေအထားများကို ဖော်ပြရန် (မြေပုံထဲတွင် ဖော်ပြရန်) Access route တစ်လျှောက် safety transport ဖြစ်စေရေးဆောင်ရွက်ပေးမည့်အစီအစဉ်၊ Transport of dangerous goods and materials (Mercury, Fuel, etc.) သည် safety ဖြစ်စေရေး ဆောင်ရွက်ပေးမည့်အစီအစဉ် ဖော်ပြရန်၊ -Access route, transmission line တစ်လျှောက် ဖြစ်ပေါ်နိုင်သော impact များကို ဆန်းစစ်ဖော်ပြ၍ လျော့ချမည့်နည်းလမ်းများကို ဖော်ပြရန်၊	
		-တစ်ရက်အလုပ်ချိန် ၊လုပ်ငန်းခွင် ဘေးကင်းလုံခြုံရေး၊ လေ့ကျင့် ပညာပေးရေးများကိုဖြည့်စွက်ဖော်ပြရန်။	-တစ်ရက်အလုပ်ချိန်မှာ ရုံးလုပ်ငန်းများအတွက် ၈နာရီဖြစ်ပြီး၊ power house အတွက် ၃ ဆိုင်း ဖြစ်ပါသည်။ ၊လုပ်ငန်းခွင် ဘေးကင်းလုံခြုံ ရေး၊ လေ့ကျင့် ပညာပေးရေးများကို

		-ဖော်ပြပါ Mitigation and Enhance Measures များကို operation phase and decommissioning phase များအတွက်ပါ ဆောင်ရွက်ရန်။ -ဖော်ပြပါ လျော့ချမည့်နည်းလမ်းများ (Rural Health Initiative, Provide medical assistance, Regulaar engagement of health and social infrastructure stakeholders, Annual medical surveillance, community health education, etc) ကိုအကောင်အထည်ဖော် ဆောင်ရွက်ပြီးစီးမှုကို မှတ်တမ်းများနှင့်တကွဖော်ပြရန်နှင့် ဆက်လက်ဆောင်ရွက်နေမှုများကို monitoring report တွင်ထည့်သွင်းတင်ပြရန်။ -စီမံကိန်းကြောင့်ဒေသတွင်းဖြစ်လာနိုင်သော Social Problems (Drug, alcohol, gender violence, ခိုက်ရန်ဖြစ်ပွားခြင်း အစရှိသော) များမဖြစ် ပေါ်စေရေး စီမံကိန်းမှ အလုပ်သမားအပေါ် ထိန်းချုပ်စီမံမည့် အစီအစဉ်များကိုဖော်ပြရန်၊	အခန်းငယ် 11.2.7.6 Health and Safety Plan တွင် ဖော်ပြထားပါသည်။ ဆောင်ရွက်ပြီးစီးမှုများကို အခန်း 11.1.2.4 Population health တွင် ဖော်ပြထားပါသည်။ ဆက်လက်ဆောင်ရွက်နေမှုများကို monitoring report တွင်ထည့်သွင်းတင်ပြပါမည်။ စီမံကိန်းကြောင့်ဒေသတွင်းဖြစ်လာနိုင်သော Social Problems (Drug, alcohol, gender violence, ခိုက်ရန်ဖြစ်ပွားခြင်းအစရှိသော) များမှာ ဆောက်လုပ်ရေး အချိန်တွင်သာ ဖြစ်ပေါ်နိုင်ပါသည်။ ယခု Operation အချိန်တွင် ဝန်ထမ်း ၇၃ ဦးသာရှိပြီး EPGE မှ ၁၂ ဦး၊ တရုတ်ပညာရှင် ၁၅ ဦး၊ မြန်မာ ၄၆ ဦးသာ ရှိပြီး ထိုပြဿနာများမဖြစ်ရန် စီမံခန့်ခွဲနိုင်ပါသည်။
	Health Impact ချီဘွေမြို့ပေါ်ရှိ ရပ်ကွက် ၄ခုနှင့် Power plant မှလူများ(၁၇ဦး) စုစုပေါင်း၁၆၃ ဦး ကို survery ပြုလုပ်၍ responndents များ၏ health status ကို ဖော်ပြထား သည်။ (page 79-86) Suggestion on health status ဖော်ပြထားသော်လည်း survey question ထဲတွင်အဆိုပါ အပိုင်းနှင့် ပတ်သတ်သော မေးခွန်းများမရှိကြောင်း စိစစ်တွေ့ရှိ ရသည်။ (page	အဆိုပြုစီမံကိန်းကြောင့် ထိခိုက်နိုင်သည့် (area of influence) သတ်မှတ်ဖော်ပြရန် ၊အဓိက ထိခိုက်ခံစားရမည့်သူများ ဖြစ်သည့်ဆည်နှင့် အနီးပတ်ဝန်းကျင်(upstream downstream) ရှိကျေးရွာများ ၊ power plant နှင့် အနီးပတ်ဝန်းကျင် (upstream downstream) ရှိကျေးရွာများမှဒေသခံများအား survey ပြုလုပ်ရန်။ -ကောက်ယူထားသော ဒေသ၏ health data များ အဆိုပြုစီမံကိန်း၏ ဝိသေသများ ၊ ထိခိုက်နိုင်မှုများကို	အထက်တွင်ဖြေကြားထားပြီး ဖြစ်ပါသည်။ စီမံကိန်းဒေသသည် စစ်မက်ဖြစ်ပွားနေသော ဒေသဖြစ်၍ ချီဘွေမြို့ မှ လွဲ၍ Health Data ကောက်ယူရန် မဖြစ်နိုင်ပါ။ Health impact mitigation measures များကို အခန်းငယ် 11.2.7.6 Health and Safety Plan တွင် ဖော်ပြထားပါသည်။

	84) HIA ကို WHO ကို determinants of health အတိုင်း အပိုင်း(၇) ခုခွဲ၍ ဆန်းစစ်သော်လည်း impact intensity identifyလုပ်ဆောင်ခြင်းသည်အချက်အလက်များကို အခြေခံ၍ ထိခိုက်နိုင်မှု၏ ပြင်းထန်မှုများကို သတ်မှတ်တွက်ချက်ခြင်းမဟုတ်ကြောင်းစိစစ်တွေ့ရှိရသည်။(page 86) Impact ရှိနိုင်သည့်ဒေသခံများမှ ပူပန်မှုရှိသည့် issue များဖြစ်သော (exposure to potentially hazardous materials and waste and sanitation unpleasant odor from using coal as fuel) လျော့ချမည့်လုပ်ငန်းများနှင့် ပတ်သက်၍ ဖော်ပြထားခြင်းမရှိကြောင်း စိစစ်တွေ့ရှိရပါသည်။ Related infrastructure Diversion Tunnel, Transmission Line, Assest	အခြေခံ၍ health impact assessment ပြုလုပ်၍ ပြန်လည်တင်ပြရန်။ Health impact mitigation measures များကို ဆောင်ရွက်မည့်ရေတိုရေရှည် လျော့ချမှုနည်းလမ်းများ ၊ လျော့ချနိုင်မည့်ပမာဏ၊ ကြွင်းကျန်သက်ရောက်မှု စသဖြင့် အသေးစိတ်ဖော်ပြရန်။ -Access routes ကို critical terrestrial habitat,migratory	In accordance with epidemic situation of infectious diseases in the construction area, main infectious diseases are classified into insect-borne, food-borne and water-borne diseases, generally including malaria, cholera, dysentery, bfasciolopsis buski, fluke colon, hepatitis, typhoid and so on. During the construction, construction personnel are dense. The construction area is sparsely populated with poor health conditions and humid subtropical environment, which provide conditions for breeding of mosquitoes and flies. If no attention is paid to food hygiene and sanitation for living areas, the possibility of infecting malaria, dengue fever, cholera and other diseases will be improved. Preventive quarantine shall be strengthened during the construction to prevent disease outbreaks. အထက်တွင်ဖော်ပြထားသည့်အတိုင်း ဆောက်လုပ်ရေးလုပ်ငန်း လုပ်ကိုင်ချိန်တွင်သာ Health Impact သည် ဆောက်လုပ်ရေးလုပ်ငန်းခွင်အတွင်းရှိ လုပ်သားများအပေါ်တွင်သာ သက်ရောက်မှုရှိပြီး အဆိုပါသက်ရောက်မှုများကို လျော့ချရေးလုပ်ငန်း များနှင့် Health Care Program ကို အခန်းငယ် 11.1.2.4 Population health တွင်ဖော်ပြထားပါသည်။ Operation Phase တွင်မူ ရေအားလျှပ်စစ် စီမံကိန်းဖြစ်၍ community အပေါ် health impact ကြီးမားစွာ ထိခိုက်နိုင်စွမ်း မရှိပါ။ ထို့ကြောင့် Occupational Health Care Program ကို အခန်းငယ် 11.2.7.6 Health and Safety Plan တွင် ဖော်ပြထားပါသည်။ ယခု EIA မှာ Hydropower အတွက် ဖြစ်၍ ၊ အဆိုပါအချက်အလက်များကို Transmission Line EIA တွင်

	Route Impact များကို ဆန်းစစ်ဖော်ပြရန်။	route, wildlife movement, breeding sites များကိုရှောင်လွဲ၍ ဖော်ထုတ်မည့်အစီအစဉ်ကိုဖော်ပြရန်။ -Access route Transmission Line များနှင့် ပတ်သတ်သော အချက်အလတ်များ (Length , width, amount of vegetation removed, route drainage) နှင့် location များကို မြေပုံများနှင့်တကွဖော်ပြရန်။ - transmission Lne များနှင့် ပတ်သတ်သော အချက်အလက်များ (Length , width, amount of vegetation removed) နှင့် location များကို မြေပုံနှင့်တကွဖော်ပြရန်။ -Access route များအား စီမံကိန်းပြီးသွားချိန်၌ မည်ကဲ့သို့ rehabilite ပြုလုပ်မည်ကိုဖော်ပြရန်။ -Access routes Transmission Line များနှင့် ဆက်စပ်၍ ဖြစ်ပေါ်လာနိုင်သော impact များကို ဆန်းစစ် ဖော်ပြ၍ လျော့ချမည့်နည်းလမ်းများကိုဖော်ပြရန်	သီးခြားဖော်ပြရမည်ဖြစ်ပါသည်။
၉။	**Mitigation measures**		
	(previous comment) Operation phase ကို စာမျက်နှာ (၁၁၅) domestic sewage နှင့် စာမျက်နှာ (၁၂၅) environmental management tasks တို့တွင်သာ အနည်းငယ် ဖော်ပြထား သည်။ Operation phase သည် ကာလအရှည်ကြာဆုံး ဖြစ်သည့်အတွက် water quality changes, terrestrial and aquatic ecology, dam safety, occupational health စသော ပတ်ဝန်းကျင်အစိတ်အပိုင်းများအတွက် EMP များ ယင်းတို့နှင့်ဆက်စပ်နေသော	-Impact assessment အခန်းတွင်ဖော်ပြခဲ့သော အဆိုပြုစီမံကိန်းကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် impact အားလုံးအတွက် လျော့ပါးစေရေးနည်းလမ်းများ ကို (ဆောင်ရွက်မည့် ရေတို ရေရှည် လျော့ချမှုနည်းလမ်းများ၊ လျော့ချနိုင်မည့်ပမာဏ၊ ကြွင်းကျန်သက်ရောက်မှု စသဖြင့် အသေးစိတ်) ဖော်ပြရန် (mitigation measures for Air Quality & Greenhouse Gas Emissions ,noise and vibration , erosion and sedimentation hydrology impact , surface water quality , ground water hydrology and quality terrestrial ecosystem & flora &	အခန်း 11.2.7 Environmental Management Plan during Operation Period တွင် ဖော်ပြထားပါသည်။

	Monitoring programs များ ၊ CSR programs များထည့်သွင်းရေးသား တင်ပြရပါမည်။ (Response) EMP များ၊ ယင်းတို့နှင့်ဆက်စပ်နေသော programs များ ၊ CSR programs များကို Appendix V _ Environmental Management Plan တွင် လည်းထပ်မံဖော်ပြထားပါသည်။ Phase ထိခိုက်မှု လျော့ချရေး ဆောင်ရွက်ပေးမည့်အစီအမံများ အနေဖြင့် waste, biological environment, health and safety အပေါ်ထိခိုက်မှု လျော့ချရေးဆိုင်ရာ များကို ဖော်ပြထားသည် (စာမျက်နှာ ၁၈) -Solid waste to be generated during operation will be mainly domestic waste and some hazardous wastes -Waste and Hazardous Waste Manangement Plans prepared will be implemented. -The domestic waste will be disposed to the appropriate sites to be speciafied by the nearest municipality. -Domestic Waste နှင့်ပတ်သတ်၍ septic tanks, sewage treatment equipment and collecting wells များထားရှိမည်ဖြစ်ကြောင်းနှင့် after treatment effluent များကို trough buried pipelines များဖြင့် surrounding gullies ထဲသို့စွန့်ပစ်မည်ဟု ဖော်ပြထား သည်။	Fauna, aquatic ecosystem & flora & Fauna, land use, socio-economic , health impact,waste) - ရပ်နားခြင်း / ပိတ်သိမ်းခြင်း/ ပိတ်သိမ်းပြီးနောက် အဆင့်များအတွက် လျော့ပါးစေရေးနည်းလမ်းများကို impact အားလုံးအတွက် ဖော်ပြရန်။ -ထွက်ရှိမည့် domestic waste and some hazardous wastes ပမာဏကိုဖော်ပြရန်။ -Hazardous Waste Management Plan ကိုဖော်ပြရန်၊ -အလုပ်သမားအရေအတွက်ပေါ် အခြေခံ၍ လုံလောက်သော septic tanks အရေအတွက်ထားရှိရန်နှင့်စက်ရုံရှိ waste water treatment facilities မှ treated effluent များသည် EQEG (1.2 waste water) ပါ နှင့်အညီ ဖြစ်စေပြီးမှ surrounding gullies ထဲသို့ စွန့်ပစ်ရန်။ -အဆိုပြု စီမံကိန်းကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် impact အားလုံး (mitigation measures for Air Quality & Greenhouse Gas Emissions, noise and vibration, erosion and sedimentation hydrologicial impact, surface water quality ,ground water hydrology and quality, terrestrial ecosystem & flora & fauna, aquatic ecosystem & flora &fauna, lanuse, socio-economic, health impact, waste) အတွက် လျော့ပါးစေရေးနည်းလမ်းများ ကို (ဆောင်ရွက်မည့် ရေတိုရေရှည် လျော့ချမှုနည်းလမ်းများ၊ ဆောင်ရွက်မည့်နေရာ ၊	အထက်တွင်ဖြေကြားပြီး ဖြစ်ပါသည်။ Operation phase တွင် အဓိကအားဖြင့် domestic waste များ ထွက်ရှိပြီး ထိုအတွက် management plant ကို အခန်းငယ် 11.2.7.5 Waste Management Plan တွင် ဖော်ပြထားပါသည်။ အချို့သော hazardous wastes များမှာ Office မှထွက်ရှိမည့် computer and accessories များဖြစ်ပြီး စနစ်တကျ စွန့်ပစ်ပါမည်။

	(စာမျက်နှာ ၁၇) -Biodiversity and Protect Area Management Plan for Rare and England Species (စာမျက်နှာ ၁၇) ကို ဖော်ပြရာတွင် ဆောင်ရွက်မည့် နေရာ၊ ဆောင်ရွက်မည့် လုပ်ငန်းအသေးစိတ်၊ impact လျော့ချနိုင်မှု နှင့် ထိရောက်မှု၊ အချိန်ကာလ စသဖြင့် အသေးစိတ် ဖော်ပြထားခြင်းမရှိဘဲ အောက်ပါ အတိုင်း ယေဘူယျသာ ဖော်ပြထားသည်။ -Improvements to the physical demarcation of reserve areas; -Coordination of the implementation of protected area management plans; -Additional ecological baseline studies, as required; -Installation of signage and fencing, as required; -Development of an access management strategy including control of ingress and egress of vehicles to the project area, gates and access barriers; -Development and implementation of a worker code of conduct prohibiting hunting, fishing and possession of wildlife for human consumption (bush meat); (Resonse to previous ECD comment)	ဆောင်ရွက်မည့်လုပ်ငန်းအသေးစိတ်၊ impact လျော့ချနိုင်မှုနှင့် ထိရောက်မှု၊ အချိန်ကာလ လျော့ချနိုင်မည့်ပမာဏ၊ ကြွင်း ကျန်သက်ရောက်မှု ၊ မလျော့ချနိုင်သော impact များ၊ မလျော့ချနိုင်သော impact များအတွက် offset ပြုလုပ်ပေးမည့် အစီအစဉ်များစသဖြင့်အသေးစိတ်) ဖော်ပြရန်။ - Table 11.5-1 (page 147 main esia report) တွင် လည်းအထက်ဖော်ပြပါ အချက်အလက်များ မပါရှိဘဲ ကုန်ကျစရိတ်များသာပါရှိသဖြင့် ထပ်မံဖော်ပြရန်။ Operation phase တွင် အလုပ်သမား staff မည်မျှထား ရှိမည်ကို ဖော်ပြရန်။	အဆိုပါအချက်အလက်များကို အခန်းငယ် ၁၁.၂.၇.၁ Biodiversity and Watershed Management Plan တွင်ဖော်ပြထားပါသည်။ အထက်တွင် ဖြေကြားထားပြီး ဖြစ်ပါသည်။

	See in Table 11.5-1 Appendix 7 ဖြင့် ထပ်မံ ဖြည့်စွက်ဖော်ပြထားသည်။ **Health and safety** Health and safety နှင့်ပတ်သက်၍ construction phase health and safety measures၊ Myanmar Legislation and IFC requirement များကို လိုက်နာမည်ဖြစ်ကြောင်းဖော်ပြထားသည်။	Operation phase နှင့် construction phase သည် ဆောင်ရွက်မည့် လုပ်ငန်းများ၊ ဖြစ်ပေါ်လာမည့် impact များ၊ အလုပ်သမားအရေအတွက် စသည်တို့ မတူညီသဖြင့် Operation phase အတွက် occupation health and safety plan သီးခြားရေးဆွဲတင်ပြရန်။	Occupation health and safety plan ကို အခန်းငယ် 11.2.7.6 Health and Safety Plan တွင် ဖော်ပြထားပါသည်။
၁၀။	**Environment Management Plan**		
	(page 37-42) table 9 environmental managemtn and monitoring plan during operation phase and some part of construction phase အချို့သော mitigation measure များ (Habitat loss and disturbance, surface water quality, disposal of waste, pollution) မှာ construction phase အတွက်သာ ဖော်ပြထားသည် (page 37-42 EMP ပါလျော့ကျစေရေးဆောင်ရွက်မည့်လုပ်ငန်းများမှာ ယေဘူယျအကြမ်းဖျင်းသာ ဖော်ပြထားပြီး လျော့ကျစေရေး လုပ်ငန်းများကို အသေးစိတ် အကောင်အထည်ဖော်မည့် အစီအစဉ်များဖော်ပြထား ခြင်းမရှိကြောင်း စိစစ်တွေ့ရှိရသည်။ EMP တွင် Emergency preparedness and response plan, workers accommodation	EMPတွင် ပတ်ဝန်းကျင်ဆိုင်ရာ အစိတ်အပိုင်းတစ်ခုချင်းစီ (Air Quality & Greenhouse Gas Emissions, noise and vibration erosion and sedimentation, hydrological impact, surface water quality, ground waer hydrology and quality, terrestrial ecosystem & flora & fauna, aquatic ecosystem & flora & fauna, landsue, socio-economic, health impact, waste, conflict & security, etc) အပေါ် ထိခိုက်မှုများကိုလျော့ကျစေရေး ဆောင်ရွက်မည့် mitigation mesures များကို operation phase/decommissioning phase post decommissioning အားလုံးအတွက် အကောင်အထည် ဖော်မည့် အစီအစဉ် အသေးစိတ် (လျော့ကျစေရေး ဆောင်ရွက်မည့် activities လုပ်ဆောင်မည့်နည်းလမ်း၊ ဆောင်ရွက်မည့်နေရာ၊ ဆောင်ရွက်မည့် အကြိမ်အရေအတွက်၊ လိုက်နာမည့် စံချိန်စံညွှန်း၊ လျော့ချနိုင်မည့် impact ပမာဏ၊ ကြွင်းကျန်သက်ရောက်မှု၊ ကုန်ကျစရိတ်၊ responsible person)တို့ကို အသေးစိတ်	အခန်း 11.2.7 Environmental Management Plan during Operation Period တွင် ဖော်ပြထားပါသည်။

	plan, community grievance plan, retrenchment plan, ecological management plan, habitat management plan စသော sub plan များရေးဆွဲမည်ဟုသာဖော်ပြထားပြီး eia report တွင် အဆိုပါ sub plan များကို ထည့်သွင်းဖော်ပြထားခြင်း မရှိကြောင်း စိစစ်တွေ့ရှိရသည်။	ဖော်ပြပေးရန်။ ရေးဆွဲမည်ဟုဖော်ပြထား သော sub planများရေးဆွဲ တင်ပြရန်နှင့် ထိုစီမံချက်ခွဲများ တွင်ရည်ရွယ်ချက်များ၊ ဥပဒေဆိုင်ရာသတ်မှတ်ချက်များ၊ အဖွဲ့အစည်းဆိုင်ရာ တာဂန်ယူမှု၊ မြေပုံများနှင့် လုပ်ငန်းခွင်ပြ layout ပုံများ၊ ဓာတ်ပုံများ၊ ကောင်းကင်မြေတိုင်းဓာတ်ပုံ များ၊ ဗြိုလ်တုဓာတ်ပုံများ၊ အကောင်အထည်ဖော်မည့်အစီအစဉ်၊ စီမံခန့်ခွဲရေးလုပ်ငန်းများ၊ စောင့်ကြပ်ကြည့်ရှုရေးစီမံချက်များ၊ ကုန်ကျစရိတ်စသည်တို့ကို ပြည့်စုံစွာထည့် သွင်းဖော်ပြပေး ရန်။	
	EMP ကို စောင့်ကြပ်ကြည့်ရှုမည့် အစီအစဉ်ကို page37-42 EMP တွင်ဖော်ပြထား သည်။	ပတ်ဂန်းကျင်ဆိုင်ရာအစိတ်အပိုင်းတစ်ခုချင်းစီ အလိုက် (Air Quality & Greenhouse Gas Emissions, noise and vibration, erosion and sedimentation, hydrolcial impact, surface water quality, ground water hydrology and quality, terrestrial ecosystem & flora & fauna, aquatic ecosystem & flora &fauna, landuse, socio-economoic, health impact, waste, etc) စောင့်ကြပ်ကြည့်ရှုရန်နှင့် EMP ပါ သတ်မှတ်ချက်များနှင့် ကုမ္ပဏီ၏ကတိကဝတ် များကိုလိုက်နာ ဆောင်ရွက်ကြောင်း သေချာစေရန်၊လျော့ပါးစေရေးနည်းလမ်း များ၏ ထိရောက်မှု ကိုဆုံးဖြတ်ရန်နှင့် မမျှော်မှန်းထားသော ထိခိုက်မှုများကို သတ်မှတ်ဖော် ထုတ်ရန်အတွက်ပတ်ဝန်း ကျင်စောင့် ကြပ်ကြည့်ရှုရေးအစီအစဉ်များကို operation phase, decommissioning phase, post decommissioning အားလုံးအတွက် ပတ်ဂန်းကျင်ဆိုရင်အစိတ်အပိုင်းတစ်ခုချင်းစီ အလိုက် monitoring ပြုလုပ်မည့်အစီအစဉ် အသေးစိတ်ကို ဖော်ပြရန် (monitoring parameters, monitoring standars,	Environmental Morning Plan ကို အခန်း 11.5.2.2 Operation Phase တွင် ဖြည့်စွက်ဖော်ပြထားပါသည်။

	Envoronmental protection ဆောင်ရွက်ခြင်း အတွက် ရင်းနှီးမြှုပ်နှံမှု ကုန်ကျစရိတ်မှာ ၂၀.၈၄၄၅ million yunan ဟုဖော်ပြထားပြီး table 5 page 31 တွင် environmental protection measures အလိုက်ကုန်ကျ စရိတ်များကို ဖော်ပြထား သည်။	loction, frequency, cost, responsible personစသဖြင့် အသေးစိတ်ဖော်ပြရန်) USD or MMK ဖြင့်တွက်ချက်ဖော်ပြရန် environmental protection measure များဆောင်ရွက်ခြင်းကြောင့် ကုန်ကျစရိတ် များကို EMP ထိခိုက်မှုလျော့ကျစေရေးဆောင်ရွက်ချက်များနှင့် Monitoring plan စောင့်ကြပ်ကြည့်ရှုမည့်လုပ်ငန်းများ အလိုက်ချိတ်ဆက် ဖော်ပြရန်၊ စွမ်းဆောင်ရည်တည်ဆောက်ခြင်း၊ စီမံကိန်းစီမံခန့်ခွဲရေးယူနစ်နှင့်တည်ဆောက်ရေး ကန်ထရိုက်တို့က ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ၀န်ထမ်းများခန့်ထားခြင်း၊ ယာဉ်များနှင့် ပစ္စည်းကိရိယာများ စသည်တို့အတွက် ကုန်ကျစရိတ်များ ထည့်သွင်းဖော်ပြရန်။	EMP အတွက် ကုန်ကျစရိတ်များကို USD ဖြင့် conversion လုပ်ပြီး ဖော်ပြထားပါသည်။ စွမ်းဆောင်ရည်တည်ဆောက်ခြင်း၊ စီမံကိန်းစီမံခန့်ခွဲရေး ယူနစ်နှင့် တည်ဆောက်ရေး ကန်ထရိုက်တို့က ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ၀န်ထမ်းများခန့်ထားခြင်း၊ ယာဉ်များနှင့် ပစ္စည်းကိရိယာများ စသည်တို့အတွက် ကုန်ကျစရိတ်များ ပါပါ၀င်ပါသည်။
၁၁။	**Monitoring**		
	Page 18-22 အထိဖော်ပြထားသော စောင့်ကြပ်ကြည့်ရှု စစ်ဆေးခြင်းအစီအစဉ်ပါ surface water quality, production sewage, domestic sewage, source of drinking water, air quality, noise, water and soil erosion monitoring, population health monitoring များမျာ construtaion phase အတွက်သာ ဖော်ပြထားခြင်းဖြစ်ပြီး terrestrial plant monitoring, terrestrial animal monitoring, aquatic monitoring များတွင်သာ operation phase အတွက် ပါ၀င်ကြောင်းစီစစ်တွေ့ရှိရသည်။	Environmental component (Air Quality & Greenhouse Gas Emissions, noise and vibration, erosion and sedimentation, hydrolcial impact, surface water quality, ground water hydrology and quality, terrestrial ecosystem & flora & fauna, aquatic ecosystem & flora &fauna, landuse, socio-economoic, health impact, waste) and mitigation measures များအားလုံးအတွက် monitoring plan ကိုဖြည့်စွက်တင်ပြရန်။	Environmental Monitoring Plan ကိုပြန်လည်ဖြည့်စွက်ပြင်ဆင်ပြီး အခန်း၁၁.၅.၂.၂ တွင် Table 11.5-1 Monitoring Plan in Operation Phase ဖြင့် ဖော်ပြထားပါသည်။

	Operation Phase environmental monitoring နှင့် ပတ်သက်၍ Table 11 page 45-46 တွင် ဖော်ပြထားသည်။	-Terrestrial plant monitoring, terrestrial animal monitoring, aquatic monitoring များတွင် monitoring frequesncy မှာ 'respectively at the first year, third year and fith year since operation.'ဟုဖော်ပြထားရာ လုံလောက်မှုမရှိ၍ အနည်းဆုံး တစ်နှစ်နှစ်ကြိမ်(once in wet season and dry season) monitoring ပြုလုပ်၍ ကောက်ယူရရှိသော အချက်အလက်များကို monitoring report တွင် ထည့်သွင်းကာ MONREC သို့တင်ပြရန်။ -monnitoring point များ၏ location များကို map, google image ထဲတွင် ဖော်ပြရန်။ -Monitoring plan အတိုင်းစောင့်ကြပ်ကြည့်ရှု စစ်ဆေးခြင်းဆောင်ရွက်၍ မှတ်တမ်းများထားရှိကာ monitoring report တွင် ထည့်သွင်းတင်ပြရန်။ Colum 2: where is the pararmeter to be monitored နှင့် Colum 5: how is the parameter to be monitored/type of monitoring equipment ကို အသေးစိတ်ဖော်ပြရန် ဥပမာ-reservoir sedimentation နှင့်ပတ်သက်၍ monitoring ပြုလုပ်မည့်နေရာမှာ 'afforestation and plantation sites' ဟုဖော်ပြထားရာ ဆည်အထက် catchment area အတွင်း monitoring ပြုလုပ်မည့်နေရာ၊ number of sampling points တို့ကို အသေးစိတ်ဖော်ပြရန်နှင့် monitoring method မှာ 'observation'ဟု ဖော်ပြထားရာ sedimentation rate ကို	

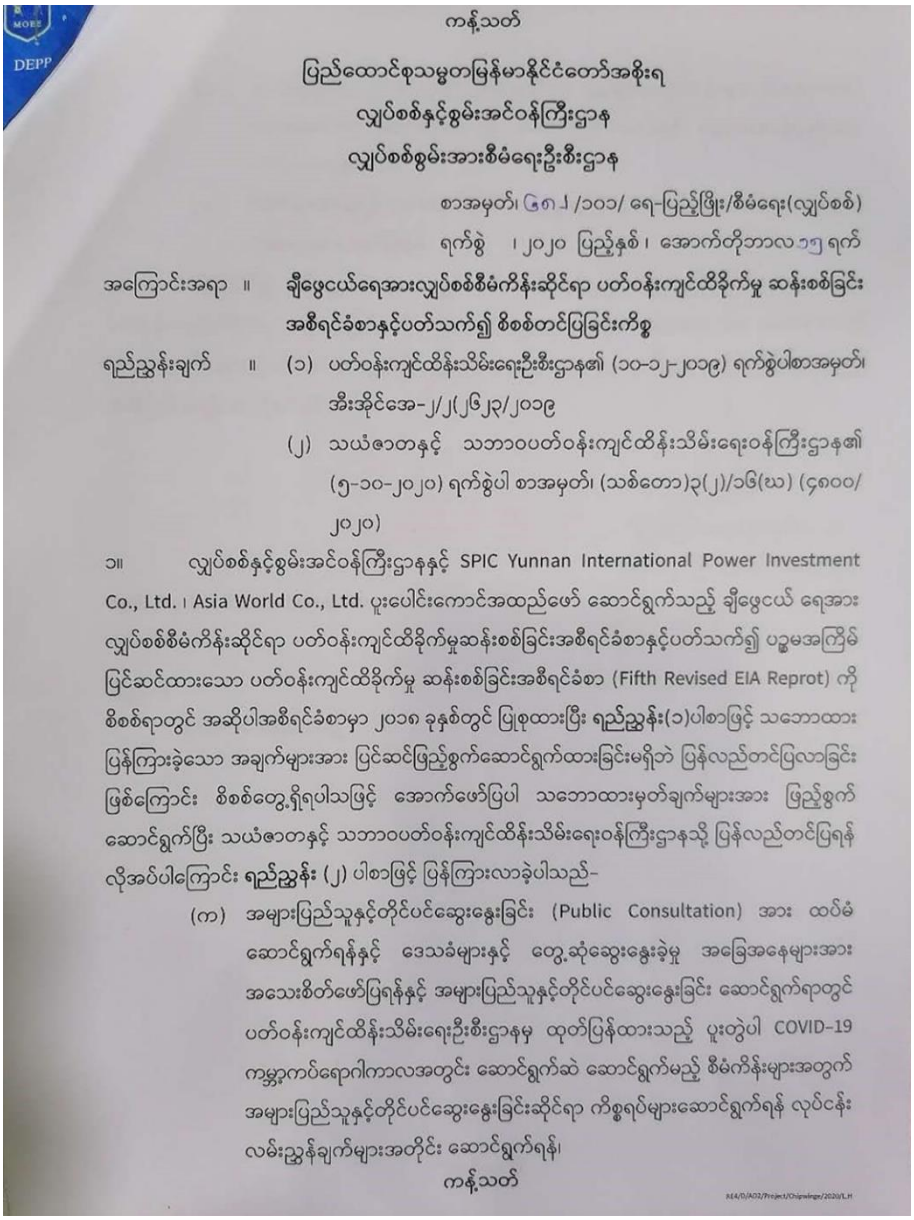
		တိုင်းတာမည့် နည်းစနစ်ကို တိကျစွာဖော်ပြပေးရန်။	
	GRM နှင့်ပတ်သက်၍ page 37-42 EMP တွင် Project performance grievance mechanism ထားရှိမည်ဟုဖော်ပြထား သော်လည်း အသေးစိတ်ဖော်ပြထားခြင်း မရှိကြောင်းစိစစ်တွေ့ရှိရသည်။	မကျေနပ်ချက်များကို လက်ခံ၊ သုံးသပ်၍ဖြေရှင်းပေးရန်အတွက် နစ်နာမှုဖြေရှင်းလုပ်ငန်းစဉ်ကို ရေးဆွဲတင်ပြပေးရန်။	မကျေနပ်ချက်များကို လက်ခံ၊ သုံးသပ်၍ဖြေရှင်းပေးရန်အတွက် နစ်နာမှုဖြေရှင်းလုပ်ငန်းစဉ်ကို အခန်းငယ် 11.2.7.10Public Consultation and Stakeholder Engagement Plan (SEP) during Operation Period တွင်ဖော်ပြထားပါသည်။
၁၂။	CSR		
	CSR နှင့်ပတ်သက်၍ page 116 appendix III and page 35 appendix V တွင်ဖော်ပြထားသည်။ CSR အဖြစ်အောက်ပါတို့ကို ဆောင်ရွက်ပြီး ကုန်ကျစရိတ်များပါဖော်ပြပေးထားသည်ဟု page 35တွင် ဖော်ပြထားသော်လည်း cost နှင့်ပတ်သက်၍ဖော်ပြထားမှုမပါရှိပါ။ 1. Improve school facilities, i.e. to upgrade Primary School to Middle School 2. Build clinic, 3. Supply electricity	ဒေသခံပြည်သူများနှင့် တိုင်ပင်ဆွေးနွေး၍ ဒေသခံပြည်သူများ ၏ လူမှုစီးပွားဆိုင်ရာဖွံ့ဖြိုးရေး လုပ်ငန်းများကို ဆောင်ရွက် ပေးမည့် CSR plan ဖော်ပြပေးရန်။	CSR နှင့် ပတ်သက်၍ အောက်ပါတို့ကို လုပ်ဆောင်ပေးပြီးဖြစ်ပါသည်။ **Education assistance** The “ACHC scholarship” was established to aid the outstanding students to support the education. **Disaster assistance** Firefighting assistance had been given in Myitkyina for 15 times. **Disaster donation** ● In May 2008, donation of 100 million Kyat was given to the victims of the Cyclone Nargis. ● In March 2010, donation of USD 50,000 was given to the victims of the earthquake in Shan state. ● In November 2012, 25 tons of living materials were donated to the Thabeikkyin region worst hit in the “November 11” earthquake. **Disaster relief** On 30 June, 2012, 20 million kyat was donated to 27 war refugee camps in Myitkyina. **Assistance** ● Public utility: Chipwi town road hardening has been completed to improve the traffic conditions for better quality of life of the local people.

			● Poverty alleviation: The "assistance foundation" has been established to help the livelihoods of the resettled people. ဒေသခံပြည်သူများနှင့် တိုင်ပင်ဆွေးနွေး၍ ဒေသခံပြည်သူများ၏ လူမှုစီးပွားဆိုင်ရာဖွံ့ဖြိုးရေး လုပ်ငန်းများကို ဆောင်ရွက်ပေးမည့် CSR Program ကို Company မှ MOEE and Kachin State Government နှင့် တိုင်ပင်ကာ နောက်ပိုင်းတွင် လုပ်ဆောင်ပေးမည်ဖြစ်ပါသည်။
၁၃။	**Residual Impact**		
	Appendix 7 တွင် operation phase နှင့် decommissioning phase အတွက် residual impact များနှင့် ပတ်သက်၍ ဖော်ပြထားသော်လည်း Impact assessment အခန်းတွင် ဖော်ပြထား သော environmental components အားလုံးအ တွက်ထိခိုက်မှု များလျော့နည်း စေရန် mitigation measures များဆောင်ရွက်ပြီး နောက်ကြွင်း ကျန်ရှိနေ မည့် residual impact များအားလုံး ကိုဖော်ပြထားမှု မရှိကြောင်း၊ residual impact များအား သက်ဆိုင်ရာစံချိန်စံညွှန်းများ၊ လမ်း ညွှန်ချက်များ နှိုင်းယှဉ်ဖော်ပြမှုများ မပါရှိ ကြောင်းစိစစ် တွေ့ရှိရသည်။ Appendix 7 residual impact အခန်းတွင်ဖော်ပြထားသောအချို့.သော operation and impact များမှာ အဆိုပြုစီမံကိန်း၏ လုပ်ငန်းများတွင်မရှိသောအကြောင်းအရာများဖြစ် နေပါသဖြင့်ပြန်လည်ပြင်ဆင်ဖော်ပြရန်။	Operation phase နှင့် decommissioning phase အတွက် impact assessment အခန်းတွင်ဖော်ပြထားသော environmental components အားလုံးအတွက်ထိ ခိုက်မှုများ လျော့နည်းစေရန် mitigation measures များဆောင်ရွက်ပြီး နောက်ကြွင်းကျန်ရှိနေမည့် residual impact များအားလုံးကို ဆန်းစစ်ဖော်ပြ၍ ၎င်း residual impact များသည်သက်ဆိုင်ရာ စံချိန်စံညွှန်းများ၊ လမ်းညွှန်ချက်များအတွင်းရှိကြောင်း ဆန်းစစ် ဖော်ပြရန်။	Residual Impact အကြောင်းကို အခန်း 11.3 Residual mpacts တွင် ဖော်ပြထားပါသည်။

	ဥပမာ- see Appendix 7: noise from cement plant, Noise form quarrying activities		
၁၄။	ဆက်စပ်သက်ရောက်မှုဆန်းစစ်ခြင်း		
	EIA procedure တွင် CIA နှင့်ပတ်သတ်၍ အောက်ပါ အတိုင်းဖော်ပြထားသည်။ EIA procedure 63 (g) ဆောင်ရွက်မည့်နည်းလမ်းနှင့်ချဉ်းကပ်မှု၊ဆက်စပ်သက်ရောက်မှုဆန်းစစ်ခြင်း- (ကက)လက်ရှိနှင့်အနာဂါတ်တွင်ပုဂ္ဂလိကနှင့် ပြည်သူပိုင်စီမံကိန်း များနှင့်ဖွံ့ ဖြိုးမှုများအကြောင်း အရာအကျဉ်းချုပ်ဖော်ပြချက်နှင့်မြေပုံ၊ (ခခ)အနီးပတ်ဝန်းကျင်တွင်ဖြစ်ပေါ် လာနိုင်သည့် ဆက်စပ်သက်ရောက်မှု ဆိုင်ရာအကြောင်းအ ချက်များနှင့်ထိုသက်ရောက်မှုများဖြစ်ပေါ် စေရန်စီမံ ကိန်း၏ပါဝင်ကူညီမှုတို့ကိုသတ်မှတ်ဖော်ထုတ်၍ ဆန်းစစ်ခြင်း၊ (ဂဂ) စီမံကိန်း၏အရေးကြီးအဆင့်ထက် ကျော် လွန်နိုင်ကြောင်းနှင့်ဆက်စပ်သက်ရောက်မှုများနှင့် ဆက်စပ်နေကြောင်း၊ (ဃဃ)ဆက်စပ်သက်ရောက်မှုများအားစီမံကိန်း၏ ပါဝင်ကူညီမှုကိုလျော့နည်းစေရန်ဆောင်ရွက်မည့် လုပ်ငန်းများဖော်ပြချက်၊	စီမံကိန်းကြောင့်ထိခိုက်နိုင်သောနယ်ပယ်သတ်မှတ်ချက်အ တွင်းအခြားသောစီမံကိန်းများ ရှိ။မရှိဖော်ပြရန် (existing and proposed projects need to take account) နှင့်ရှိပါက cumulative impact ကို ဆန်းစစ်ရန်နှင့်အဆိုပြုစီမံကိန်းကြောင့် cumuiative impact ကိုလျော့နည်းစေရန် ဆောင်ရွက်မည့် အစီအစဉ်ကိုဖော်ပြရန်။ ချီဘွေရေအားလျှပ်စစ်စီမံကိန်းသည်မြစ်ကြီးနားမြို့ အထက်ရှိ ဇရာဝတီမြစ်ဝှမ်းဒေသ cascade hydropower project အနက်တစ်ခုဖြစ်သဖြင့်အဆိုပြုစီမံကိန်းနှင့် အခြားစီမံကိန်း များ ကြောင့်ဖြစ်လာမည့် cumulative impact ကိုဆန်းစစ်၍လျော့ချ မည့်နည်းလမ်းများကိုဖော်ပြရန်။	Comulative Impacts Assessment ကို အခန်း ၁၂ တွင် ဖော်ပြထားပါသည်။
၁၅။	**အများပြည်သူနှင့်တိုင်ပင်ဆွေးနွေးခြင်းနှင့်သတင်းအချက်အလက်များထုတ်ဖော်ခြင်း**		
	စီမံကိန်းလည်ပတ်မည့် ကာလတစ် လျှောက် နှင့် ပိတ်သိမ်းမည့်ကာလ၊ ပိတ်သိမ်းပြီး ပြန်လည်ထူ ထောင်ရေး လုပ်ငန်းများ ဆောင်ရွက်မည့်ကာလ တစ် လျှောက်အတွက် အများပြည်သူနှင့်		စီမံကိန်းလည်ပတ်မည့် ကာလတစ်လျှောက် အများ ပြည်သူနှင့် သင့်တော်သော တိုင်ပင်ဆွေးနွေးခြင်း နှင့် သတင်းအချက်အ လတ်ထုတ်ပြန်ရေး ဆောင်ရွက်ရန်နှင့် ဆောင်ရွက်မည့် လုပ် ငန်းစဉ်ကို အခန်း 11.2.7.10

	သင့်တော်သော တိုင်ပင်ဆွေးနွေးခြင်း နှင့် သတင်းအချက်အ လတ်ထုတ်ပြန်ရေး ဆောင်ရွက်ရန်နှင့် ဆောင်ရွက်မည့် လုပ်ငန်းစဉ်ကိုဖော်ပြရန်။		Public Consultation and Stakeholder Engagement Plan (SEP) during Operation Period တွင်ဖော်ပြထားပါသည်။
၁၆။	**အထွေထွေ**		
	Construction phase impact များအားပြန်လည်ကုစားထားမှုဆောင်ရွက်ချက်များအား monitoring report တွင်တင်ပြရန်။		Construction phase impact များအားပြန်လည်ကုစားထားမှုဆောင်ရွက်ချက်များအား monitoring report တွင်တင်ပြပါမည်။

Table 14.2 Correspondence to the Comments from ECD (Fifth Revised ESIA Report)



ကန့်သတ်

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ

လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန

လျှပ်စစ်စွမ်းအားစီမံရေးဦးစီးဌာန

စာအမှတ်၊ ဌစ၂ /၁၀၁/ ရေ-ပြည့်ဖြိုး/စီမံရေး(လျှပ်စစ်)

ရက်စွဲ ၊ ၂၀၂၀ ပြည့်နှစ်၊ အောက်တိုဘာလ ၁၅ ရက်

အကြောင်းအရာ ။ **ချီဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်းဆိုင်ရာ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း အစီရင်ခံစာနှင့်ပတ်သက်၍ စိစစ်တင်ပြခြင်းကိစ္စ**

ရည်ညွှန်းချက် ။ (၁) ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၏ (၁၀-၁၂-၂၀၁၉) ရက်စွဲပါစာအမှတ်၊ အီးအိုင်အေ-၂/၂(၂၆၂၃/၂၀၁၉

(၂) သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၏ (၅-၁၀-၂၀၂၀) ရက်စွဲပါ စာအမှတ်၊ (သစ်တော)၃(၂)/၁၆(ဃ) (၄၈၀၀/ ၂၀၂၀)

၁။ လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာနနှင့် SPIC Yunnan International Power Investment Co., Ltd.၊ Asia World Co., Ltd. ပူးပေါင်းကောင်အထည်ဖော် ဆောင်ရွက်သည့် ချီဖွေငယ် ရေအား လျှပ်စစ်စီမံကိန်းဆိုင်ရာ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာနှင့်ပတ်သက်၍ ပဉ္စမအကြိမ် ပြင်ဆင်ထားသော ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းအစီရင်ခံစာ (Fifth Revised EIA Reprot) ကို စိစစ်ရာတွင် အဆိုပါအစီရင်ခံစာမှာ ၂၀၁၈ ခုနှစ်တွင် ပြုစုထားပြီး **ရည်ညွှန်း**(၁)ပါစာဖြင့် သဘောထား ပြန်ကြားခဲ့သော အချက်များအား ပြင်ဆင်ဖြည့်စွက်ဆောင်ရွက်ထားခြင်းမရှိဘဲ ပြန်လည်တင်ပြလာခြင်း ဖြစ်ကြောင်း စိစစ်တွေ့ရှိရပါသဖြင့် အောက်ဖော်ပြပါ သဘောထားမှတ်ချက်များအား ဖြည့်စွက် ဆောင်ရွက်ပြီး သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ ပြန်လည်တင်ပြရန် လိုအပ်ပါကြောင်း **ရည်ညွှန်း** (၂) ပါစာဖြင့် ပြန်ကြားလာခဲ့ပါသည်-

(က) အများပြည်သူနှင့်တိုင်ပင်ဆွေးနွေးခြင်း (Public Consultation) အား ထပ်မံ ဆောင်ရွက်ရန်နှင့် ဒေသခံများနှင့် တွေ့ဆုံဆွေးနွေးခဲ့မှု အခြေအနေများအား အသေးစိတ်ဖော်ပြရန်နှင့် အများပြည်သူနှင့်တိုင်ပင်ဆွေးနွေးခြင်း ဆောင်ရွက်ရာတွင် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနမှ ထုတ်ပြန်ထားသည့် ပူးတွဲပါ COVID-19 ကမ္ဘာ့ကပ်ရောဂါကာလအတွင်း ဆောင်ရွက်ဆဲ ဆောင်ရွက်မည့် စီမံကိန်းများအတွက် အများပြည်သူနှင့်တိုင်ပင်ဆွေးနွေးခြင်းဆိုင်ရာ ကိစ္စရပ်များဆောင်ရွက်ရန် လုပ်ငန်း လမ်းညွှန်ချက်များအတိုင်း ဆောင်ရွက်ရန်၊

ကန့်သတ်

(ခ) ဒေသခံပြည်သူများ၏ လူမှုစီးပွားရေးဆိုင်ရာ ဖွံ့ဖြိုးရေးလုပ်ငန်းများ (Community Development Activities) ကို ဆောင်ရွက်ပေးရန်နှင့် လျာထားရန်ပုံငွေအား ဖော်ပြပေးရန်၊

(ဂ) စီမံကိန်းအနေဖြင့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု ရန်ပုံငွေတစ်ရပ် ထူထောင်ထားရှိရန်နှင့် ရန်ပုံငွေအား ဖော်ပြရန်၊

၂။ သို့ဖြစ်ပါ၍ ချီဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်းဆိုင်ရာ ပဉ္စမအကြိမ်ပြင်ဆင်ထားသော ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းအစီရင်ခံစာ (Fifth Revised EIA Reprot) အား သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၏ သဘောထားမှတ်ချက်များအတိုင်း ပြင်ဆင်ပြုစု၍ တင်ပြနိုင်ပါရန် ပေးပို့အပ်ပါသည်။

15/10/20

ညွှန်ကြားရေးမှူးချုပ်(ဒု.ဝ)
(တင့်လွင်ဦး၊ ညွှန်ကြားရေးမှူး)

SPIC Yunnan International Power Investment Co., Ltd.

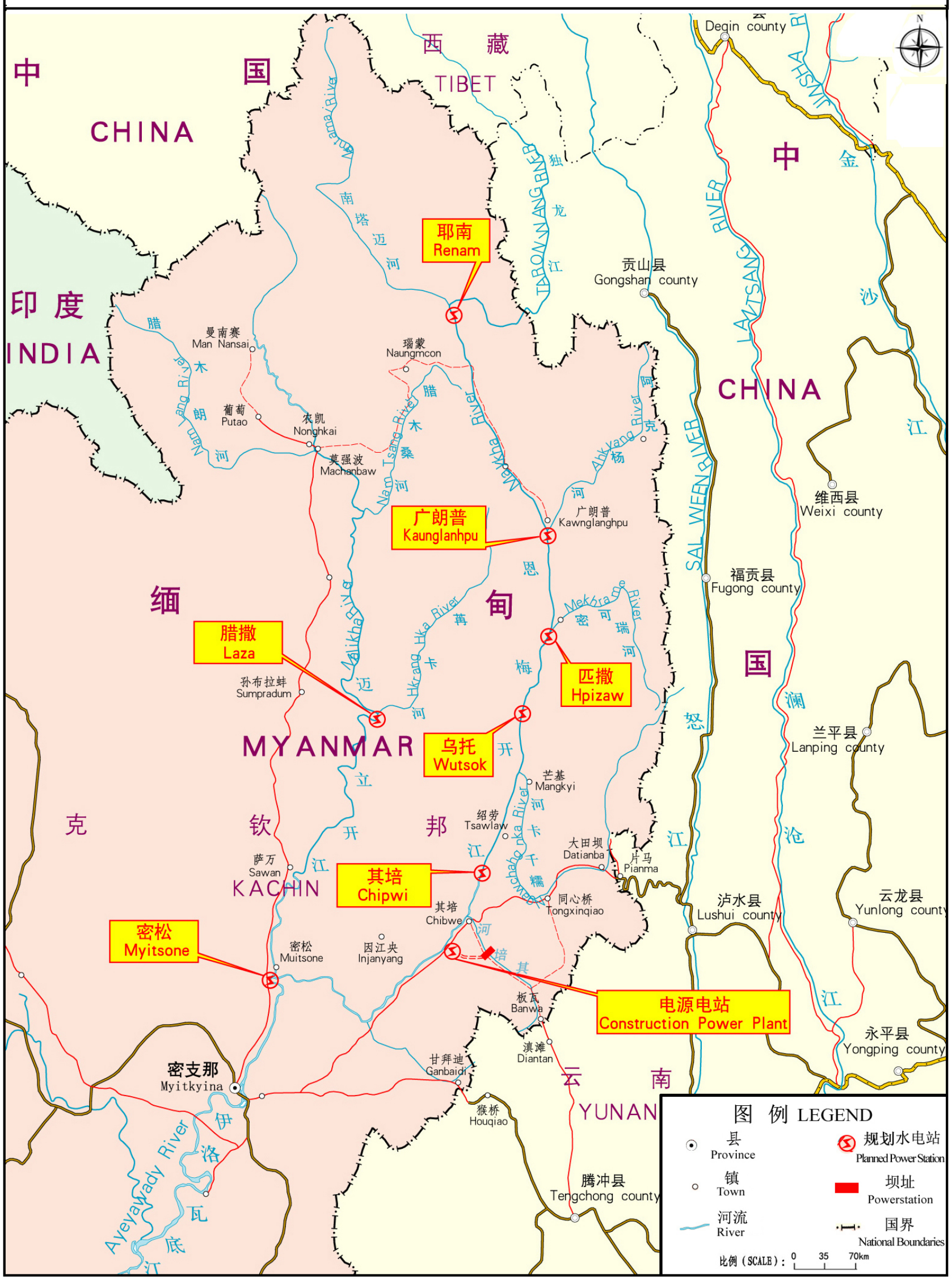
Asia World Co., Ltd.

မိတ္တူကို
ရုံးလက်ခံ/မျှောစာတွဲ

စဉ်	စိစစ်တွေ့ရှိချက်	ပြန်လည်ဖြေရှင်းချက်
၁။	အများပြည်သူနှင့်တိုင်ပင်ဆွေးနွေးခြင်း (Public Consultation) အားထပ်မံဆောင်ရွက်ရန်နှင့် ဒေသခံများနှင့်တွေ့ဆုံဆွေးနွေးခဲ့မှု အခြေအနေများအား အသေးစိတ်ဖော်ပြရန်နှင့် အများပြည်သူနှင့်တိုင်ပင်ဆွေးနွေးခြင်း ဆောင်ရွက်ရာတွင် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနမှ ထုတ်ပြန်ထားသည့် COVID-19 ကမ္ဘာကပ် ရောဂါ ကာလအတွင်း ဆောင်ရွက်မည့် ၊ ဆောင်ရွက်ဆဲ စီမံကိန်းများအတွက် အများပြည်သူနှင့်တိုင်ပင်ဆွေးနွေးခြင်းဆိုင်ရာ လုပ်ငန်းလမ်းညွှန်ချက်များအတိုင်းဆောင်ရွက်ရန်။	ပတ်ဝန်းကျင်ထိန်း သိမ်းရေးဦးစီးဌာနမှ ထုတ်ပြန်ထားသည့် COVID-19 ကမ္ဘာကပ် ရောဂါ ကာလအတွင်း ဆောင်ရွက်ဆဲ စီမံကိန်း များအတွက် အများပြည်သူနှင့်တိုင်ပင်ဆွေးနွေးခြင်း (Public Consultation) ကို ၁၁-၁၂-၂၀၂၀ တွင် Meeting Hall, GAD Chipwi Township တွင် (Zoom Meeting) ဖြင့်ပြုလုပ်ခဲ့ပြီး တက်ရောက်သူများနှင့် ဆွေးနွေးမှုများကို Appendix – 5 တွင် ဖော်ပြထားပါသည်။
၂။	ဒေသခံပြည်သူများ၏ လူမှုစီးပွားရေးဆိုင်ရာ ဖွံ့ဖြိုးရေးလုပ်ငန်းများ (Community Development Activities) ကိုဆောင်ရွက်ပေးရန်နှင့် လျာထားရန်ပုံငွေအား ဖော်ပြပေးရန်။	ဆောင်ရွက်ပြီးသော ဒေသခံပြည်သူများ၏ လူမှုစီးပွားရေးဆိုင်ရာ ဖွံ့ဖြိုးရေးလုပ်ငန်း များ (Community Development Activities) နှင့် လျာထားရန်ပုံငွေအား Appendix – 6 တွင်ဖော်ပြထားပါသည်။
၃။	စီမံကိန်းအနေဖြင့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု ရန်ပုံငွေတစ်ရပ် ထူထောင်ထားရှိရန်နှင့် ရန်ပုံငွေအား ဖော်ပြရန်။	စီမံကိန်းအနေဖြင့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု ရန်ပုံငွေတစ်ရပ် ထူထောင်ထားရှိပြီး ရန်ပုံငွေအား စာမျက်နှာ ၂၅၁ ၊ Table 11.6-2 တွင် ဖော်ပြထားပါသည်။

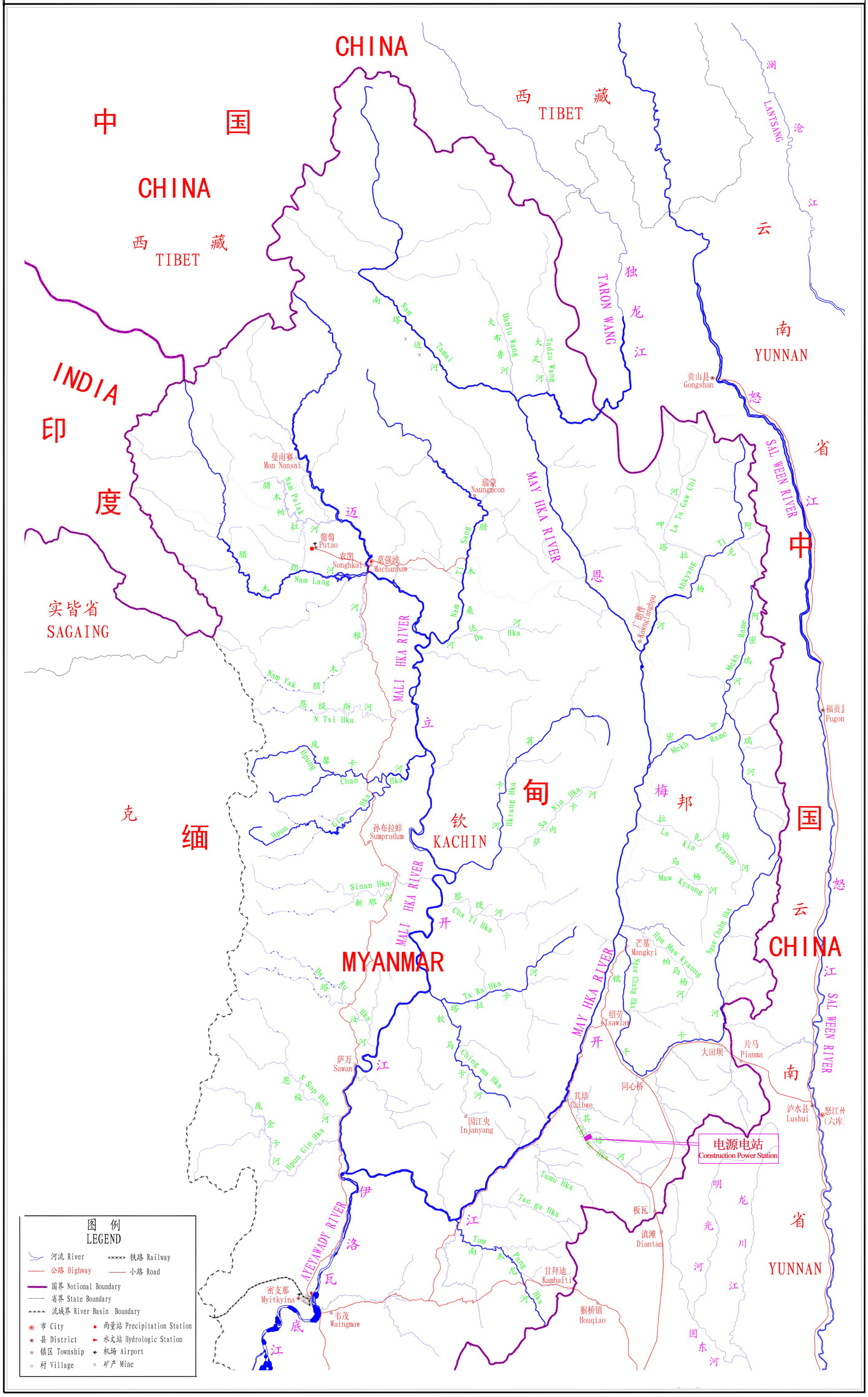
附图1 电源电站地理位置示意图

FIGURE 1 SKETCH MAP OF GEOGRAPHY POSITION OF CONSTRUCTION POWER PLANT



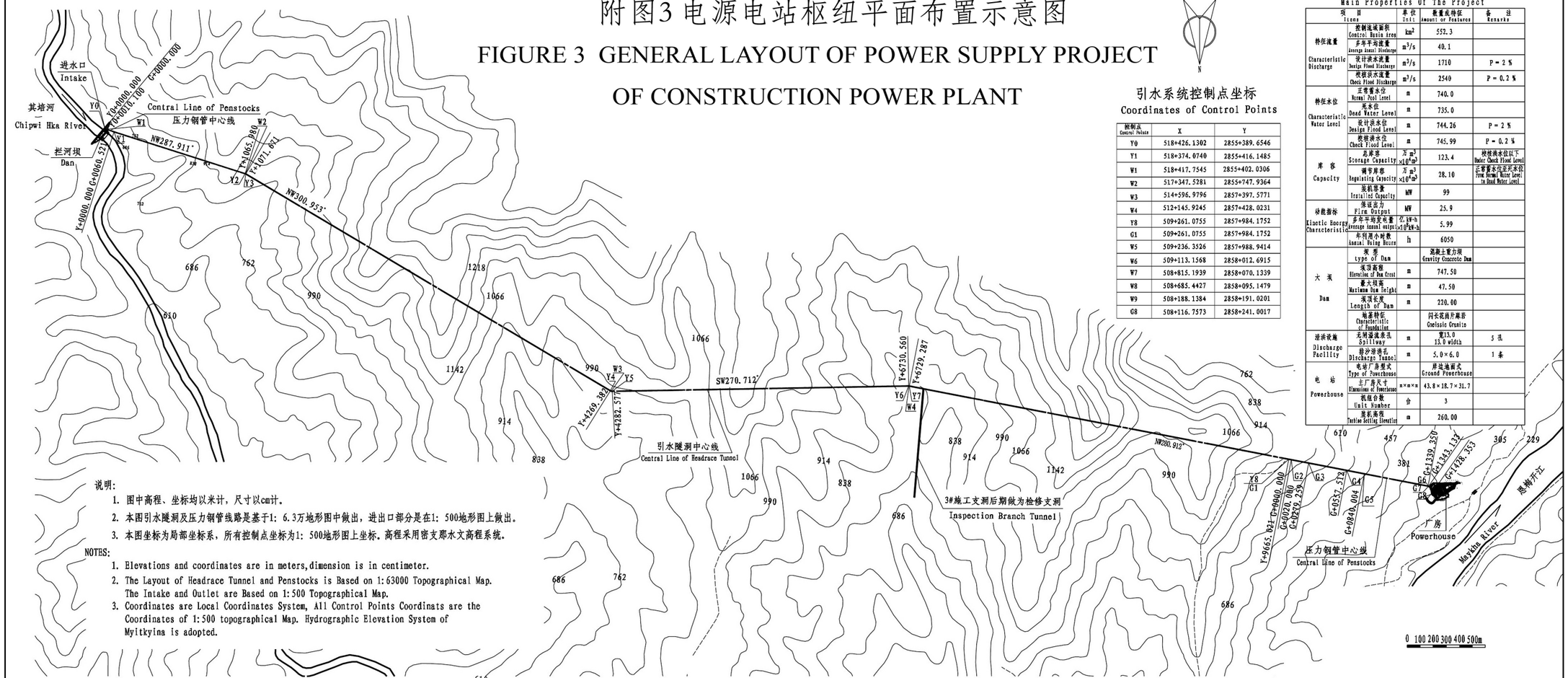
附图2 电源电站水系图

FIGURE 2 DRAINAGE MAP OF CONSTRUCTION POWER PLANT



附图3 电源电站枢纽平面布置示意图

FIGURE 3 GENERAL LAYOUT OF POWER SUPPLY PROJECT OF CONSTRUCTION POWER PLANT



引水系统控制点坐标
Coordinates of Control Points

控制点 Control Points	X	Y
Y0	518+426.1302	2855+389.6546
Y1	518+374.0740	2855+416.1485
W1	518+417.7545	2855+402.0306
W2	517+347.5281	2855+747.9364
W3	514+596.9796	2857+397.5771
W4	512+145.9245	2857+428.0231
Y8	509+261.0755	2857+984.1752
G1	509+261.0755	2857+984.1752
W5	509+236.3526	2857+988.9414
W6	509+113.1568	2858+012.6915
W7	508+815.1939	2858+070.1339
W8	508+685.4427	2858+095.1479
W9	508+188.1384	2858+191.0201
G8	508+116.7573	2858+241.0017

主要工程特性表
Main Properties Of The Project

项目 Items		单位 Unit	数量或特征 Amount or Features	备注 Remarks
特征流量 Characteristic Discharge	控制流域面积 Control Basin Area	km^2	552.3	
	多年平均流量 Average Annual Discharge	m^3/s	40.1	
	设计洪水流量 Design Flood Discharge	m^3/s	1710	P = 2 %
	校核洪水流量 Check Flood Discharge	m^3/s	2540	P = 0.2 %
特征水位 Characteristic Water Level	正常蓄水位 Normal Pool Level	m	740.0	
	死水位 Dead Water Level	m	735.0	
	设计洪水位 Design Flood Level	m	744.26	P = 2 %
	校核洪水位 Check Flood Level	m	745.99	P = 0.2 %
库容 Capacity	总库容 Storage Capacity	万 m^3 $\times 10^4 m^3$	123.4	校核洪水位以下 Under Check Flood Level
	调节库容 Regulating Capacity	万 m^3 $\times 10^4 m^3$	28.10	正常蓄水位至死水位 From Normal Water Level to Dead Water Level
动能指标 Kinetic Energy Characteristics	装机容量 Installed Capacity	MW	99	
	保证出力 Firm Output	MW	25.9	
	多年平均发电量 Average Annual Output	亿 kW·h $\times 10^8$ kW·h	5.99	
	年利用小时数 Annual Using Hours	h	6050	
大坝 Dam	坝型 Type of Dam		混凝土重力坝 Gravity Concrete Dam	
	坝顶高程 Elevation of Dam Crest	m	747.50	
	最大坝高 Maximum Dam Height	m	47.50	
	坝顶长度 Length of Dam	m	220.00	
	地基特征 Characteristic of Foundation		闪长花岗片麻岩 Gneissic Granite	
泄洪设施 Discharge Facility	无闸溢流表孔 Spillway	m	宽13.0 13.0 width	5 孔
	排沙洞(兼导流) Discharge Tunnel	m	5.0×6.0	1 条
电站 Powerhouse	电站厂房型式 Type of Powerhouse		岸边地面式 Ground Powerhouse	
	主厂房尺寸 Dimensions of Powerhouse	m×m×m	43.8×18.7×31.7	
	机组台数 Unit Number	台	3	
	发机高程 Turbine Setting Elevation	m	260.00	

说明：

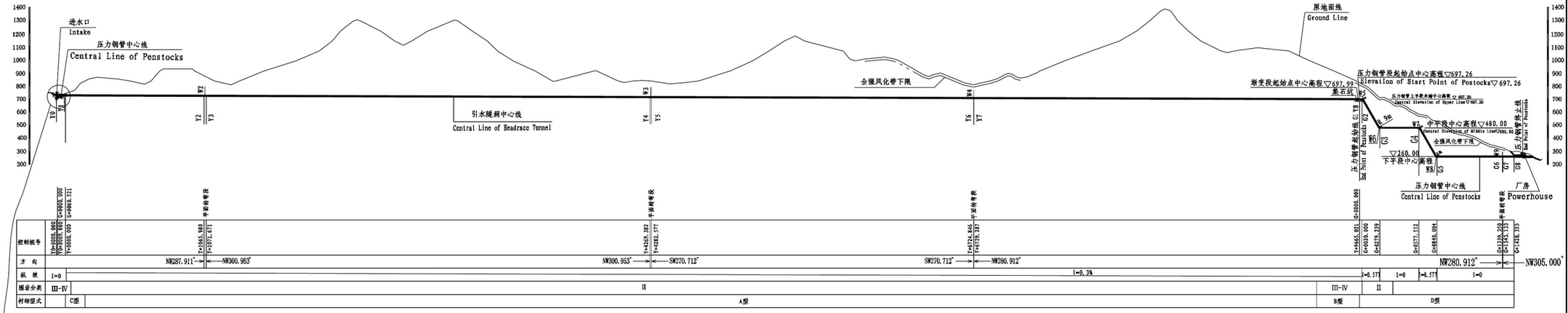
1. 图中高程、坐标均以米计，尺寸以cm计。
2. 本图引水隧洞及压力钢管线路是基于1：6.3万地形图中做出，进出口部分是在1：500地形图上做出。
3. 本图坐标为局部坐标系，所有控制点坐标为1：500地形图上坐标。高程采用密支邸水文高程系统。

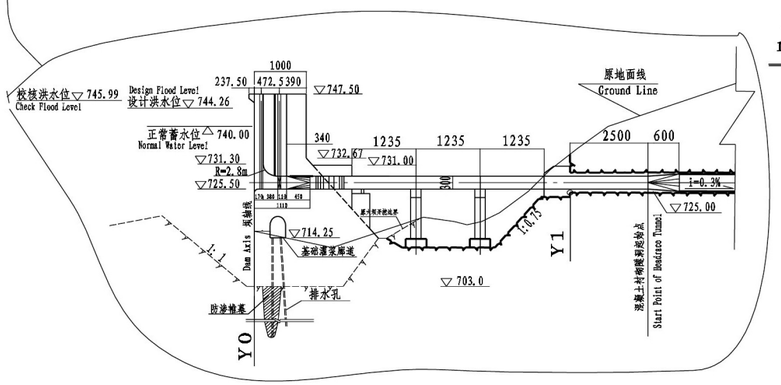
NOTES:

1. Elevations and coordinates are in meters, dimension is in centimeter.
2. The Layout of Headrace Tunnel and Penstocks is Based on 1:63000 Topographical Map. The Intake and Outlet are Based on 1:500 Topographical Map.
3. Coordinates are Local Coordinates System, All Control Points Coordinats are the Coordinates of 1:500 topographical Map. Hydrographic Elevation System of Myitkyina is adopted.

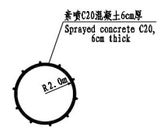
附图4 电源电站引水系统纵剖面图

FIGURE 4 LONGITUDINAL PROFILE OF HEADRACE TUNNEL OF CONSTRUCTION POWER PLANT

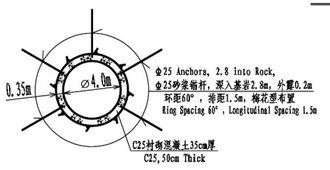




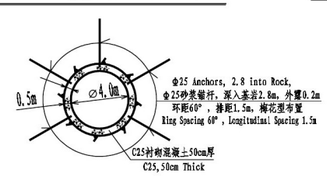
II类围岩A型衬砌断面
rock support class I



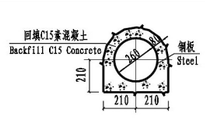
III类围岩B型衬砌断面
rock support class II



IV类围岩及破碎带C型衬砌断面
rock support classIII



压力钢管主管D型衬砌断面
typical cross section of penstocks



说明:

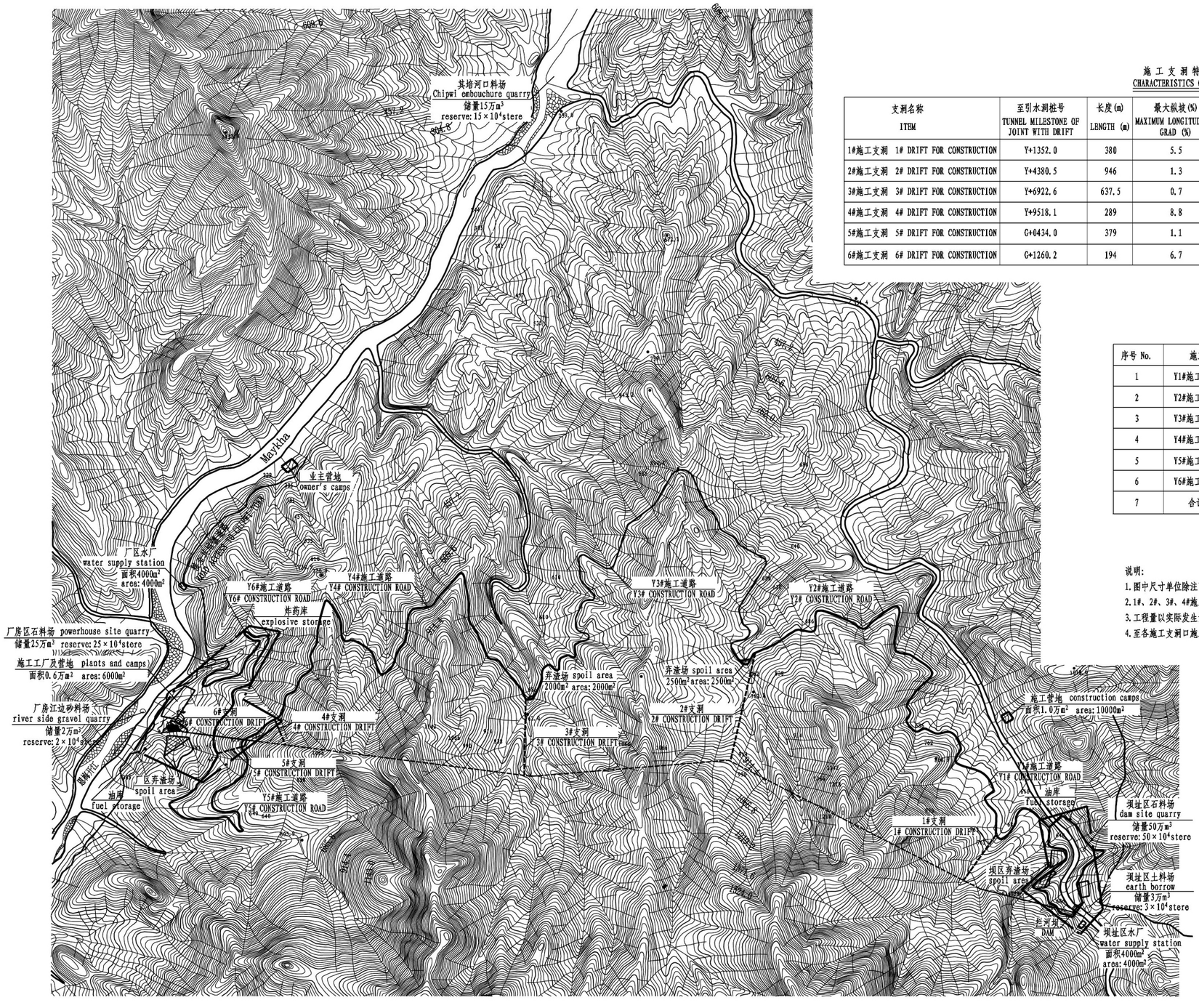
图中高程、坐标均以米计，尺寸以cm计。

NOTES:

Elevations and coordinates are in meters, dimension is in centimeter.

附图5 电源电站施工总平面布置图

FIGURE 5 GENERAL LAYOUT OF CONSTRUCTION LOCATION OF CONSTRUCTION POWER PLANT



施工支洞特性表

CHARACTERISTICS OF DRIFTS

支洞名称 ITEM	至引水洞桩号 TUNNEL MILESTONE OF JOINT WITH DRIFT	长度(m) LENGTH (m)	最大纵坡(%) MAXIMUM LONGITUDINAL GRAD (%)	起点高程(m) ELEVATIONS OF START POINT (m)	终点高程(m) ELEVATIONS OF ENFPOINT (m)	断面(宽X高,m) CROSS-SECTIONAL DIMENSION (W×H,m)	洞挖(万m³) QUANTITIE OF TUNNELING (×10⁴ STERE)
1#施工支洞 1# DRIFT FOR CONSTRUCTION	Y+1352.0	380	5.5	700	720.94	3X3.5	0.37
2#施工支洞 2# DRIFT FOR CONSTRUCTION	Y+4380.5	946	1.3	700	711.85	3X3.5	0.92
3#施工支洞 3# DRIFT FOR CONSTRUCTION	Y+6922.6	637.5	0.7	700	704.2	3X3.5	0.62
4#施工支洞 4# DRIFT FOR CONSTRUCTION	Y+9518.1	289	8.8	671	696.45	3X3.5	0.28
5#施工支洞 5# DRIFT FOR CONSTRUCTION	G+0434.0	379	1.1	476	480.0	3.5X4.0	0.49
6#施工支洞 6# DRIFT FOR CONSTRUCTION	G+1260.2	194	6.7	270	257	3.5X4.0	0.25

施工道路汇总表

SUMMARY SHEET OF CONSTRUCTION ROADS

序号 No.	施工道路名称 ITEM		长度 LENGTH (km)	宽度 WIDTH (m)
1	Y1#施工道路	Y1# CONSTRUCTION ROAD	2.50	4.0
2	Y2#施工道路	Y2# CONSTRUCTION ROAD	6.00	4.0
3	Y3#施工道路	Y3# CONSTRUCTION ROAD	6.00	4.0
4	Y4#施工道路	Y4# CONSTRUCTION ROAD	6.10	4.0
5	Y5#施工道路	Y5# CONSTRUCTION ROAD	3.90	4.0
6	Y6#施工道路	Y6# CONSTRUCTION ROAD	3.60	4.0
7	合计	TOTAL	28.10	

说明:

1. 图中尺寸单位除注明外,高程及桩号以m计,其余以cm计。
2. 1#、2#、3#、4#施工支洞断面尺寸为3×3.5m;5#、6#施工支洞断面尺寸为3.5×4m。
3. 工程量以实际发生量为准。
4. 至各施工支洞口施工临时道路沿相应的等高线布置,施工道路长约28.1km,宽4.0m。

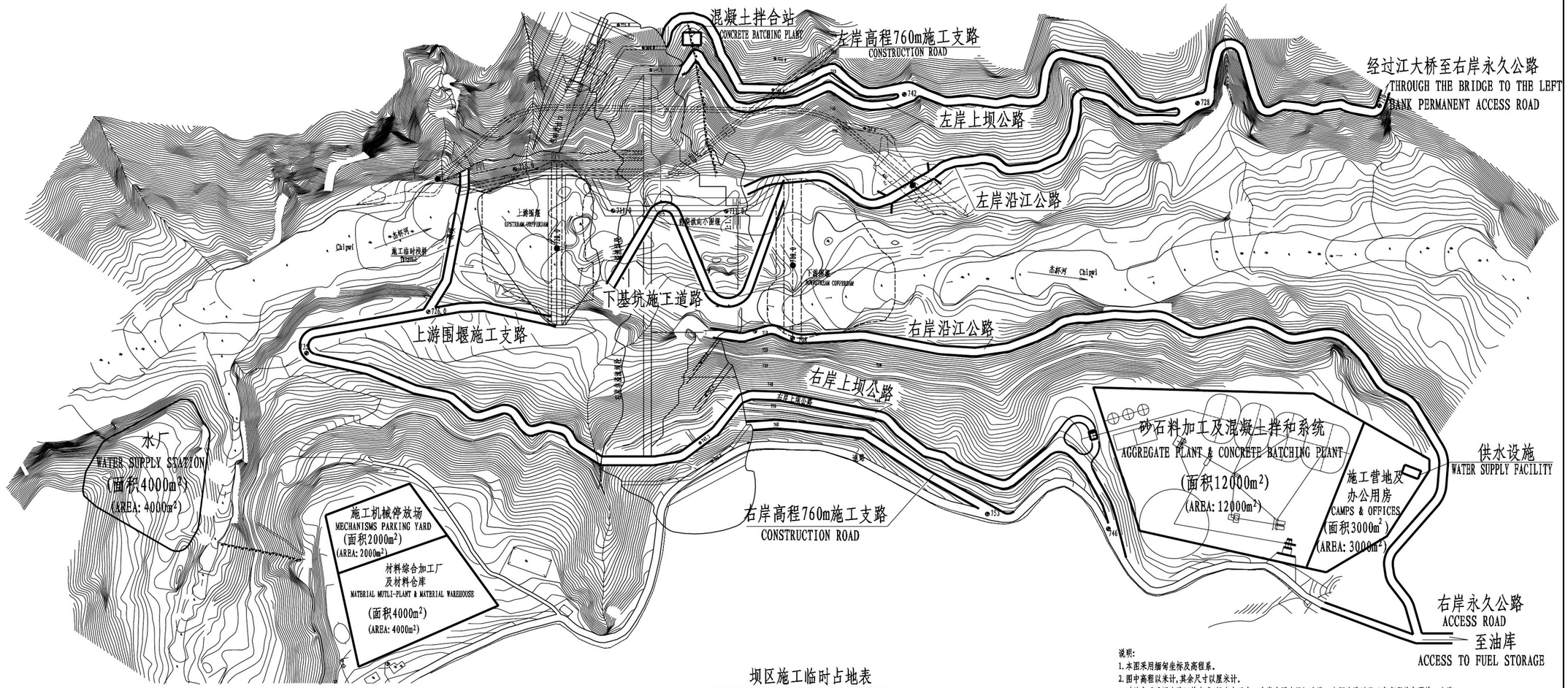
NOTES:

1. Elevation and dimension are in meter, others are in centimeter, excluding noted.
2. The types of cross-sections of 1~4# construction drifts are 3×3.5m; The types of cross-sections of 5~6# construction drifts are 3.5×4m.
3. Quantity shall be determined to the actual constrution.
4. Constuction roads wander along contours to intakes of drifts for construction, all the constuction roads are about 28.1 kilometer long, and 4.0 meter wide.

比例 (SCALE): 0 500 1000 1500m

附图6 电源电站坝址区施工平面总布置图

FIGURE 6 GENERAL LAYOUT OF CONSTRUCTION LOCATION OF DAM SITE OF CONSTRUCTION POWER PLANT



坝区主要施工道路特性表

CHARACTERISTICS OF MAIN CONSTRUCTION ROADS

部位 PART	名 称 ITEM	主要指标 MAIN INDEXES			
		长度（m） LENGTH（m）	路面宽（m） WIDTH（m）	最大纵坡（%） MAXIMUM LONGITUDINAL GRAD（%）	面积（$\times 10^2$m） AREA（$\times 10^4$m²）
左岸 LEFT BANK	沿江公路	309	5.0	7.8	0.15
	高程760m施工支路	175	5.0	11.1	0.09
	上坝公路	520	5.0	5.4	0.26
右岸 RIGHT BANK	沿江公路	232	5.0	3.8	0.12
	高程760m施工支路	360	5.0	15.7	0.18
	上坝公路	265	5.0	1.0	0.13
	上游围堰上堰公路	340	5.0	7.2	0.17
	至导流洞进口公路及施工栈桥	82	5.0	0.02	0.04
下基坑道路		200	5.0	10.0	0.1
合计 TOTAL		2483			1.24

坝区施工临时占地表

TABLE OF TEMPORARY CONSTRUCTION AREA

序号 No.	项 目 ITEM		单位 UNIT	面积 AREA
1	施工营地及办公用房	CAMPS AND OFFICES	$\times 10^4$m²	1.30
2	混凝土拌合系统	CONCRETE BATCHING PLANT	$\times 10^4$m²	0.40
3	砂石料加工系统	AGGREGATE PLANT	$\times 10^4$m²	0.80
4	机械设备停放场	MECHANISMS PARKING YARD	$\times 10^4$m²	0.20
5	材料综合加工厂及仓库	MUTLI-PLANTS AND WAREHOUSE	$\times 10^4$m²	0.40
6	砂砾石料场	GRAVEL QUARRY	$\times 10^4$m²	3.08
7	坝址区石料场	STONE BORROWS	$\times 10^4$m²	0.35
8	土料场	STONE DEPOISTS	$\times 10^4$m²	2.1
9	弃渣场	SPOIL AREA	$\times 10^4$m²	11.5
10	水厂	WATER SUPPLY STATION	$\times 10^4$m²	0.4
11	施工道路	CONSTRUCTION ROADS	$\times 10^4$m²	1.24
12	合计	TOTAL	$\times 10^4$m²	21.77

说明:

1. 本图采用插甸坐标及高程系。
2. 图中高程以米计,其余尺寸以厘米计。
3. 对外交通采用公路运输方式;场内交通左、右岸布置有沿江公路、上坝公路以及至各高程的主要施工支路、至上游围堰的施工支路和下基坑施工道路，路宽5.0m。
4. 施工设施主要分为生活设施和生产设施两部分。生活设施主要为施工管地及办公用房；生产设施包括各种材料加工厂及堆场、混凝土拌和系统、砂石料加工系统、砂（石）料备料场等。
5. 开挖弃料运至指定弃渣场。
6. 在导流洞出口架设一座简易桥梁,在导流洞出口施工完成及运行期间贯通左岸沿江公路的交通。
7. 在坝址下游2km内修建过江大桥一座;左岸需修建约2km的永久公路。

NOTES:

1. All the material and goods would be tansported through roads, the roads showed in this drawing are 5 meter wide.
2. Buildings and facilities are shown in the table.
3. Waste residues should be depoisted at spoil area appointed.
4. A trestle would be builded at the outlet of the diversion tunnel, and a bridge would be builded downstream 2 kilometer faraway from the dam.

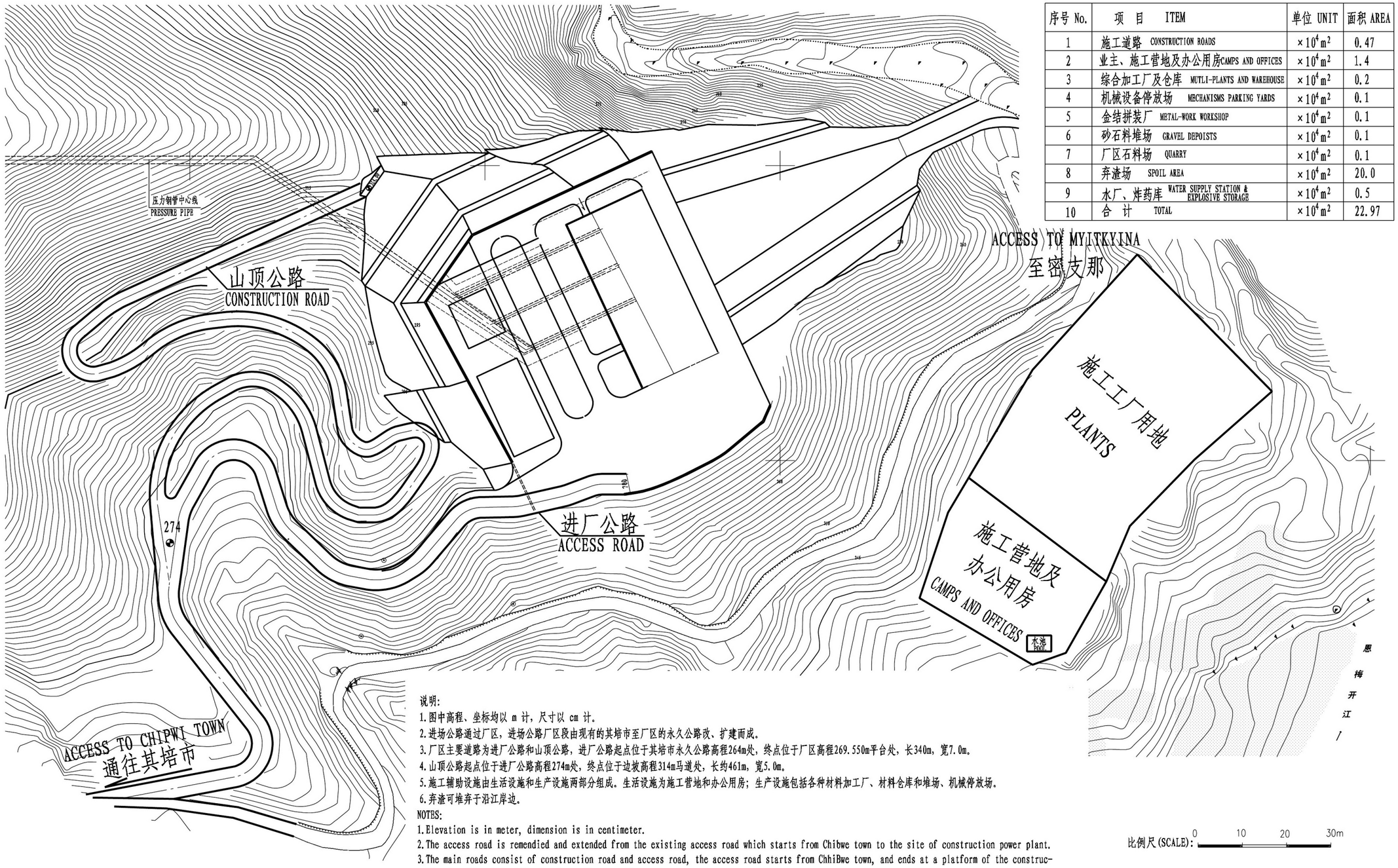
比例尺(SCALE): 0 20 40 60 80 100m

附图7 电源电站厂址区施工平面总布置图

FIGURE 7 GENERAL LAYOUT OF POWERHOUSE OF CONSTRUCTION POWER PLANT

厂区施工临时占地表
TABLE OF TEMPORARY CONSTRUCTION LOCATION

序号 No.	项 目 ITEM	单位 UNIT	面积 AREA
1	施工道路 CONSTRUCTION ROADS	$\times 10^4 m^2$	0.47
2	业主、施工营地及办公用房CAMPS AND OFFICES	$\times 10^4 m^2$	1.4
3	综合加工厂及仓库 MUTLI-PLANTS AND WAREHOUSE	$\times 10^4 m^2$	0.2
4	机械设备停放场 MECHANISMS PARKING YARDS	$\times 10^4 m^2$	0.1
5	金结拼装厂 METAL-WORK WORKSHOP	$\times 10^4 m^2$	0.1
6	砂石料堆场 GRAVEL DEPOISTS	$\times 10^4 m^2$	0.1
7	厂区石料场 QUARRY	$\times 10^4 m^2$	0.1
8	弃渣场 SPOIL AREA	$\times 10^4 m^2$	20.0
9	水厂、炸药库 WATER SUPPLY STATION & EXPLOSIVE STORAGE	$\times 10^4 m^2$	0.5
10	合 计 TOTAL	$\times 10^4 m^2$	22.97



说明:

1. 图中高程、坐标均以 m 计，尺寸以 cm 计。
2. 进场公路通过厂区，进场公路厂区段由现有的其培市至厂区的永久公路改、扩建而成。
3. 厂区主要道路为进厂公路和山顶公路，进厂公路起点位于其培市永久公路高程264m处，终点位于厂区高程269.550m平台处，长340m，宽7.0m。
4. 山顶公路起点位于进厂公路高程274m处，终点位于边坡高程314m马道处，长约461m，宽5.0m。
5. 施工辅助设施由生活设施和生产设施两部分组成。生活设施为施工营地和办公用房；生产设施包括各种材料加工厂、材料仓库和堆场、机械停放场。
6. 弃渣可堆弃于沿江岸边。

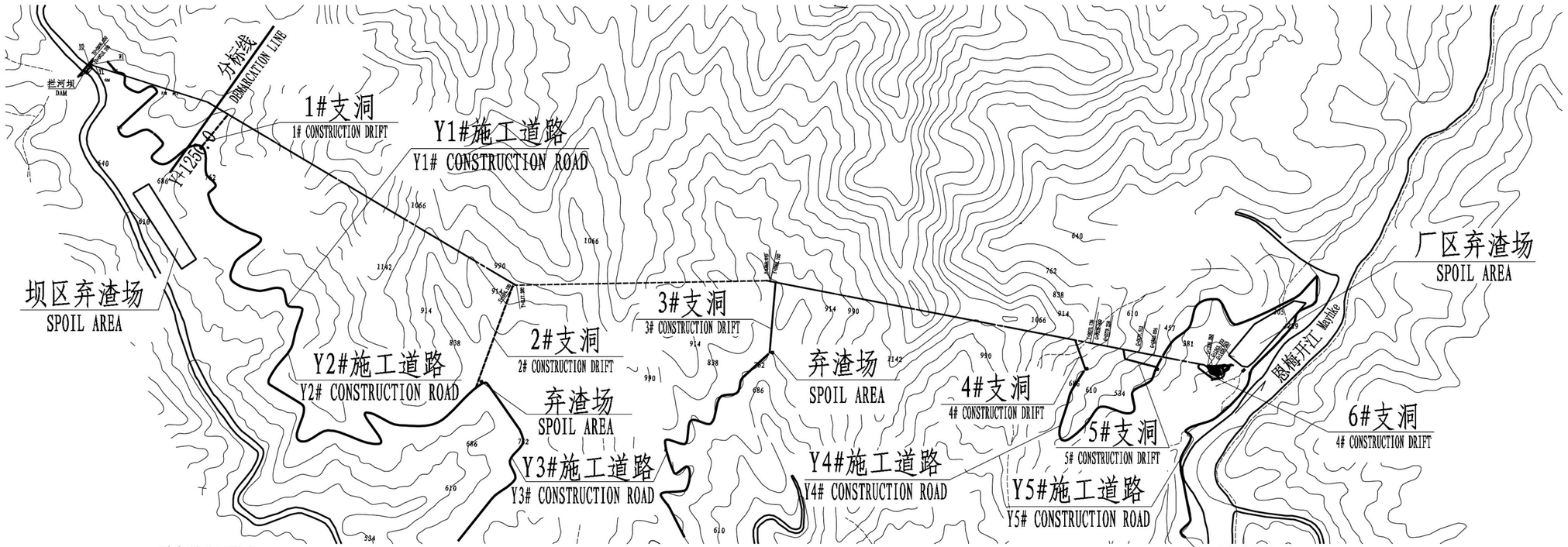
NOTES:

1. Elevation is in meter, dimension is in centimeter.
2. The access road is remendied and extended from the existing access road which starts from Chibwe town to the site of construction power plant.
3. The main roads consist of construction road and access road, the access road starts from ChhiBwe town, and ends at a platform of the construction location, it's 340 meter long, 7 meter wide
4. The construction road starts from the access road and ends at a berm of the powerhouse slope, it's 461 meter long, 5 meter wide.
5. Auxiliary construction facilities are shown in the table.
6. Waste residues could be depoisted along Chipwi river banks.

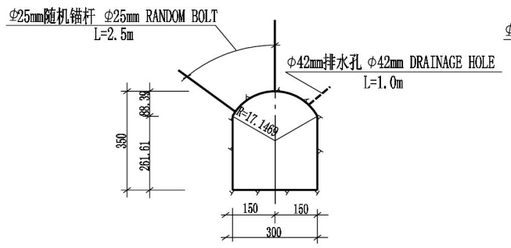
比例尺(SCALE): 0 10 20 30m

附图8 电源电站引水系统施工支洞平面布置图

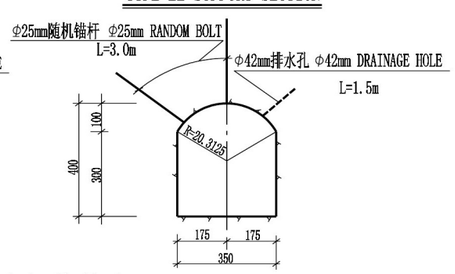
FIGURE 8 LAYOUT OF CONSTRUCTION DRIFTS OF THE HEADRACE TUNNEL OF CONSTRUCTION POWER PLANT



Z1型支护断面图
TYPE Z1 SUPPORT SECTION



Z型支护断面图
TYPE Z2 SUPPORT SECTION



说明:

1. 图中尺寸单位除注明外,高程及桩号以m计,其余以cm计。
2. 1#、2#、3#、4#施工支洞断面尺寸为Z1型;5#、6#施工支洞断面尺寸为Z2型。
3. 支护型式:I、II类围岩采用随机锚杆支护; III类围岩采用系统锚杆加喷砼支护。
4. 系统锚杆和排水孔均按梅花型布置;随机锚杆视地质情况布置; 施工过程中视地质情况及时进行喷锚支护, 必要时可采取钢拱架、钢筋砼等加强支护措施。
5. 工程量以实际发生量为准。
6. 至各施工支洞口施工临时道路沿相应的等高线布置,施工道路长约28.1km, 宽4.0m。

NOTES:

1. Elevation and dimension are in meter, others are in centimeter,excluding noted.
2. The types of cross-sections of 1~4# construction drifts are type Z1; The types of cross-sections of 5~6# construction drifts are type Z2。
3. Class I and II surrounding rock would be supported by random bolts, Class III surrounding rock would be supported by system bolts and shotcrete.
4. System bolts and drain boreholes should be cloverleaf type placed, random bolts should be placed according to geological condition; shotcrete and bolt supports should be placed immediately, steel bow supports and reinforced concrete lining should be carried out if neccessary during construction.
5. Quantity shall be determined to the actual constrution.
6. Constuction roads wander along contours to intakes of drifts for construction, all the constuction roads are about 28.1 kilometer long, and 4.0 meter wide.

施 工 支 洞 特 性 表
CHARACTERISTICS TABLE OF DRIFTS

支洞名称 ITEM OF CONSTRUCTION DRIFTS	至引水洞桩号 TUNNEL MILESTONE OF JOINTS WITH DRIFTS	长度(m) LENGTH (m)	最大纵坡(%) MAXIMUM LONGITUDINAL GRAD (%)	起点高程(m) ELEVATIONS OF START POINTS (m)	终点高程(m) ELEVATIONS OF ENDPOINTS (m)	断面(宽X高,m) CROSS-SECTIONAL DIMENSION (B×H,m)	洞挖(万m^3) QUANTITIES OF TUNNELING ($\times 10^4$ STERE)
1#施工支洞 1# CONSTRUCTION DRIFT	Y+1352.0	380	10.8	762	720.94	3X3.5	0.37
2#施工支洞 2# CONSTRUCTION DRIFT	Y+4380.5	946	5.3	762	711.85	3X3.5	0.92
3#施工支洞 3# CONSTRUCTION DRIFT	Y+6922.6	637.5	9.1	762	704.2	3X3.5	0.62
4#施工支洞 4# CONSTRUCTION DRIFT	Y+9518.1	289	3.6	686	696.45	3X3.5	0.28
5#施工支洞 5# CONSTRUCTION DRIFT	G+0434.0	379	1.1	476	480.0	3.5X4.0	0.49
6#施工支洞 6# CONSTRUCTION DRIFT	G+1260.2	194	1.5	270	257	3.5X4.0	0.25

施工支洞施工道路汇总表
SUMMARY SHEET OF CONSTRUCTION ROADS

序号 No.	施工道路名称 NAME OF CONSTRUCTION ROADS		长度 LENGTH (km)	宽度 WIDTH (m)
1	Y1#施工道路	Y1# CONSTRUCTION ROAD	2.5	4.0
2	Y2#施工道路	Y2# CONSTRUCTION ROAD	6.0	4.0
3	Y3#施工道路	Y3# CONSTRUCTION ROAD	6.0	4.0
4	Y4#施工道路	Y4# CONSTRUCTION ROAD	6.1	4.0
5	Y5#施工道路	Y5# CONSTRUCTION ROAD	3.9	4.0
6	Y6#施工道路	Y6# CONSTRUCTION ROAD	3.6	4.0
7	合计	SUMMARY	28.1	

比例 (SCALE): 0 500 1000 1500m

附图9 电源电站对外交通示意图

FIGURE 9 ACCESS ROAD SKETCH MAP OF CONSTRUCTION POWER PLANT

N

电源电站对外交通公路里程表（km）

MILEAGE TABLE OF ACCESS ROAD (km)

保山	保山(Baoshan)				
腾冲	158	腾冲(Tengchong)			
滇滩	217	59	滇滩(Gongtan)		
板瓦	228	70	11	板瓦(Banwa)	
其培	299	141	82	71	其培(Chipwi)

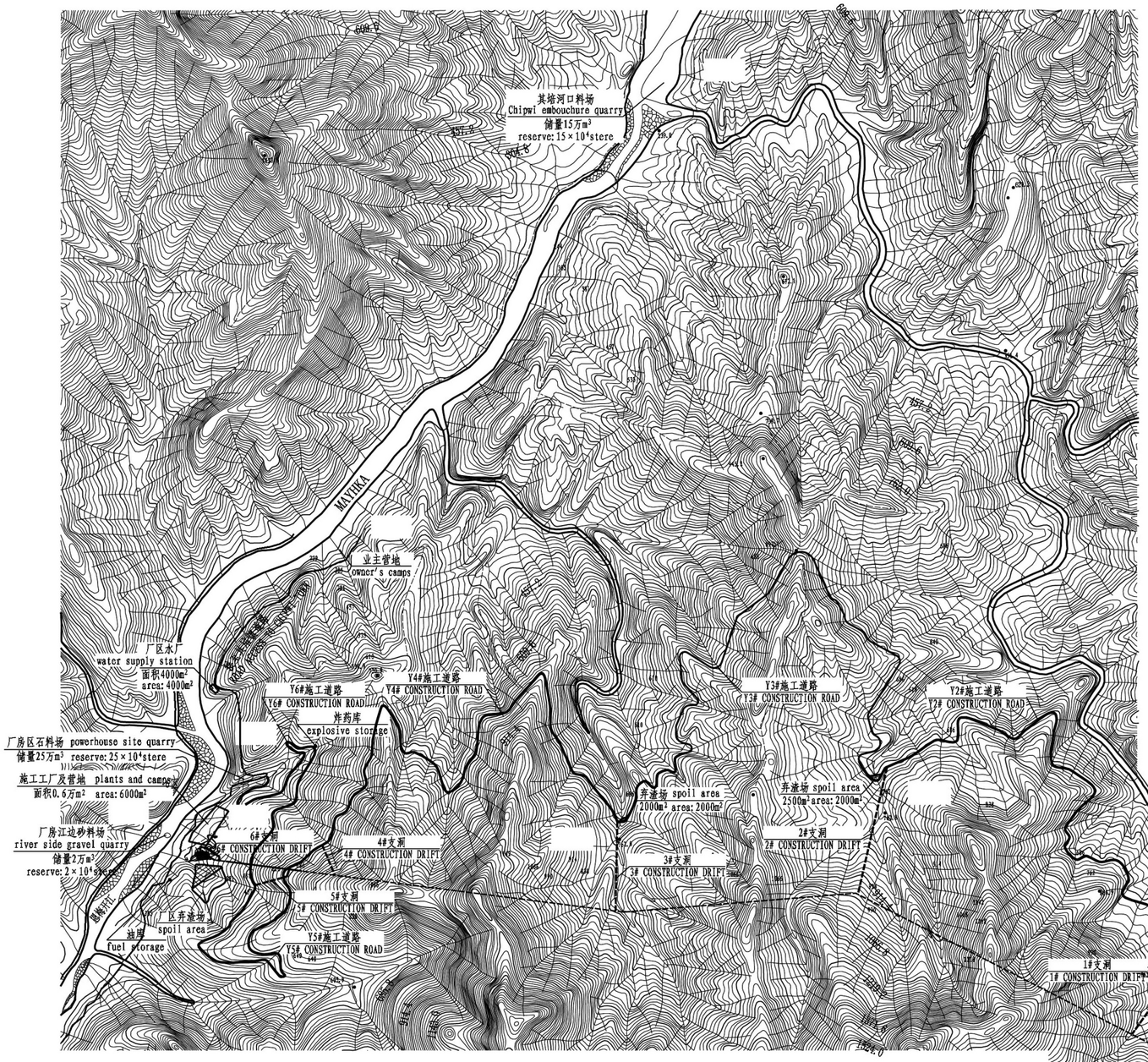
图 例

- ◉保山(Baoshan) —— 市、区(City)
- ◎盈江(Yingjiang) —— 县、区(County)
- ○猴桥镇(Houqiao) —— 乡、镇(Township)
- ★ 芒基(Mangji) —— 村(Village)
- 铁路(Railway)
- 高速公路(Highway)
- 二级公路(Second Grade Road)
- 三级公路(Third Grade Road)
- 四级公路（弹石路面、土路面）(Forth Grade Road)
- 便道（土路）(Carttrack)
- 主要河流(River)

比例尺(Scale)：0 10 20 30 40 50km

附图10 电源电站施工征地范围图

FIGURE 10 TEMPORARY CONSTRUCTION AREA OF CONSTRUCTION POWER PLANT



施工征地范围控制点坐标表

Table of reference points coordinates of temorary construction location

序号 No.	部 位 part	控制点 reference point	坐 标 coordinates X	坐 标 coordinates Y	序号 No.	部 位 part	控制点 reference point	坐 标 coordinates X	坐 标 coordinates Y
1	水厂 water supply station	A1	3562654.59	918375.05	4	2#施工支洞 2# construction drift	E4	3558905.93	921598.01
		B1	3562732.78	918460.63			F4	3558880.37	921595.62
		C1	3562686.68	918500.72			G4	3558821.78	921516.52
		D1	3562619.72	918424.55			H4	3558699.02	921500.51
2	坝址区 location of dam site	A2	3562558.53	918511.40	5	3#施工支洞 3# construction drift	A5	3556225.24	921039.07
		B2	3562655.06	918628.49			B5	3556303.90	921041.71
		C2	3562713.54	918577.62			C5	3556343.49	921095.92
		D2	3562789.12	918580.80			D5	3556277.29	921084.84
		E2	3562773.84	918667.56			E5	3556246.84	921052.14
		F2	3562720.58	918659.11			F5	3556223.53	921052.14
		G2	3562692.12	918731.59	6	厂区 (含厂区施工营地) location of powerhouse	A6	3552496.34	920087.15
		H2	3562777.80	918753.39			B6	3553411.03	920794.28
		I2	3562747.98	918969.82			C6	3553313.91	920849.11
		J2	3562671.27	918955.37			D6	3553014.47	920634.78
		K2	3562707.13	919080.84			E6	3552949.61	920529.16
		L2	3562916.98	919251.24			F6	3552690.59	920453.35
		M2	3562940.26	919297.81			G6	3552673.00	920683.59
		N2	3562812.81	919305.07			H6	3552849.23	920923.01
		O2	3562534.59	919753.79			I6	3552883.43	921135.77
		P2	3562384.85	919690.15			J6	3553051.93	921212.16
		Q2	3562269.56	919574.86			K6	3553301.88	921779.87
		R2	3562271.88	919339.23			L6	3553274.72	921811.14
		S2	3562305.43	919339.89			M6	3553090.37	921774.11
		T2	3562283.82	919113.31			N6	3552995.73	921847.35
		U2	3562066.42	918871.66			O6	3552192.35	921189.99
		V2	3562244.69	918806.02			P6	3551775.64	920463.59
		W2	3562282.13	918680.40			Q6	3551861.96	920411.24
		X2	3562361.40	918639.63			R6	3551926.18	920620.27
		Y2	3562404.41	918577.17			S6	3552043.39	920591.71
3	坝区施工营地 construction camps	A3	3561789.83	920771.95			T6	3552002.24	920439.37
		B3	3561877.56	920820.50			U6	3552074.92	920286.00
		C3	3561822.70	920904.43	7	砂料场 gravel quarry	A7	3551812.10	920853.95
		D3	3561734.97	920855.88			B7	3551861.71	920910.59
4	2#施工支洞 2# construction drift	A4	3558771.98	921442.31			C7	3551805.08	920960.20
		B4	3558805.18	921450.12			D7	3551740.75	920916.45
		C4	3558872.14	921580.76	8	水厂 water supply station	A8	3552292.42	922293.53
		D4	3558907.08	921585.73			B8	3552315.29	922347.23
							C8	3552247.39	922405.47
							D8	3552211.21	922371.53
					9	业主营地 owner's camps	A9	3553474.95	923670.95
							B9	3553597.05	923758.09
							C9	3553527.76	923830.19
							D9	3553405.66	923743.05
					10	其培河口料场 Chipwi embouc-hure quarry	A10	3556738.06	928086.80
							B10	3556840.19	928303.19
							C10	3556880.84	928686.68
							D10	3556799.33	928724.74
							E10	3556515.78	928406.71
							F10	3556442.03	928185.47

比例 (SCALE)： 0 500 1000 1500m

说明:

1. 图中尺寸单位除注明外,高程及桩号以m计,其余以cm计。
2. 施工征地具体位置现场查勘后确定。

NOTES:

1. Elevation and milestone are in meter, others are in centimeter, excluding noted.
2. The final temporary construction location should decided by locale survey.

Appendix I

Baseline Study of Physical Environment for Chipwi Nge HPP

TABLE OF CONTENTS

List of the Table

List of the Figure

BASELINE STUDY FOR PHYSICAL ENVIRONMENT

1. Outline

The summary of physical environmental survey is shown in Table 1, and sampling points for environmental survey are shown in Figure 1.

Table 1 Summary of Physical Environmental Survey

Air Quality & Meteorology	Parameter	1) Nitrogen dioxide, 2) CO, 3) particulate Matter PM10, 4) Particulate Matter PM 2.5, 5) Sulphur Dioxide, 6) Relative Humidity, 7) Temperature, 8) Wind Speed, and 9) Wind Direction
	Period	2 points for one time within 24 hours
	Location	Residential & Powerhouse
Noise Level	Parameter	LAeq (A-weighted loudness equivalent)
	Period	One time at 2 location within 24 hours
	Location	Residential & Powerhouse
Surface Water Quality	Parameter	1)Water Depth, 2) Flow rate, 3) Water temperature, 4) Air temperature, 5) pH, 6) Electrical Conductivity, and 7) Dissolved Oxygen
	Period	One time at 4 locations
	Location	River and Stream

Source: Field Survey, August 2016

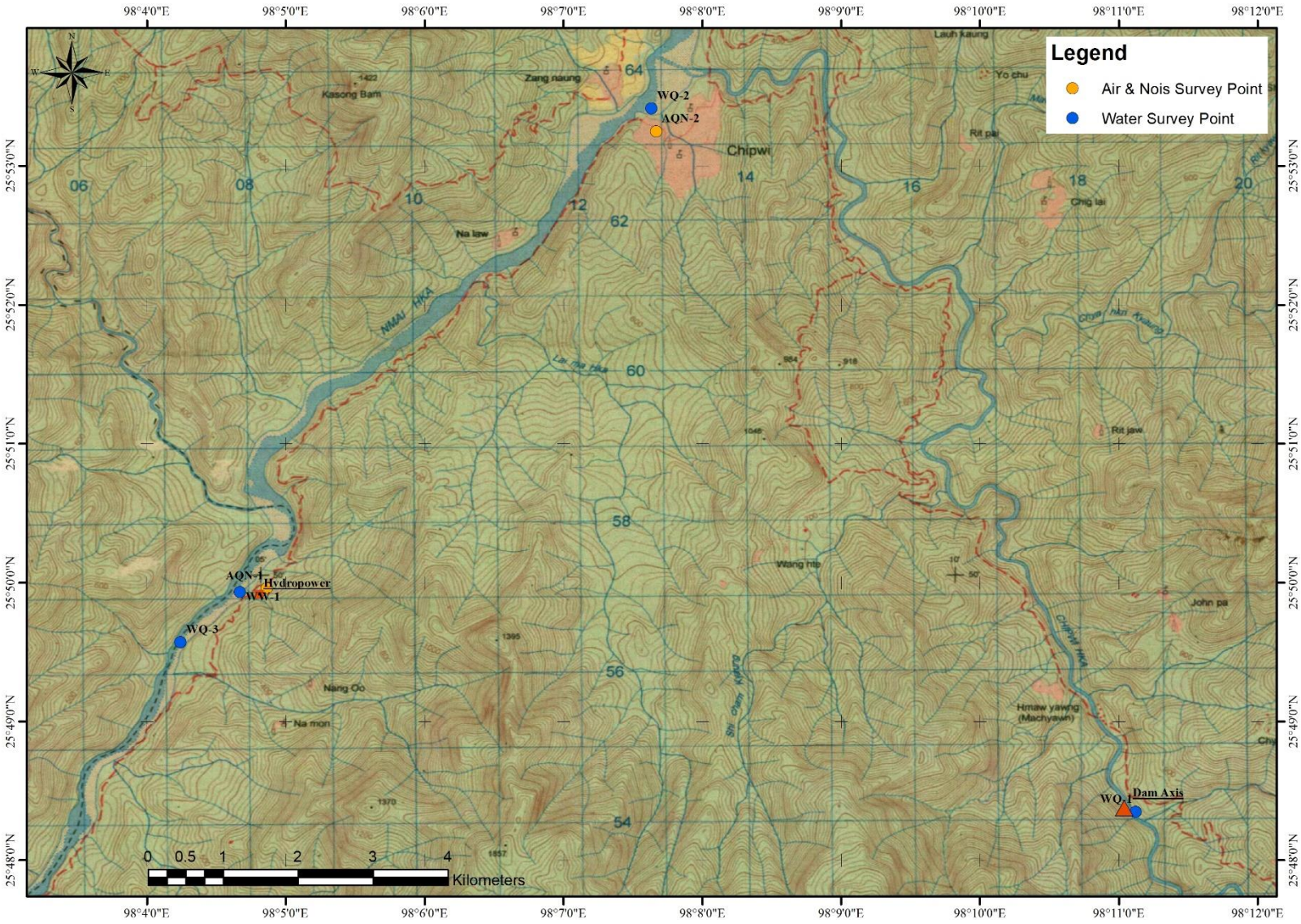


Figure 1 **Location map of water, air and noise quality survey**

2. Air Quality

2.1 Survey Item

Myanmar National Environmental Quality (Emission) Guidelines were announced on 29th December, 2015 and guideline values for air pollution level are shown in Table 2.

Table 2 Myanmar National Environmental Quality Guideline values for survey parameters of air quality

No	Parameter	Averaging Period	Guideline Value	Units
1.	Nitrogen dioxide	1-hour	0.20	mg/m^3
2.	Carbon monoxide	-	-	mg/m^3
3.	Particulate matter PM_{10} [a]	24-hours	0.50	mg/m^3
4.	Particulate matter $PM_{2.5}$ [b]	24-hours	0.25	mg/m^3
5.	Sulphur dioxide	24-hour	0.02	mg/m^3
6.	Temperature	-	-	°C
7.	Relative Humidity	-	-	%

Remark: PM_{10} [a] = Particulate matter 10 micrometers or less in diameter

$PM_{2.5}$ [b] = Particulate matter 2.5 micrometers or less in diameter

2.2 Survey Location

The locations of air quality monitoring survey in detail are shown in Figure 2. The detail of sampling points are described as Table 3.

Table 3 Sampling location for air quality survey

Sampling Points	Coordination	Description of Sampling Point
AQN-1	25° 49' 57.40" N 98° 04' 51.81" E	About 100 m northeast of Powerhouse, Chipwi Hydroelectricity project site, Chipwi Town, Kachin State
AQN-2	25° 53' 14.81" N 98° 07' 39.94" E	Within the compound of the public hospital, Chipwi Town, Kachin State

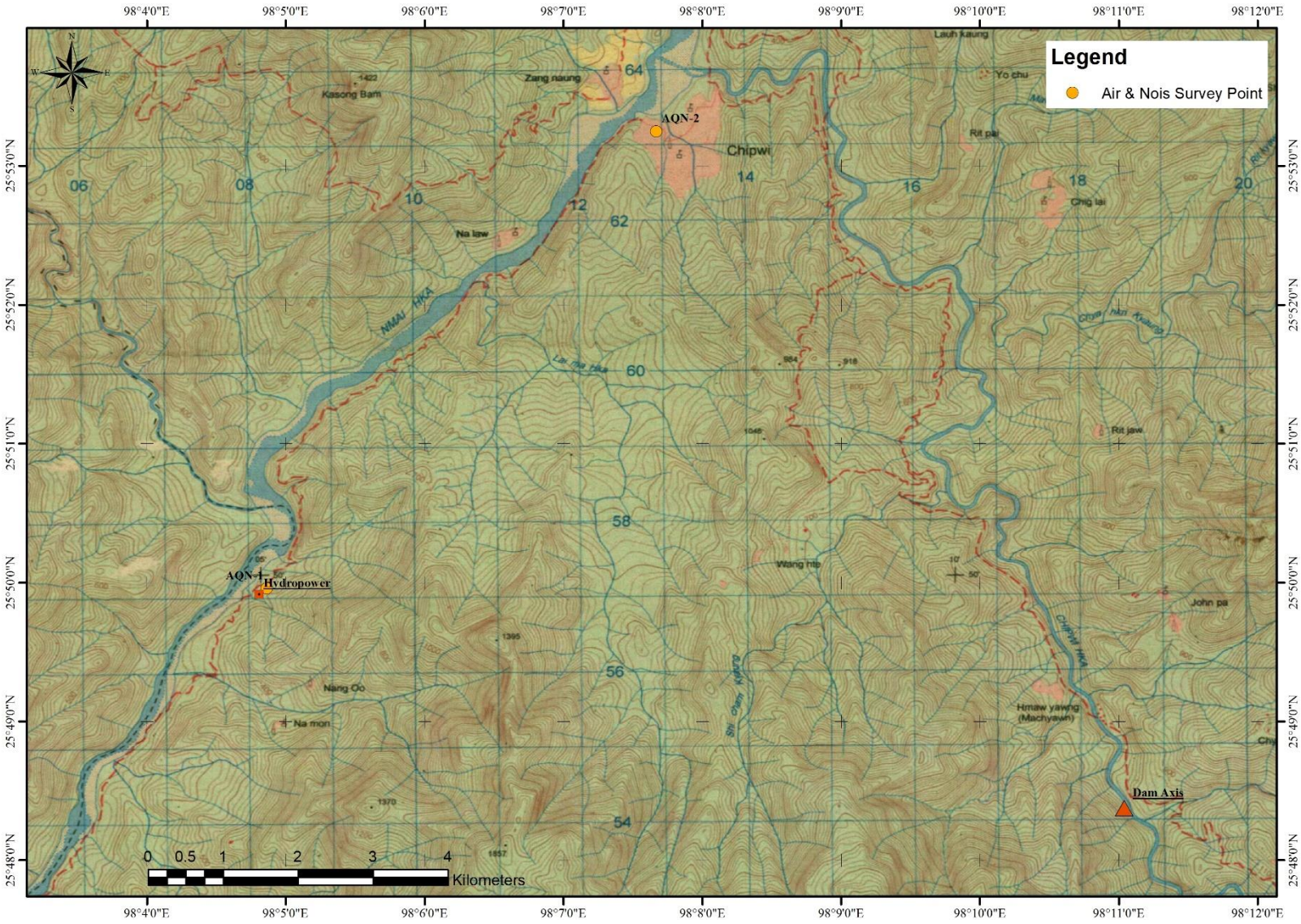


Figure 2 Location map of air and noise quality survey

AQN-1

AQN-1 was monitored in front the store room, about 100m southwest of Chipwi hydropower house. It is located about 300m east of Maykha River and 140m far from the staff housing. Myitkyina- Chipwi communication road which is located in front of that compound and far about 147m from monitoring points. The possible emitted sources are from Industrial activities and various kinds of vehicles. Topographically, the surrounding area is highly terrain and dense vegetation. The ambient noise may be come from the running of the powerhouse. The field activities of AQN-1 is shown in Figure 3.

Figure 3 Air quality monitoring survey at AQN-1

AQN-2

This station was installed within the compound of Chipwi Public Hospital, Chipwi Township. AQN-2 is surrounded by the residential houses of Oukket quarter and 30 m far from main building of Chipwi Public Hospital. The possible emitted sources are from human activities and various kinds of vehicles nearby. The field activities of survey points is shown in Figure 4.

Figure 4 Air quality monitoring survey at AQN-2

2.3 Survey Period

Air quality survey was conducted for 24 hours consecutively for baseline data. The sampling durations are as shown in Table 4.

Table 4 Sampling Duration for Air Quality Survey

Point	Period
AQN-1	August 10th – 11th, 2016 (24 hours)
AQN-2	August 11th – 12th, 2016 (24 hours)

2.4 Survey Method

Methodology

Sampling and analysis of ambient air pollutants were conducted by referring to the recommendation of United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner EPAS Wireless Environmental Perimeter Air Station was used to collect Ambient Air Monitoring data. The characteristics of the instrument are

- Portable direct reading and logging
- Configure up to 14 simultaneous air measurements including U.S. EPA criteria air pollutants
- Standard configuration measures PM2.5, PM10 or TSP particulates, CO, NO, NO2, SO2, temperature, and relative humidity
- Wind parameters are also measured by Haz-scanner EPAS and the required data are analysed by using the WRPLOT View of AERMOD View (ver.7.0) in which calm wind is defined below 0.5 m/s.

Table 5 Sampling and Analysis Method for Air Quality

No.	Parameter	Analysis Method
1	Nitrogen dioxide (NO2)	On site reading
2	Carbon monoxide (CO)	On site reading
3	Particulate matter 10 (PM10)	On site reading
4	Particulate matter 2.5 (PM2.5)	On site reading
5	Sulphur dioxide (SO2)	On site reading
6	Temperature	On site reading
7	Relative Humidity	On site reading
8	Wind Speed	On site reading
9	Wind Direction	On site reading

2.5 Survey Result

a) Ambient Air Quality

AQN-1

Average value of ambient gaseous levels at AQN-1 for one day is presented in following Table 6. It is obvious that the concentrations of most gaseous and particulate levels are lower than the standard whereas SO_2 concentration is fairly higher than the applied standard. Generally, it indicated the area had few emission sources and it was certainly to say the measured data were baseline level in the area.

Table 6 Ambient air quality results at AQN-1

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**hours**	**mg/m3**	**mg/m3**	**mg/m3**	**mg/m3**	**mg/m3**	**%**	**mg/m3**	**Deg. C**
10-11 August, 2016	24	0.230	0.041	0.006	0.012	0.014	58.50	0.031	33.085
Myanmar emission guideline value		-	-	-	0.25	0.5	-	0.02	-

AQN-2

It is obvious that the concentrations of most gaseous and particulate levels are lower than the standard whereas SO_2 concentration is fairly higher than the applied standard. Generally, it indicated the area had few emission sources and it was certainly to say the measured data were baseline level in the area as shown in Table 7.

Table 7 Ambient air quality results at AQN-2

Date	**Time**	**CO**	**NO2**	**NO**	**PM2.5**	**PM10**	**RH**	**SO2**	**TmpC**
D.M.Y	**hours**	**mg/m3**	**mg/m3**	**mg/m3**	**mg/m3**	**mg/m3**	**%**	**mg/m3**	**Deg. C**
11-12 August, 2016	24	0.318	0.068	0.030	0.024	0.027	61.056	0.036	34.618
Myanmar emission guideline value		-	-	-	0.25	0.5	-	0.02	-

b) Wind Speed and Wind Direction

The average wind speed and direction were collected for 24 hours continuous over a seven-day period. According to the wind rose diagram, average wind speed and prevailing wind direction of each sampling points are summarized as follow. Wind speed and direction diagram of each stations are shown in Figure 5 and 6.

Sampling Point	Average Speed (m/s)	Prevailing direction (blowing from)	Calm wind (%)
AQN-1	0.32	N	62.50
AQN-2	0.05	N	70.83

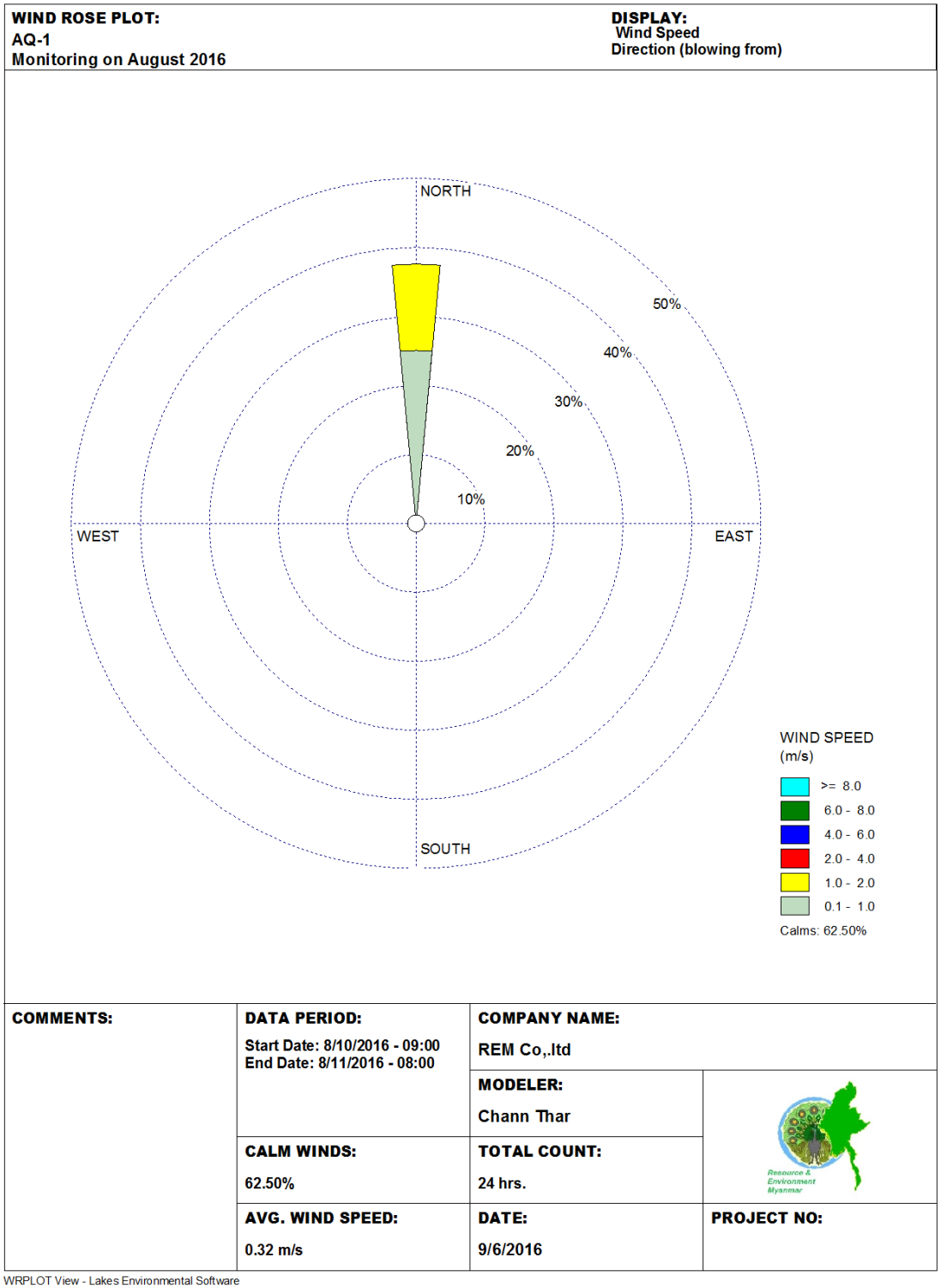


Figure 5 Wind speed and direction diagram at AQN-1

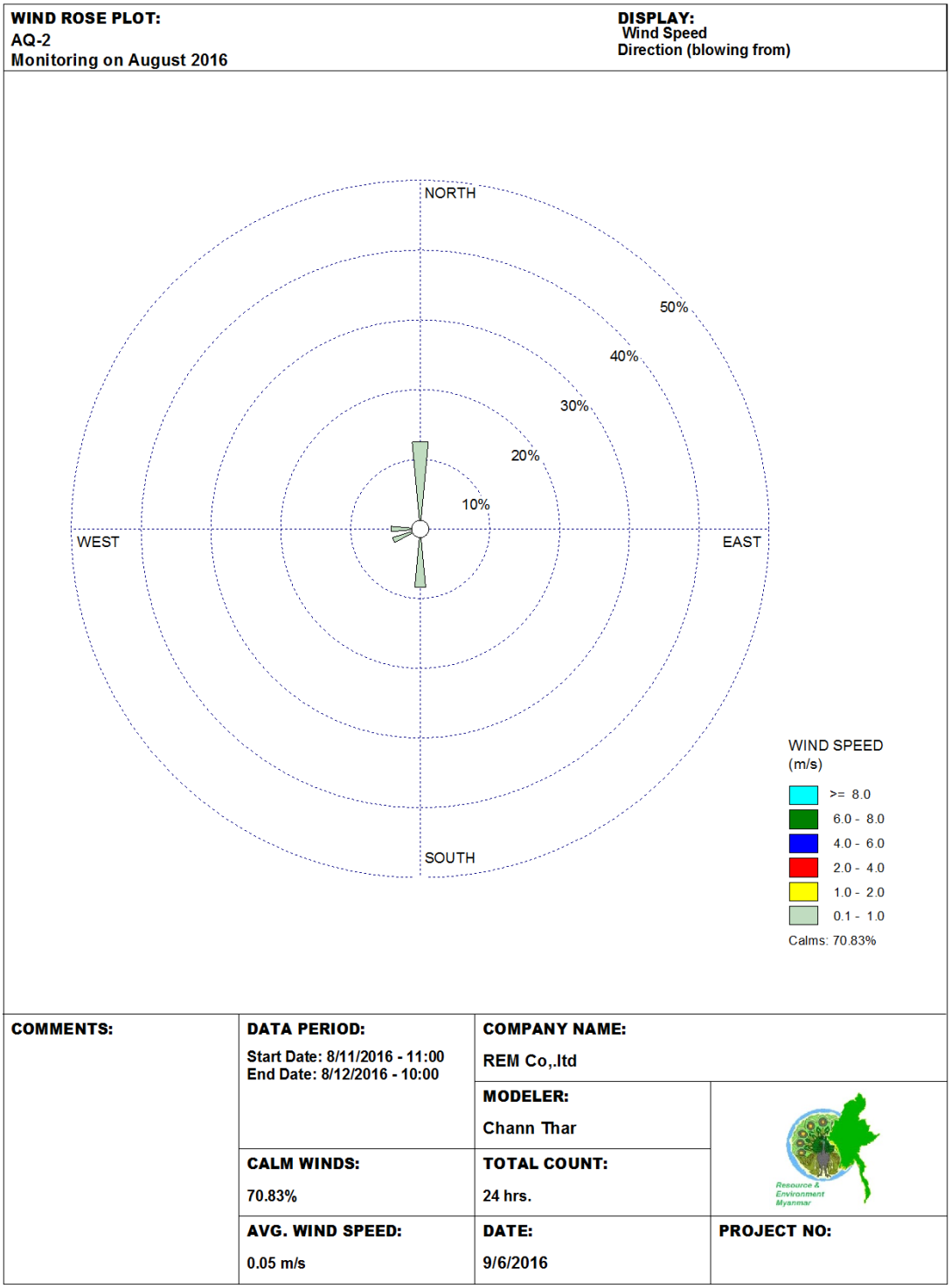


Figure 6 Wind speed and direction diagram at AQN-2

3. Noise Level

3.1 Survey Item

Myanmar National Environmental Quality (Emission) Guidelines were announced on 29th December, 2015 and guideline value for noise level is as shown in Table 8.

Table 8 Myanmar National Environmental Quality (Emission) Guideline of Noise Level

No.	Parameter	Unit	Environmental Standard (Myanmar)		
			Category	Day time 7:00-22:00	Night time 22:00-7:00
1	A-weighted loudness equivalent (L_{Aeq})	dB	Residential, educational, institutional	55	45
			Industrial, commercial	70	70

Source: National Environmental Quality (Emission) Guidelines, 2015
Remark: a LAeq = Equivalent continuous sound level in decibels

3.2 Survey Location

The locations of noise quality monitoring points are as same as the air quality monitoring survey.

3.3 Survey Period

Noise level survey was conducted on 72 hours consecutively. The measurement duration was as shown in Table 9.

Table 9 Sampling Duration for Noise Level Survey

Point	Period
AQN-1	August 10th – 11th, 2016 (24 hours)
AQN-2	August 11th – 12th, 2016 (24 hours)

3.4 Survey Method

Measurement of environmental sound level was conducted by referring to the recommendation of International Organization for Standardization (ISO), i.e. ISO 1996-1:2003 and ISO 1996-2:2007. The instrumentation used for noise quality survey is shown in the following Table 10.

Noise meter was set up to record the log as ten minutes intervals during an hour for one consecutive day.

Table 10 Instrumentation for Noise Survey

Instrumentation	Description
Sound level meter	Sound level meter with SD Card, Model SL-4023SD

Source: Sustainable Environment Myanmar Co., Ltd.

Figure 7 Lutron sound level meter

3.5 Survey Result

Noise levels (L_{Aeq}) of the monitoring points were presented in Table 11. One day L_{Aeq} was calculated by using the following array formula in the excel sheet. This formula is firstly used for hourly L_{Aeq} and then for the 24 hours L_{Aeq}.

10*LOG10(AVERGAE(10^((RANGE)/10)))

As the monitoring is conducted for the industrial areas, the results are compared with "Industrial, Commercial" environment.

By means of the calculated results, day time and night time L_{eq} at all sampling points are lower than the environmental standard for each categorized environment.

Table 11 A-weighted loudness Equivalent (LAeq) Level

Unit: dBA

Sampling Point	**AQN-1** **10th – 11th August, 2016**		**AQN-2** **11th – 12th August, 2016**	
Date/Time	Day time (7:00 AM- 10:00 PM)	Night time (10:00 PM – 7:00 AM)	Day time (7:00 AM- 10:00 PM)	Night time (10:00 PM – 7:00 AM)
Result	50	52	53	57

Environmental standard (Myanmar)	70	70	55	45

Table 12 Hourly LAeq value in noise monitoring stations (AQN-1 & AQN-2)

Unit: dBA

Time	AQN-1 10th – 11th August, 2016	AQN-2 11th – 12th August, 2016
7:00-8:00	50	63
8:00-9:00	48	66
9:00-10:00	52	66
10:00-11:00	51	49
11:00-12:00	49	41
12:00-13:00	46	50
13:00-14:00	44	35
14:00-15:00	48	49
15:00-16:00	45	37
16:00-17:00	47	56
17:00-18:00	47	51
18:00-19:00	52	57
19:00-20:00	55	65
20:00-21:00	56	52
21:00-22:00	59	53
Day L_{Aeq}	50	53
22:00-23:00	53	51
23:00-24:00	55	52
24:00-01:00	53	51
01:00-02:00	53	51
02:00-03:00	51	56
03:00-04:00	51	52
04:00-05:00	51	70
05:00-06:00	51	71
06:00-07:00	51	61
Night L_{Aeq}	52	57

4. Water Quality

4.1 Survey Item

Parameters for water quality survey are determined so as to cover the parameters of existing environmental standards of Myanmar.

Table 13 Survey Parameters for Water Quality Survey

No.	Item/Sample Name	Unit	Standard*
1	Temperature	ºC	-
2	pH	-	6 - 9
3	ORP	mV	-
4	DO	mg/l	-
5	EC	µs/cm	-
6	TDS	ppm	-
7	Salinity	psu	-
8	Turbidity	FNU	-
9	Total suspended solid	mg/l	50
10	BOD	mg/l	50
11	COD	mg/l	250
12	Chlorine	mg/l	0.2
13	Selenium	mg/l)	0.1
14	Fluoride	mg/l	20
15	Sulfide	mg/l)	1
16	Total Coliform	MPN/100ml	400
17	Ammonia	mg/l	10
18	Cyanide	mg/l	1
19	Phenols	mg/l	0.5
20	Oil and grease	mg/l	10
21	Arsenic	mg/l	0.1
22	Mercury	mg/l	0.01
23	Zinc	mg/l	2
24	Cadmium	mg/l	0.1
25	Copper	mg/l	0.5
26	Chromium (Hexavalent)	mg/l	0.1
27	Lead	mg/l	0.1
28	Nickel	mg/l	0.5
29	Silver	mg/l	05
30	Chromium (Total)	mg/l	0.5
31	Iron	mg/l	3.5
32	Total Phosphorus	mg/l	2

'*' - General guideline value for wastewater or effluent, Myanmar National Environmental Quality (Emission) Guideline (2015)

4.2 Survey Locations

The locations of water samples and surveys are shown in Table 14 and Figure 8. The detail of each sampling points are described as below.

Table 14 Sampling and survey points of surface water quality survey

No.	Station	Type	Coordinate	Location description
1.	WW-1	Waste Water	25°49'55.86"N 98° 04'40.24"E	About 200m west of powerhouse, near Maykha River, Chipwi Township, Kachin state.
2.	WQ-1	Surface Water	25°48'20.91"N 98°11'7.23"E	Chipwi Nge Dam Site, Chipwi River, Chipwi Township, Kachin state.
3.	WQ-2	Surface Water	25°53'24.69"N 98° 7'37.87"E	Upstream of Maykha river, Chipwi Township, Kachin state.
4.	WQ-3	Surface Water	25°49'34.18"N 98° 04'14.49"E	Downstream of Maykha river, Chipwa Township, Kachin state.

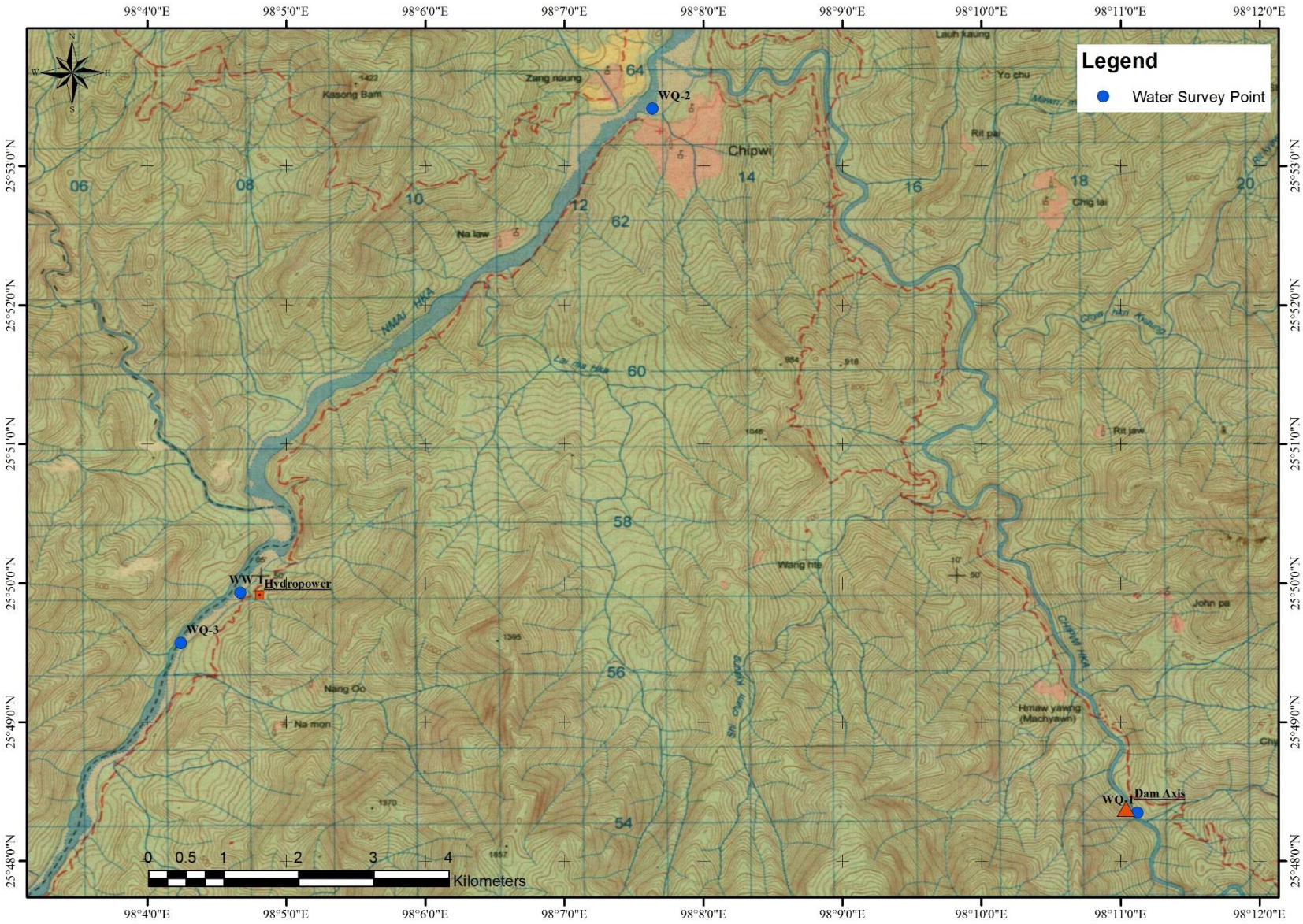


Figure 8 Location map of surface water quality survey

WW-1

WW-1 was collected from waste water creek of powerhouse, where water is draining from spillway of powerhouse. It is located about 200m west of powerhouse. The creek is generally flowing east- west in direction and then entering into May Kha River. The transparency of water is moderate. The width of the creek at WW-1 is about 4 m. The location and field activities of WW-1 are shown in Figure 9.

Figure 9 Surface water sampling at WW-1

WQ-1

WQ-1 was collected at the upstream of Chipwi Nge dam area, where Chipwi River is generally flowing from southeast to northwest. It is located near the northern bank of dam. The transparency of the river water is moderate. Surrounding is the mountainous region. The location of survey point is shown in Figure 10.

Figure 10 Surface water sampling at WQ-1

WQ-2

WQ-2 was collected at the upstream of Maykha River, which is flowing from north to south. It is located at northeast of Chipwi Town. The width of MayKha River near WQ-2 is about 200 m and the transparency is moderate. River water are mainly used for transportation and plantation. Surrounding are the Chipwi Town, some farm land and plantation.

Figure 11 Surface water sampling at WQ-2

WQ-3

WQ-3 was collected at the downstream of Maykha River, near Chipwi Nge Power Plant. This is located about 1.3 km southwest of power plant. The width of MayKha River near WQ-3 is about 130 m and the transparency is low. River water are mainly used for transportation and plantation. Surrounding are the some farm land and mountainous area.

Figure 12 Surface water sampling at WQ-3

4.3 Survey Period

The sampling and measuring of the surface water were conducted on 10th, 11th and 14th, 2016.

4.4 Survey Method

Water samples were taken by Alpha horizontal water sampler and collected in plastic and sterilized glass sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters as pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), and total dissolved solid including the odor and color in visual analyzing were measured at each site concurrently with sample collection and. According to the Laboratory standard, some samples were preserved using the chemicals. All samples were kept in iced boxes and were transported to the laboratory within 24 hours.

Moreover, the river survey; the flow rate, width and depth of river, was also measured using Vale port Flow Meter equipment and depth sounder.

Table 15 Field Equipment for surface water quality survey

No.	Equipment	Manufacturer	Originate Country	Model/Serial No.
1	SMART TROLL@ MP _Multi parameter for water	In_Situ Inc.	USA	SN - 346054
2	Multi Parameters for water quality	HANNA	USA	H17609823 (Turbidity Sensor)
3	Alpha Bottle (Water Sampler)	Wildlife Supply Company®	Indonesia	Wildco P/N-1120-G45

Table 16 Container and preservation method for water samples

No.	Parameter	Container	Preservation
1	BOD, COD	1000 ml glass bottle	Refrigerate
2	Oil and Grease	1000 ml glass bottle	Sulfuric acid, Refrigerate
3	Suspended solid	1000 ml plastic bottle	Refrigerate
4	Heavy metals	2000 ml plastic bottle	Refrigerate
5	Coliform	1000 ml glass bottle	Refrigerate
6	Other	2000 ml plastic bottle	Refrigerate

Source: Resource and Environment Myanmar co., Ltd

The following table provides the test method for water quality.

Table 17 Analysis Method for Water Samples

No.	Item	Analysis method	Water Quality
			WW-1, WQ-1, WQ-2, WQ-3
1	Temperature	SmarTROLL Sensor	✔
2	pH	SmarTROLL Sensor	✔
3	Oxidation-Reduction Potential (ORP)	SmarTROLL Sensor	✔
4	Dissolved Oxygen (DO)	SmarTROLL Sensor	✔
5	Electrical Conductivity (EC)	SmarTROLL Sensor	✔
6	Total Dissolved Solid (TDS)	SmarTROLL Sensor	✔
7	Salinity	SmarTROLL Sensor	✔
8	Turbidity	HI7609829-4 Sensor	✔
9	Suspended Solids	APHA-AWWA-WEF Method	✔
10	BOD	APHA-AWWA-WEF Method	✓

No.	Item	Analysis method	Water Quality
			WW-1, WQ-1, WQ-2, WQ-3
11	COD	APHA-AWWA-WEF Method	✓
12	Chlorine	APHA-AWWA-WEF Method	✓
13	Selenium	APHA-AWWA-WEF Method	✓
14	Fluoride	APHA-AWWA-WEF Method	✓
15	Sulfide	APHA-AWWA-WEF Method	✓
16	Total Coliform	APHA-AWWA-WEF Method	✓
17	Ammonia	K.Jeldahl and Calculation Method	✓
18	Cyanide	Distillation Method	✓
19	Phenols	Distillation Method	✓
20	Oil and grease	Partition-Gravimetric Method	✓
21	Arsenic	AAS Method	✓
22	Mercury	AAS Method	✓
23	Zinc	In-House Method	✓
24	Cadmium	In-House Method	✓
25	Copper	In-House Method	✓
26	Chromium (Hexavalent)	Colourimetric Method	✓
27	Lead	In-House Method	✓
28	Nickel	In-House Method	✓
29	Silver	ICP Method	✓
30	Chromium	In-House Method	✓
31	Iron	In-House Method	✓
32	Total Phosphorus	AAS Method	✓

4.5 Survey Result

Laboratories

Water samples were sent to the ISO Tech Lab, Agricultural Department and SGS Myanmar.

Water quality results are shown in the following table.

Water quality results are shown in following Table 18.

Table 18 In-Situ Measurement and laboratory analysis of Surface Water Quality

No.	Item/Sample Name	WW-1	WQ-1	WQ-2	WQ-3	Standard*
1	Temperature (c)	21.6	21	22.2	21	-
2	pH	8.73	7.6	7.6	7.8	6 - 9
3	ORP (mV)	419.8	576.7	534.5	464.9	-
4	DO (mg/l)	8.44	7.12	9.2	9.2	-
5	EC (µs/cm)	13	23.3	36	43.3	-
6	TDS (ppm)	15.4	15.1	28.8	28.1	-
7	Salinity (psu)	0	0	0	0	-
8	Turbidity (FNU)	45.5	18.6	60.3	59.1	-
9	Total suspended solid (mg/l)	35	16	70	59	50
10	BOD (mg/l)	2	0.9	0.3	0.5	50
11	COD (mg/l)	10	<10	<10	<10	250
12	Chlorine (mg/l)	0.05	0.04	0.01	<0.01	0.2
13	Selenium (mg/l)	<0.01	<0.01	<0.01	<0.01	0.1
14	Fluoride (mg/l)	0.12	0.13	0.12	0.12	20
15	Sulfide (mg/l)	<0.01	<0.01	<0.01	<0.01	1
16	Total Coliform (MPN/100ml)	11	11	400	22	400
17	Ammonia (mg/l)	ND	0.55	1.02	0.34	10
18	Cyanide (mg/l)	ND	ND	ND	ND	1
19	Phenols (mg/l)	ND	ND	0.025	0.01	0.5
20	Oil and grease (mg/l)	ND	ND	ND	ND	10
21	Arsenic (mg/l)	0.0006	ND	0.001	0.0012	0.1
22	Mercury (mg/l)	ND	ND	ND	ND	0.01
23	Zinc (mg/l)	ND	ND	<LOQ	ND	2
24	Cadmium (mg/l)	ND	ND	ND	ND	0.1
25	Copper (mg/l)	ND	ND	<LOQ	<LOQ	0.5
26	Chromium (Hexavalent) (mg/l)	ND	ND	ND	ND	0.1
27	Lead (mg/l)	ND	ND	ND	ND	0.1
28	Nickel (mg/l)	ND	ND	ND	ND	0.5
29	Silver (mg/l)	ND	ND	ND	0.003	05
30	Chromium (Total) (mg/l)	ND	ND	ND	ND	0.5
31	Iron (mg/l)	1.16	0.490	1.40	2.24	3.5
32	Total Phosphorus (mg/l)	0.06	0.02	0.04	0.01	2

'*' - General guideline value for wastewater or effluent, Myanmar National Environmental Quality (Emission) Guideline (2015)

Appendix

Hourly Air Quality Results

AQN-1 (hourly results)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	%	mg/m3	Deg. C
10.8.2016	09:00-10:00	0.011	0.025	0.000	0.021	0.021	53.80	0.004	33.93
10.8.2016	10:00-11:00	0.012	0.061	0.000	0.010	0.007	50.20	0.026	34.95
10.8.2016	11:00-12:00	0.024	0.041	0.000	0.011	0.025	50.53	0.011	34.33
10.8.2016	12:00-13:00	0.037	0.005	0.002	0.002	0.001	42.52	0.060	39.70
10.8.2016	13:00-14:00	0.045	0.007	0.061	0.002	0.004	39.58	0.080	42.10
10.8.2016	14:00-15:00	0.070	0.004	0.008	0.015	0.020	41.13	0.028	40.05
10.8.2016	15:00-16:00	0.245	0.004	0.000	0.002	0.004	40.63	0.041	41.55
10.8.2016	16:00-17:00	0.547	0.004	0.000	0.003	0.010	40.03	0.072	43.22
10.8.2016	17:00-18:00	0.863	0.004	0.000	0.015	0.017	44.02	0.084	42.08
10.8.2016	18:00-19:00	0.486	0.004	0.000	0.021	0.026	52.43	0.040	36.48
10.8.2016	19:00-20:00	0.292	0.012	0.000	0.023	0.031	59.73	0.015	32.57
10.8.2016	20:00-21:00	0.685	0.025	0.000	0.017	0.018	63.68	0.098	30.67
10.8.2016	21:00-22:00	0.194	0.068	0.000	0.021	0.020	66.40	0.010	29.53
10.8.2016	22:00-23:00	0.176	0.073	0.000	0.022	0.020	67.90	0.012	28.50
10.8.2016	23:00-00:00	0.290	0.092	0.000	0.018	0.014	66.65	0.019	28.95
11.8.2016	00:00-01:00	0.192	0.105	0.000	0.016	0.012	70.98	0.013	27.82
11.8.2016	01:00-02:00	0.213	0.082	0.000	0.013	0.009	69.25	0.015	27.95
11.8.2016	02:00-03:00	0.185	0.068	0.000	0.012	0.011	73.03	0.010	26.92
11.8.2016	03:00-04:00	0.159	0.086	0.000	0.009	0.013	73.57	0.018	26.73
11.8.2016	04:00-05:00	0.161	0.066	0.000	0.011	0.015	72.18	0.016	27.27
11.8.2016	05:00-06:00	0.161	0.055	0.000	0.012	0.014	74.08	0.010	26.57
11.8.2016	06:00-07:00	0.170	0.055	0.001	0.012	0.010	73.58	0.007	27.03
11.8.2016	07:00-08:00	0.150	0.024	0.037	0.003	0.002	65.40	0.019	30.02
11.8.2016	08:00-09:00	0.146	0.008	0.028	0.004	0.006	52.67	0.036	35.13
MAX	24hours	0.863	0.105	0.061	0.023	0.031	74.08	0.098	43.22
MIN	24hours	0.011	0.004	0.000	0.002	0.001	39.58	0.004	26.57
Average	**24hours**	**0.230**	**0.041**	**0.006**	**0.012**	**0.014**	**58.50**	**0.031**	**33.09**

AQN-2 (hourly results)

Date	Time	CO	NO2	NO	PM2.5	PM10	RH	SO2	TmpC
D.M.Y	H.M.S	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	%	mg/m3	Deg. C
11.8.2016	11:00-12:00	0.014	0.004	0.000	0.010	0.012	29.60	0.012	51.17
11.8.2016	12:00-13:00	0.021	0.006	0.000	0.004	0.006	32.95	0.003	46.60
11.8.2016	13:00-14:00	0.024	0.007	0.000	0.002	0.005	33.25	0.011	46.77
11.8.2016	14:00-15:00	0.130	0.007	0.000	0.027	0.032	38.17	0.070	44.11
11.8.2016	15:00-16:00	0.458	0.021	0.000	0.005	0.011	40.95	0.061	42.43
11.8.2016	16:00-17:00	0.354	0.056	0.000	0.032	0.037	44.68	0.037	39.67
11.8.2016	17:00-18:00	0.272	0.072	0.000	0.045	0.036	49.78	0.028	36.88
11.8.2016	18:00-19:00	0.304	0.062	0.000	0.038	0.033	57.12	0.022	33.27
11.8.2016	19:00-20:00	0.320	0.056	0.001	0.034	0.032	60.48	0.014	31.80
11.8.2016	20:00-21:00	0.550	0.060	0.036	0.026	0.019	63.27	0.068	31.00
11.8.2016	21:00-22:00	0.316	0.059	0.001	0.036	0.033	67.72	0.025	29.90
11.8.2016	22:00-23:00	0.277	0.104	0.000	0.027	0.022	74.42	0.011	28.25
11.8.2016	23:00-00:00	0.240	0.095	0.009	0.012	0.012	72.55	0.004	28.77
12.8.2016	00:00-01:00	0.200	0.071	0.012	0.014	0.018	73.50	0.006	28.53
12.8.2016	01:00-02:00	0.174	0.074	0.015	0.022	0.022	74.60	0.010	28.23
12.8.2016	02:00-03:00	0.159	0.080	0.000	0.031	0.036	80.50	0.008	26.40
12.8.2016	03:00-04:00	0.135	0.067	0.000	0.019	0.021	80.70	0.005	26.00
12.8.2016	04:00-05:00	0.209	0.179	0.000	0.020	0.020	83.48	0.007	25.35
12.8.2016	05:00-06:00	1.210	0.226	0.000	0.028	0.025	90.65	0.234	24.08
12.8.2016	06:00-07:00	0.644	0.128	0.000	0.129	0.121	99.18	0.148	24.32
12.8.2016	07:00-08:00	0.451	0.056	0.016	0.045	0.038	85.10	0.019	27.75
12.8.2016	08:00-09:00	0.314	0.071	0.107	0.007	0.004	57.03	0.009	34.90
12.8.2016	09:00-10:00	0.383	0.070	0.146	0.006	0.002	42.00	0.017	43.68
12.8.2016	10:00-11:00	0.469	0.005	0.379	0.002	0.003	33.65	0.043	50.97
MAX	24hours	1.210	0.226	0.379	0.129	0.121	99.18	0.234	51.17
MIN	24hours	0.014	0.004	0.000	0.002	0.002	29.60	0.003	24.08
Average	**24hours**	**0.318**	**0.068**	**0.030**	**0.026**	**0.025**	**61.06**	**0.036**	**34.62**

SGS

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Analysis Report

PROJECT NAME : Environmental Monitoring for Chipwi Hydropower
SAMPLE DESIGNATED AS : Wastewater Quality **SAMPLING DATE** : August 10, 2016
SAMPLING LOCATION : Chipwi Township **SAMPLING BY** : Client

Parameters	Units	LOQ	WW-1
Biochemical Oxygen Demand (BOD)	mg/l	-	2
Chemical Oxygen Demand (COD)	mg/l	-	10
Total Suspended Solids (SS)	mg/l	-	35
Free Chlorine (Cl_2)	mg/l	0.01	0.05
Selenium (Se)	mg/l	0.01	<0.01
Fluoride (F)*	mg/l	0.05	0.12
Sulfide (S)	mg/l	0.01	<0.01
Total Coliform Bacteria*	MPN/100mL	1.8	11

Remarks : - Analysis Methods follow the Standard Methods for the Examination of Water and Wastewater endorsed by American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF)
- LOQ = Limit of Quantitation
* Analysis(s) is/are not included in scope of Accreditation by Department of Industrial Works of Thailand.

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Environmental Monitoring Manager
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(Thepson Yommana)
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Analysis Report

PROJECT NAME : Environmental Monitoring for Chipwi Hydropower Project
SAMPLE DESIGNATED AS : Surface Water Quality
SAMPLING LOCATION : Chipwi Township **SAMPLING BY:** Client

Parameters	Units	LOQ	Results		
			WQ-1	WQ-2	WQ-3
Sampling Date	-	-	August 11, 2016	August 14, 2016	August 11, 2016
Biochemical Oxygen Demand (BOD)	mg/l	-	0.9	0.3	0.5
Chemical Oxygen Demand (COD)	mg/l	-	<10	<10	<10
Total Suspended Solids (SS)	mg/l	-	16	70	59
Free Chlorine (Cl_2)	mg/l	0.01	0.04	0.01	<0.01
Selenium (Se)	mg/l	0.01	<0.01	<0.01	<0.01
Fluoride (F)	mg/l	0.05	0.13	0.12	0.12
Sulfide (S)	mg/l	0.01	<0.01	<0.01	<0.01
Total Coliform Bacteria	MPN/100mL	1.8	11	400	22

Remarks : - Analysis Methods follow the Standard Methods for the Examination of Water and Wastewater endorsed by American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF)
- LOQ = Limit of Quantitation

(Siriporn Imwilaiwan)
Environmental Monitoring Manager

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Appendix II

Baseline Study of Ecological Environment for Chipwi Nge HPP

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Terrestrial Ecology and Wildlife

1. Introduction

An ecological assessment is part of an EIA study for a designated project which may have an impact on the natural environment including existing flora, fauna and wildlife habitats. The term "ecology" includes both marine and terrestrial ecology. The main objective of ecological assessment is to provide sufficient and accurate ecological data to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts. The methodology used may vary from case to case depending on the natural environment to be affected and the nature and scale of the project.

1.2 Study Area

Ayeyawady River basin is situated at north latitude 15°30'~ 28°50' and east longitude 93°16'~ 98°42', and originates from the southwest foot of Boshula Mountains in Zayu County Tibet China. It is named Jitaiqu in Tibet and Dulong River in Yunnan. It is called as Nmaihka River after flowing into Myanmar from Maku, Gongshan County Yunnan Province and only called as Ayeyawady River after converging with Malikha River in Myitsone Town around 45km above Myitkyina. Nmaihka River, 353km long in total, is the main source of Ayeyawady River, with the catchment area around 24,200km^2 (including 4,200km^2 in China) and the natural head about 1010m. Malikha River originates from the south foot of the Himalayas in the north of Myanmar, has three sources i.e. left, middle and right, 375km long in total, with the catchment area around 23,000km^2 and the natural head about 4470m. Catchment area of the upper reaches of Ayeyawady River is around 47,300km^2 (including 4,200km^2 in China).

Chipwi River is a primary branch on the left bank of Nmaihka River, with the geographic coordinates 98°8′~98°28′EL and 25°30′~25°52′NL, originates from Gaoligong Mountain in China-Myanmar border area, from southeast to northwest and finally flows to Nmaihka River nearby Chipwi Town. Chipwi River has the catchment area 743.6km^2, length 58.0km, fall around 3,000m, gradient 52‰ and average annual flow around 54.0m^3/s.

2. The Scope and Content of Ecological Assessment

An ecological assessment shall consist of 5 parts of equal importance:

1. provision of comprehensive and accurate information on the ecological baseline;
2. identification and prediction of potential ecological impacts;
3. evaluation of the significance of the impacts identified;

4. recommendations of effective and practicable alternatives and mitigation measures; and

5. recommendations of the need for and the scope of an appropriate monitoring and audit programme.

3. Desktop Survey

Publicly available sources of information were analysed to build an outline of known and likely ecological values for the Study Area. Aerial imagery was used to build a more complete spatial understanding of the pattern of vegetation communities and human uses on the site, and to map access routes and internal tracks. The survey was conducted to provide baseline information on the distribution of wildlife and wildlife habitats to determine likely impacts of the project on such fauna and flora and to assess how any such impacts might be mitigated through appropriate interventions. After a review of available literature, a field survey was conducted to collect primary field data concerning all wildlife species including mammals, reptiles, amphibians, birds, fish, benthos and planktons. In addition, ecologists with experience of the Study Area were consulted where possible to obtain information about species known to be present or previously recorded from the site, and other ecological values considered by them to be relevant. Where information in this report is reliant on this information, the source has been acknowledged.

4. Site Reconnaissance

A targeted site reconnaissance was conducted to ground-truth information gathered during the desktop survey stage, and supplements it with site observations, data and photographs. The site reconnaissance targeted the following specific ecological objectives:

• To name, describe and map vegetation communities and habitats present within the Project Area at a suitable scale, using existing community nomenclature where possible;

• To identify, describe and map other ecologically sensitive areas within the Project Area such as springs, watercourses and other water bodies;

• To the extent possible within the survey time frame and season, determine if species of conservation significance known or predicted likely to be present in the Study Area are actually present within the Project Area;

• To ascertain the suitability of habitats, present for flora and fauna species of conservation significance known or predicted likely to be present in the Study Area;

• To identify opportunities for future ecological monitoring and enhancement within the framework of the proposed project.

In addition, where possible local people were consulted about the species known to utilize the Study Area,

and how the Study Area is affected by seasonal variations (e.g. flooding levels, whether water bodies dry up in driest seasons, etc.).

5. Vegetation Communities

Existing vegetations in the area concerned with this project, Bombax ceiba and Dendrocalamus spp. of tropical spare tree-bamboo forest are most widely distributed in the project site. The community belongs to secondary vegetations formed after tropical rainforests are destroyed artificially. It is similar to spare monsoon community with respect to its appearance. Zonal vegetation in the project area belongs to humid rainforest and now is degraded to spare bamboo and banana forest due to man-made interference. Cultivated land is little in this region and only a little has been degraded to shrub; while the riverside shrub is a type of disclimax community and a relatively stable type formed due to influence of periodic fluctuation of the river.

6. Survey Items

Survey items for flora and fauna survey are as follows;

1. Vegetation
2. Inhabitants
3. Important species
4. Biodiversity and Ecosystem

7. Methodology

7.1 Field Observation

(1) Flora

The methodology involved in assessing the forest and vegetation cover was to compile maps and available literature on the land and water resources of the region and in particular the survey area. Based on these maps and literature, the field survey was conducted to collect primary data concerning tree and vegetation species, density and relative frequency for big tree species with diameter at breast height (DBH) of equal or more than 10 centimeters.

The main method used in this survey is similar to that used for the wildlife survey including interviews with villagers, especially senior persons who have experience with the types of vegetation and non-timber forest products in their vicinity. The villagers were questioned on land use as well as lists of vegetation and non-timber forest products (NTFPs).

Systematic data was collected from the temporary sample plots that were set in the form of quadrat system covering the study sites according to land use, geographic conditions and forest types. The sample plots were set in the dominant area or good sample areas located where the dam and power house will be located. Then, the data collected depended on their shapes and size.

(2) Habitat Map

To obtain the habitat map, firstly we designate the 3km buffer zone, there is combination between field observation and secondary image from Google Earth and generate it applying in GIS software. At first, the field observations were performed for habitat survey at site collecting the data with the Garmin GPS and upload it in Map Info Software. On the other hand, the Google image was visually digitized based on the primary field survey. Finally, the habitat map was analyzed based on both of field survey and secondary image data using the Map Info software.

Sources & Tools

- Google Earth Images
- Map Info 11.0 and Discover
- Garmin GPS 62 cx
- Field survey

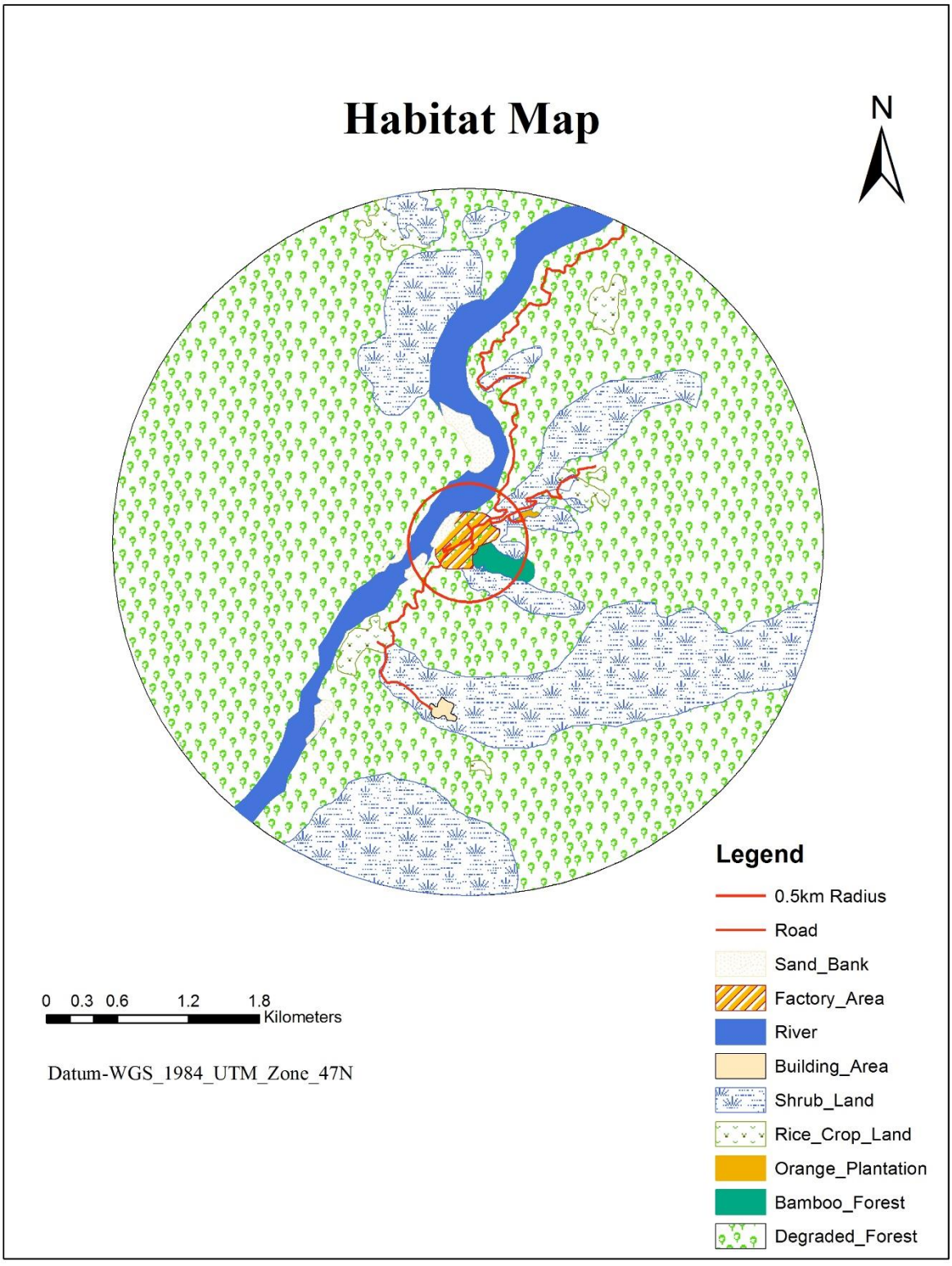


Fig 2: Habitat Map of the Chipwe Hydropower Project

(3) Fauna

Random Point count method was used for the bird survey and took the photograph of birds. Birds were observed with binoculars and identified aided with field guide. Nocturnal birds were observed when it becomes dusk. Point count and opportunistic methods were used to census the species richness and point counting was used to get the relative measure of bird abundance.

Distribution and presence of mammals were examined by conducting track and sign surveys. Sighting of prey species, tracks, scats, droppings were undertaken as data gathering in the field. Voucher specimens of tracks were taken in the forms of plaster casts, photographs or tracings. Questionnaire Survey was conducted and the results of questioning each individual informant were treated as a distinct sample.

The study on reptilian and amphibian species was based on active search and trapping method. Stratification of the habitat was relatively similar to that of mammal study. Reptilian and amphibian species were actively searched during the survey period. The collected specimens were preserved in 10% formalin for further identification in the laboratory.

(4) Aquatic Fauna

Examination of aquatic fauna included distribution of indigenous fish species and their abundance in particular areas of the river. Plankton and benthos, which provide nutrients to young fish, were also examined.

The aim of the survey was mainly to determine the existence of aquatic life in the river. Study results and other relevant data (hydrology, water quality) were used to predict possible changes in aquatic life after project development and its effect on peoples' livelihood.

(i) Fish

Fish were collected using sampling seine net with the size of 430 x 160 cm with 5 mm mesh size. At the site, the seine net was equipped with bamboo pole at each end that was at least equal to the height of the net. Haul seine was operated and fished parallel to the river bank.

Fish samples were preserved in a plastic bottle or a jar containing 10% formalin solution. The bottle was labeled with information such as date of sampling, station code, name of collector and time of collection. The samples were sent to a laboratory for species identification. In the laboratory, fish sampled from each station were identified by using a magnifier, a dissection microscope and classification guidance books.

(ii) Plankton

Plankton sampling from those stations was conducted using plankton net of 50 μm mesh size and a 2-litter beaker. Sampling depth of water was taken at 30 cm below the water surface. Samples were preserved in a

plastic bottle containing 5% formalin solution. Information such as the code of sampling station and date were marked on the bottle. The specimens were sent to a laboratory for species identification as well as their density.

(iii) Benthic

Benthic fauna at each station was sampled using an Ekman dredge. The samples were sieved by using a 1 mm-mesh sieve. Each specimen was preserved in a separate bottle containing 7% formalin solution. Necessary information was labeled on the bottle. They were delivered to a laboratory for specie identification and density assessment.

7.2 Interviewing and literature survey

In addition to the field observation, secondary data was also surveyed by interviewing from local residents and literature reviewing. In the interview survey, the surveyor visited the residents in and around the survey area and interviewed the name of plants and animals existing in and around the area. Also, the past situation of flora and fauna, and the change on biodiversity and ecosystem in the area was interviewed for examination.

Fig 3: Interview survey from local people

8. Survey Result

8.1 Flora

(1) Habitat

The proposed Chibwenge Dam site is covered with degraded forest and the forest type was found as secondary forest type. At present, the only remaining viable wildlife habitats are on the steep and relatively inaccessible slopes of undisturbed forests outside the project area. Forests are the dominant habitat of

wildlife in the project area. Some of the forest cover of the proposed project area has long been cleared for shifting cultivation. Shifting cultivation is practiced widely near the Chibwenge River around the dam sites. The forest types recorded around the dam site and power house area were degraded forest with some patches of slash and burn agriculture and mixed forest that is located either on areas of steep hills where the forest is inaccessible or on poor soils unsuitable for upland rice and other crop production.

Fig 4: Sceneries of the survey area

(2) Survey Area

The survey area is shown in Figure 5. The survey locations of power house and dam site are listed below.

Table 1: GPS location of the quadrants around the dam site

Names	**Quadrats**	**Representative GPS Points**	
		Longitude	Latitude
Dam Site	1	E 098˚11′ 24.2″	N 25˚48′ 24.2″
	2	E 098˚11′ 17.7″	N 25˚48′ 24.8″
	3	E 098˚11′ 19.3″	N 25˚48′ 12.8″
	4	E 098˚11′ 21.1″	N 25˚48′ 13.3″
	5	E 098˚11′ 25.7″	N 25˚48′ 12.2″
	6	E 098˚11′ 23.7″	N 25˚48′ 12.1″
	7	E 098˚11′ 22.2″	N 25˚48′ 12.8″
	8	E 098˚09′ 25.4″	N 25˚50′ 36.6″
	9	E 098˚09′ 45.1″	N 25˚51′ 49.9″
	10	E 098˚10′ 56.7″	N 25˚48′ 23.9″
	11	E 098˚11′ 23.0″	N 25˚48′ 11.1″
	12	E 098˚10′ 55.4″	N 25˚49′ 00.0″

	13	E 098˚11′ 30.7″	N 25˚48′ 25.1″
	14	E 098˚10′ 48.5″	N 25˚49′ 01.7″
	15	E 098˚07′ 54.3″	N 25˚53′ 37.4″
	16	E 098˚10′ 31.1″	N 25˚48′ 58.0″
	17	E 098˚10′ 58.5″	N 25˚48′ 21.3″
	18	E 098˚17′ 40.5″	N 25˚53′ 25.3″

Table 2: GPS location of quadrants around the power house

Names	**Quadrats**	**Representative GPS Points**	
		Longitude	Latitude
Power House	1	E 098˚04′ 31.9″	N 25˚49′ 36.8″
	2	E 098˚05′ 06.98″	N 25˚50′ 07.8″
	3	E 098˚05′ 09.9″	N 25˚50′ 06.4″
	4	E 098˚05′ 13.0″	N 25˚50′ 08.8″
	5	E 098˚05′ 14.0″	N 25˚50′ 07.1″
	6	E 098˚05′ 21.3″	N 25˚50′ 04.5″
	7	E 098˚05′ 18.7″	N 25˚50′ 13.4″
	8	E 098˚05′ 11.1″	N 25˚50′ 04.8″
	9	E 098˚05′ 09.0″	N 25˚50′ 02.1″
	10	E 098˚05′ 12.9″	N 25˚50′ 12.6″
	11	E 098˚05′ 20.0″	N 25˚50′ 11.6″
	12	E 098˚05′ 00.0″	N 25˚49′ 57.0″
	13	E 098˚04′ 53.0″	N 25˚49′ 52.2″
	14	E 098˚04′ 51.4″	N 25˚49′ 49.8″
	15	E 098˚04′ 22.6″	N 25˚49′ 33.4″
	16	E 098˚04′ 19.9″	N 25˚49′ 36.9″
	17	E 098˚04′ 26.6″	N 25˚49′ 41.3″
	18	E 098˚04′ 52.0″	N 25˚50′ 09.5″
	19	E 098˚04′ 46.9″	N 25˚50′ 06.3″
	20	E 098˚04′ 42.0″	N 25˚49′ 59.1″
	21	E 098˚04′ 35.2″	N 25˚49′ 59.4″

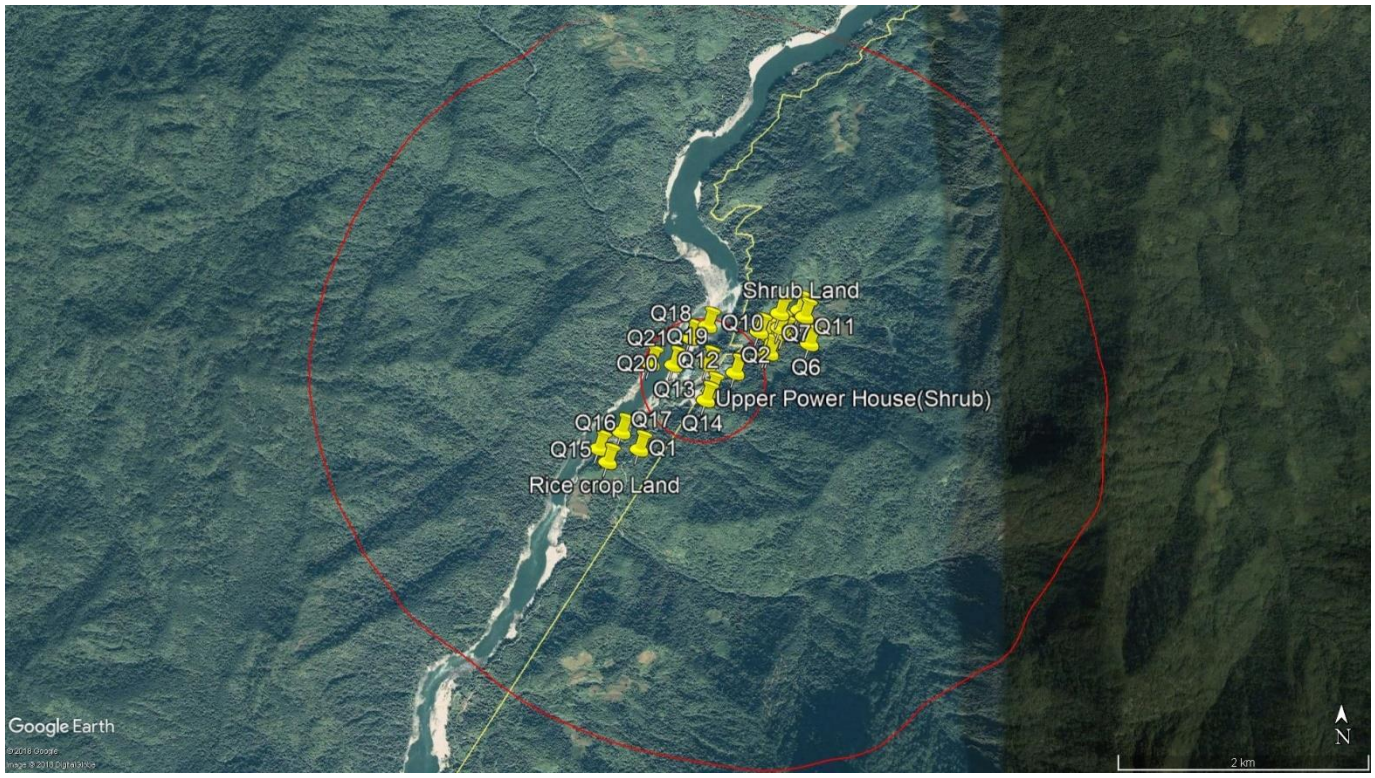


Fig 5: Power House Survey area

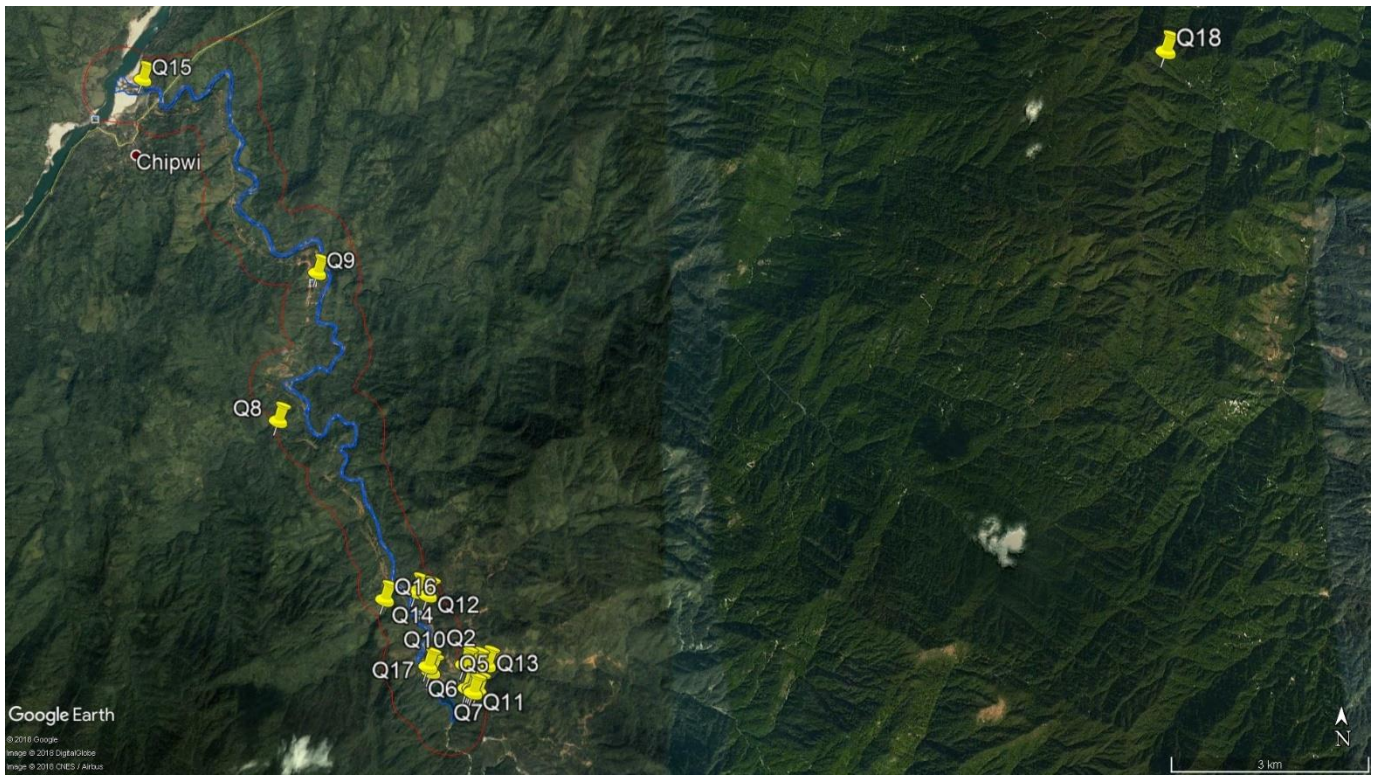


Fig 6: Dam site survey area

(3) Survey Result

Floristic surveys were conducted at the dam site and power house area. In this survey, a total of (101) tree and small tree species were collected and identified. The range of tree species recorded at the quadrats was 12-23. The tree species with the highest IVI value were found to be *Cedrela serrata* Royle, *Macaranga denticulata* Muell. Arg., *Garuga pinnata* Roxb., *Millettia pendula* Benth., *Decaspermum parviflorum* (Lam.) A.J. Scott., *Bombax ceiba* L., *Emblica officinalis* Gaertn., *Ficus clavata* Wall., *Alstonia scholaris* (L.) R. Br., *Dillenia elata* Pierre, *Ficus hispida* L.f., and *Heterophragma adenophylla*. Threatened species was not found among the recorded species.

Table 3: List of plant species recorded around the power house

No.	Scientific Name	Family	Myanmar Name	Habits	IUCN Status
1	*Acmella calva* (DC.) R.K. Jansen	Asteraceae	Pae thone ywat	H	NE
2	*Agave americana* L.	Agavaceae	Nanagyi	H	NE
3	*Alstonia scholaris* L.	Apocynaceae	Taung mayoe	T	LR/LC
4	*Antidesma diandrum* Roth.	Euphorbiaceae	Kinbalin	T	NE
5	*Barleria prionitis* L.	Acanthaceae	Leik-su-shwe	H	NE
6	*Bauhinia acuminata* L.	Caesalpiniaceae	Pha-lan	T	LC
7	*Bauhinia corymbosa* Roxb. ex DC.	Caesalpiniaceae	Swe-daw	T	NE
8	*Bignonia apathacea* L. f.	Bignoniaceae	Phetthan	T	NE
9	*Bombax malabaricum* DC.	Bobacaceae	Letpan	T	NE
10	*Bridelia burmanica* Hk.f.	Euphorbiaceae	Seik chi	T	NE
11	*Buchanania lanzan* Spreng.	Anacardiaceae	Lunbo	T	NE
12	*C.barbata L.Sw. Andropogon barbata* L.	Graminae	Sinngo myet	G	NE
13	*Capparis xanthophylla* Collett&Hemsl.	Capparaceae	Madi Tha Hlat	CL	NE
14	*Cassia fistula* L.	Fabaceae	Ngu	T	NE
15	*Cephalandra indica* Naud.	Cucurbitaceae	Kin-pon	CI	NE
16	*Chromolaena odorata* (L.) R.M. King & H. Robinson	Asteraceae	Bezet	H	NE
17	*Citrus sinensis* (L.) Osbeck	Rutaceae	Orange	T	NE
18	*Convolvulus arvensis* L.	Convolvulaceae	Kouk-yoe-nwel	CI	NE
19	*Cyperus rotundus* L.	Cyperceae	Myat-monyin	G	LC

20	*Desmodium diffusum* DC.	Fabaceae	Gyat	S	NE
21	*Dillenia pentagyna* Roxb.	Dilleniaceae	Zinbyun	T	NE
22	*Eckipta alba* Hassk	Compositaceae	Kyate-Hman	H	NE
23	*Emblica officinalis* Gaertn.	Euphorbiaceae	Zibyu	T	NE
24	*Erythrina arborescens* Roxb	Fabaceae	Kathit	T	NE
25	*Euphorbia hypericfolia* L.	Euphorbiaceae	Hmin -sae	H	NE
26	*Heptapleurum venulosum* Seem	Araliaceae	Myauk let wa	CI	NE
27	*Indigofera atropurpurea* Bucb-Ham.	Fabaceae	Mae-yine	H	NE
28	*Jatropha gossypifolia* L.	Euphorbiaceae	Ka Na Kho	H	NE
29	*Macaranga denticulate* Muell.Arg.	Euphorbiaceae	Phetwun	T	NE
30	*Mangifera indica* L.	Anacardiaceae	Thayet	T	DD
31	*Millettia vesicolor* Baker.	Fabaceae	Thit win	T	NE
32	*Oroxylum indicum* Vent.	Bignoniaceae	Kyaung shar	T	NE
33	*Phaseolus aconitifolius* Jacq.	Fabaceae	Taw-panan	H	NE
34	*Phlogacanthus tubiflorus* Nees	Acanthaceae	Lada Labyin	H	NE
35	*Phyllanthud urinaria* L.	Euphorbiaceae	Myay-zi-phyu	H	NE
36	*Polyalthia longifolia* L:	Annonaceae	Thin-baw-te	T	NE
37	*Pterocarpus macrocarpus* Kurz	Fabaceae	Padauk	T	NE
38	*Senna siamea* (Lam.) Irwin & Barneby	Fabaceae	Mazali	T	NE
39	*Streptocaulon tomentosum* Wight & Arn.	Asclepiadaceae	Myin-dagon-ni	CI	NE
40	*Tephrosia purpurea* pers.	Fabaceae	Tapin-shwehti	S	NE
41	*Terminalia bellerica* Roxb.	Combretaceae	Thit seint	T	NE

Table 4: List of plant species recorded around the dam site

No.	**Scientific Name**	**Family**	**Myanmar Name**	**Habit**	**IUCN Status**
1	*Abutilon indicum (L.) Sweet.*	Malvaceae	Bauk-khwe	H	NE
2	*Acacia Chundra (*Rottler) Willd	Mimosaceae	Gandaya	S	NE
3	*Acacia concinna DC.*	Mimosaceae	Kin Pon Chin	S	NE
4	*Aerides spp.*	Orchidaceae	Sagalay-pan	H	NE
5	An*drapogan brevifolius* L.	Poaceae	Zein myet	G	NE
6	*Andropogon fastigiatus* Sw.	Poaceae	Myauk-Myar	G	NE

7	*Angustiafolium vahl.*	Oleaceae	Taw-sabal	CI	NE
8	*Archidendron jiringa* (Jack)Nielsen	Mimosaceae	Danyin	T	NE
9	*Artocarpus heterophyllus* Lam.	Moraceae	Pein-ne	T	NE
10	*Arundina bambusifolia* Lindl	Orchidaceae	Bamboo orchid	H	NE
11	*Arundinella birmanica* Hook. f.	Poaceae	Myat-pauk	G	NE
12	*Bulbophyllum spp.*	Orchidaceae	Tha-zin	H	NE
13	*Cardiospermum corindum* L	Sapindaceae	Kala myatsi	H	NE
14	*Cedrela serrata* Royle	Meliaceae	Taung Tama	T	NE
15	*Chloris barbata* Sw.	Poaceae	Sinngo-Myat	G	NE
16	*Chukrasia tabularis* A. juss.	Meliaceae	Yinma	T	LR/LC
17	*Coelogyne brachyplera* Reichb.	Orchidaceae	Pha-yaung-taing-thikhawa	H	NE
18	*Crammatophyllum speciosum* Bl.	Orchidaceae	Kya-ba-hon-thikha	H	NE
19	*Curculigo orchioides* Gaertn.	Hypoxidaceae	Taw-Htan	H	NE
20	*Cymbopogon virgatus* Stapf ex Bor	Poaceae	Myet set/myet nan	G	NE
21	*Cynodon dactylon* (L.) Pers.	Poaceae	Myayzar-Myat	G	NE
22	*Cynodon dactylon* (L.) Pers.	Poaceae	Myesa myet	G	NE
23	*Cypridium spp.*	Orchidaceae	Lady's slipper	H	NE
24	*D. longispathus* Kurz	Graminae	Wanet	G	NE
25	*D.Indica Spreng D. malabarica* L. Merr.	Graminae	Myet cho	G	NE
26	*Dendrocalamus giganteus* Munro.	Graminae	Wa-bo	G	LC
27	*Dichanthium annulatum* (Forssk.) Stapf	Poaceae	Padaw-ni	G	NE
28	*Echinochola colona* L. Link.	Graminae	Pazon-sar-Myat	G	NE
29	*Eragrostella bifaria* Wt.	Graminae	Thaman	G	NE
30	*Eragrostis bifaria* Wt. ex Steud.	Graminae	Myat-mwel	G	NE
31	*Eugenia diospyrifolia* Wall.	Myrtaceae	Taung Thabyay	T	NE
32	*Ficus chittagonga* Miq.	Moraceae	Thaphan	T	NE
33	*Ficus hispida* L.f.	Moraceae	Kha aung	T	NE
34	*Ficus nervosa* Heyne ex Roth	Moraceae	Nyaung Pinene	T	NE
35	*Ficus rumphii* Bl.	Moraceae	Nyaung	T	NE
36	*Garuga pinnata* Roxb.	Papilionaceae	Chinyouk	T	NE

37	*Gmelina arborea Roxb*.	Verbenaceae	Yemena	T	NE
38	*Grewia hirsuta* (Korth.) Vahl.	Tillaceae	Tayaw	H	NE
39	*Hyptis suaveolens*	Lamiaceae	Nan-saw	S	NE
40	*Jussiaea suffruticosa* Linn.	Onagraceae	Taw Lay Nyin	H	NE
41	*Melhania hamiltoniana* Wall.	Sterculiaceae	Bauk- mwe	S	NE
42	*Mesua ferrea* L.	Hypericaceae	Gangaw	T	NE
43	*Michelia champaca L.*	Magnoliaceae	Sakawar	T	LC
44	*Mimosa pudica*	Mimosaceae	Tikayon	Cl	NE
45	*Musa sapientum* L.	Musaceae	Nget-pyaw	H	NE
46	*Phoenix paludosa* Roxb.	Thinbaung	Arecaceae	T	NT
47	*Physalis minima* L.	Solanaceae	Bauk-kwe-galay	H	NE
48	*Psidium guajava* L.	Myrtaceae	Malaka	T	NE
49	*Saccharum spontaneum* L.	Poaceae	Kine	G	NE
50	*Scaphium scaphigerum* (G. Don) Guibort	Sterculiaceae	Shaw	T	NE
51	*Schima wallichii* (DC) Korth	Theaceae	Loukya	T	NE
52	*Selaginlla martensii* L.	Selaginelaceae	Kyauk-pan	H	NE
53	*Smilax parvifolia* Wall.	Smilacaeae	That-naunt-nwel	CI	NE
54	*Solamjn inficum* L.	Solanaceae	Kayan-kazort	H	NE
55	*Solanum virginanum* L.	Solanaceae	Myaybote-khayan	S	NE
56	*Tacca leontopetaloides*	Taccaceae	Balue taungwae	H	LC
57	*Tectona grandis* L. f.	Verbenaceae	Kyun	T	NE
58	*Tinospra cordifolia* Miers.	Menispermaceae	Sindon manwe	CI	NE
59	*Ureana lobata* L.	Malvaceae	Chinpaung-Yine	H	NE
60	*Zizyphus rugosa* Lam.	Rhamnaceae	Taw-zi	T	NE

Note: Conservation Status of *Tephrosia purpurea* pers. (Endangered) change to Not Evaluated at the IUCN Red List version 2016-2.

NE = Not Evaluated

LR/LC = Lower Risk/Least Concerned

DD = Data Deficient

EN = Endangered

NT = Near Threatened

Conservation Status for *Phoenix paludosa* Roxb. (Thinbaung)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Plantae	Tracheophyta	Liliopsida	Arecales	Palmae

Scientific Name:	*Phoenix paludosa*
Species Authority:	Roxb.
Common Name(s): English – Mangrove Date Palm	

Assessment Information

Red List Category & Criteria:	Near Threatened ver 3.1
Year Published:	2010
Date Assessed:	2008-03-07
Assessor(s):	Ellison, J., Koedam, N.E., Wang, Y., Primavera, J., Jin Eong, O., Wan-Hong Yong, J. & Ngoc Nam, V.
Reviewer(s):	Polidoro, B.A., Livingstone, S.R., Carpenter, K.E. (Global Marine Species Assessment Coordinating Team) & Baker, W.J. (Palm Red List Authority)

Justification:

This species is threatened by the loss of mangrove habitat throughout its range, primarily due to extraction and coastal development, and there has been an estimated 24% decline in mangrove area within this species' range since 1980. It has an area of occupancy of less than 2,000 km² within its restricted range in southeast Asia. There is a continuing decline in the area and quality of its habitat due to coastal development and resource extraction. This species meets two out of three thresholds under Criterion B and nearly qualifies for Criterion A, and therefore is listed as Near Threatened.

Geographic Range

Range Description:	This species occurs in India, including the Andaman and Nicobar Islands, Bangladesh, Cambodia, Malaysia, Indonesia (Sumatra), Thailand, and Viet Nam. It possibly occurs in Myanmar. However, it is very patchily distributed and uncommon throughout its range, with an estimated area of occupancy of less than 2,000 km².
Countries occurrence:	**Native:** Bangladesh; Cambodia; India; Indonesia (Sumatera); Malaysia; Thailand; Viet Nam

Habitat and Ecology

Habitat and	This is a back mangroves species. Individuals often occur in scattered stands of other mangrove species.

Ecology:	This species can also form stands of its own in some areas.
Systems:	Terrestrial; Marine
Generation Length (years):	40

Use and Trade

Use and Trade:	This species is harvested for flooring in households, and construction. People also eat the young shoots.

Threats

Major Threat(s):	This species is patchily distributed within its relatively restricted range. Intensive coastal development and extraction of mangroves resources is occuring throughout its range. It is a back-mangrove species, and is therefore particularly vulnerable to coastal development and sea-level rise. Mangrove species with a habitat on the landward margin may be particularly vulnerable to sea-level rise if owing to coastal development their movement inland is blocked. Although local estimates are uncertain due to differing legislative definitions of what is a 'mangrove' and to the imprecision in determining mangrove area, current consensus estimates of mangrove loss in the last quarter-century report an approximately 24% decline in mangrove areas in countries within this species range since 1980 (FAO 2007). All mangrove ecosystems occur within mean sea level and high tidal elevations, and have distinct species zonations that are controlled by the elevation of the substrate relative to mean sea level. This is because of associated variation in frequency of elevation, salinity and wave action (Duke *et al*. 1998). With rise in sea-level, the habitat requirements of each species will be disrupted, and species zones will suffer mortality at their present locations and re-establish at higher elevations in areas that were previously landward zones (Ellison 2005). If sea-level rise is a continued trend over this century, then there will be continued mortality and re-establishment of species zones. However, species that are easily dispersed and fast growing/fast producing will cope better than those which are slower growing and slower to reproduce. In addition, mangrove area is declining globally due to a number of localized threats. The main threat is habitat destruction and removal of mangrove areas. Reasons for removal include cleared for shrimp farms, agriculture, fish ponds, rice production and salt pans, and for the development of urban and industrial areas, road construction, coconut plantations, ports, airports, and tourist resorts. Other threats include pollution from sewage effluents, solid wastes, siltation, oil, and agricultural and urban runoff. Climate change is also thought to be a threat, particularly at the edges of a species range. Natural threats include cyclones, hurricane and tsunamis.

Conservation Actions

Conservation Actions:	There are no conservation measures specific to this species, but its range may include some marine and coastal protected areas. Continued monitoring and research is recommended, as well as the inclusion of mangrove areas in marine and coastal protected areas.

Range Map for *Phoenix paludosa Roxb.* (Thinbaung)

Source: IUCN.org

(4) Data Analysis

Quantitative analysis of dominance and their relative values of frequency, density and basal area were calculated and summed to get Importance Value Index. Diversity indices such as Shannon-Wiener diversity index (H), Simpson diversity index (D) and Shannon-Wiener evenness (E) were used in this study.

Shannon-Wiener diversity index (H)

$$H' = -[\sum (p_i)\, ln\ (p_i)]$$

H´ = the amount of diversity in an ecosystem. **H´** will be the greatest if the species are all equally abundant.

p_i = relative abundance of each individual species to the total (measure from 0 to 1)

$ln\ (p_i)$ = the natural logarithm of p_i.

Important Value Index (IVI) of tree species around dam site

The total number of tree species with GBH >10cm was 17 species around dam site. Ranking of ecological significance by IVI of tree species in the study area were given in table (1. The tree layer in the study area is dominated by *Cedrela serrata* Royle. (IVI= 34.67%), *Macaranga denticulata* Muell. Arg. (IVI = 27.35%) and *Garuga pinnata* Roxb. (26.66%) was third. The number of species greater than 10% and 10% IVI value was fourteen species (Table 1, Fig. 5). Those species could be considered as ecological indicator species of the study area.

Table 5: Important Value Index (IVI) of tree species recorded around dam site

Sr. No.	Scientific Name	Relative Density (%)	Relaitve Frequency (%)	Relative Dominance (%)	I.V. I
1	*Cedrela serrata* Royle	10.559	7.6923	16.4182	34.6695
2	*Macaranga denticulata* Muell. Arg.	8.0745	9.6154	9.661	27.3509
3	*Garuga pinnata* Roxb.	8.0745	9.6154	8.974	26.6639
4	*Millettia pendula* Benth.	6.8323	7.6923	8.8963	23.4209
5	*Decaspermum parviflorum* (Lam.) A.J. Scott	7.4534	5.7692	8.1632	21.3858
6	*Bombax ceiba* L.	6.2112	5.7692	7.6281	19.6085
7	*Emblica officinalis* Gaertn.	6.2112	5.7692	7.088	19.0684
8	*Ficus clavata* Wall.	6.2112	5.7692	6.4793	18.4597
9	*Bridelia* sp.	6.2112	5.7692	5.0479	17.0283
10	*Alstonia scholaris* (L.) R. Br.	5.5901	5.7692	4.2282	15.5875
11	*Dillenia elata* Pierre	5.5901	5.7692	3.9827	15.342
12	*Ficus hispida* L.f.	5.5901	3.8462	4.5918	14.028
13	*Heterophragma adenophylla*	4.9689	3.8462	2.8067	11.6218
14	*Oroxylum indicum*	4.3478	3.8462	2.2957	10.4896
15	*Ficus religosa* Linn.	2.4845	5.7692	1.2571	9.5108
16	*Antidesma bunius* (L.) Spreng.	3.1056	3.8462	1.8126	8.7643
17	*Terminalia bellerica* Roxb.	2.4845	3.8462	0.6694	7
	Total	**100**	**100**	**100**	**300**

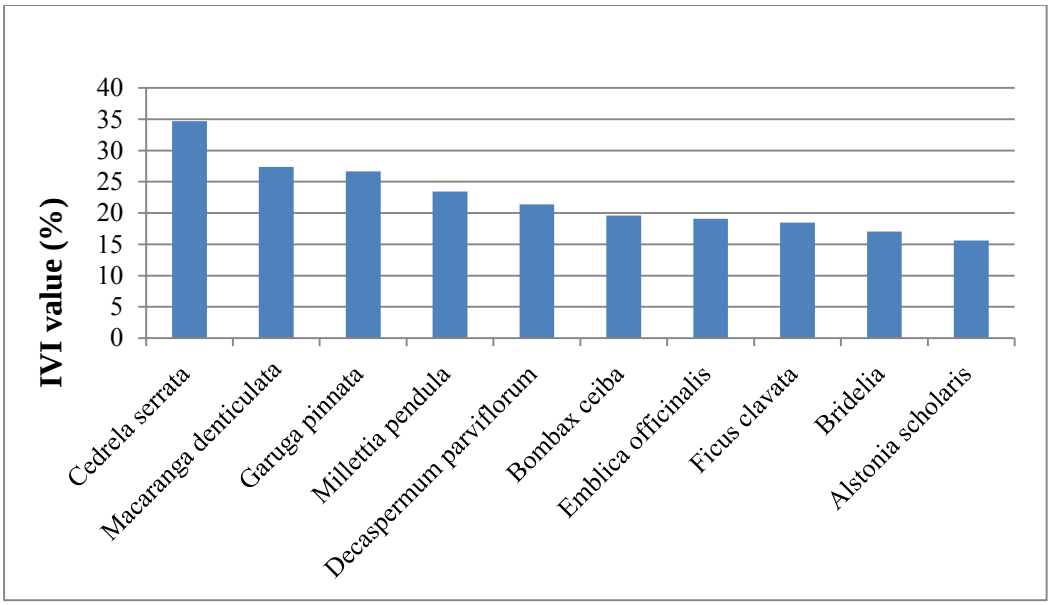


Fig 7: Important value index values of tree species around the dam site

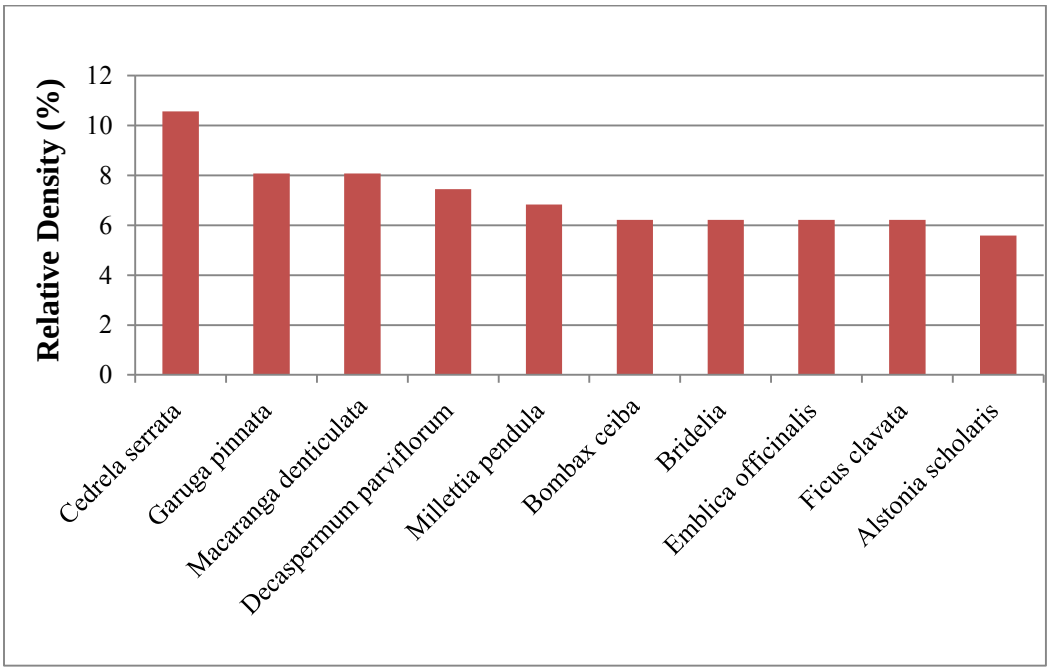


Fig 8: Relative density of tree species around the dam site

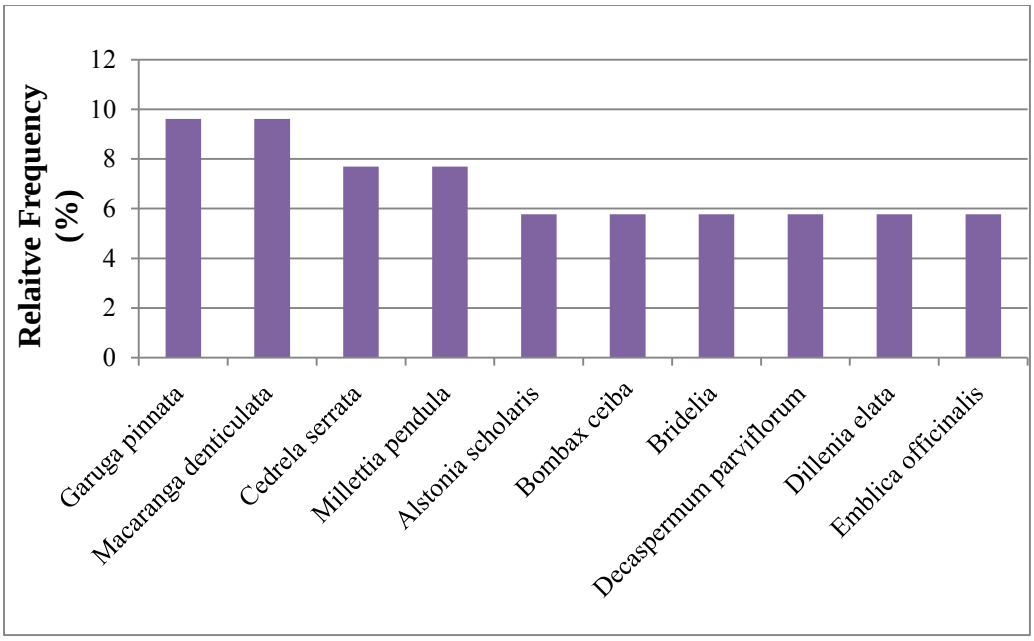


Fig 9: Relative frequency of tree species around the dam site

Important Value Index (IVI) of tree species around power house area

The total number of tree species with equal to and more than GBH >10cm was 17 species around power house area. Ranking of ecological significance by IVI of tree species in the study area were given in table (5). The tree layer in the study area is dominated by *Chukrasia tabularis* A. Juss. (IVI= 51.96%), *Cedrela serrata* Royle. (IVI = 50.35%) and *Michelia champaca* L. (40.03%) was third. The number of species greater than 10% and 10% IVI value was eight species (Table 1, Fig. 5). Those species could be considered as ecological indicator species of the study area.

Table 6: Important Value Index (IVI) of tree species recorded in Power House area

Sr. No.	Scientific Name	Relative Density (%)	Relaitve Frequency (%)	Relative Dominance (%)	I.V. I
1	*Chukrasia tabularis* A. Juss	15.625	16.6667	19.6708	51.9625
2	*Cedrela serrata* Royle	16.6667	13.3333	20.3487	50.3487
3	*Michelia champaca* L.	14.5833	10	15.4452	40.0285
4	*Schima khasiana* Dyer	12.5	13.3333	12.29	38.1233
5	*Macaranga denticulata* Muell. Arg.	13.5417	10	13.2649	36.8066
6	*Gmelina arborea* Roxb.	10.4167	13.3333	10.8808	34.6308
7	*Abarema bigemina* (L.) Kosterm.	7.2917	10	5.2364	22.528
8	*Ficus altissima* Blume	3.125	6.6667	0.6532	10.4449
9	*Emblica officinalis* Gaertn.	4.1667	3.3333	1.5568	9.05678
10	*Ficus religosa* Linn.	2.0833	3.3333	0.6532	6.06991
	Total	**100**	**100**	**100**	**300**

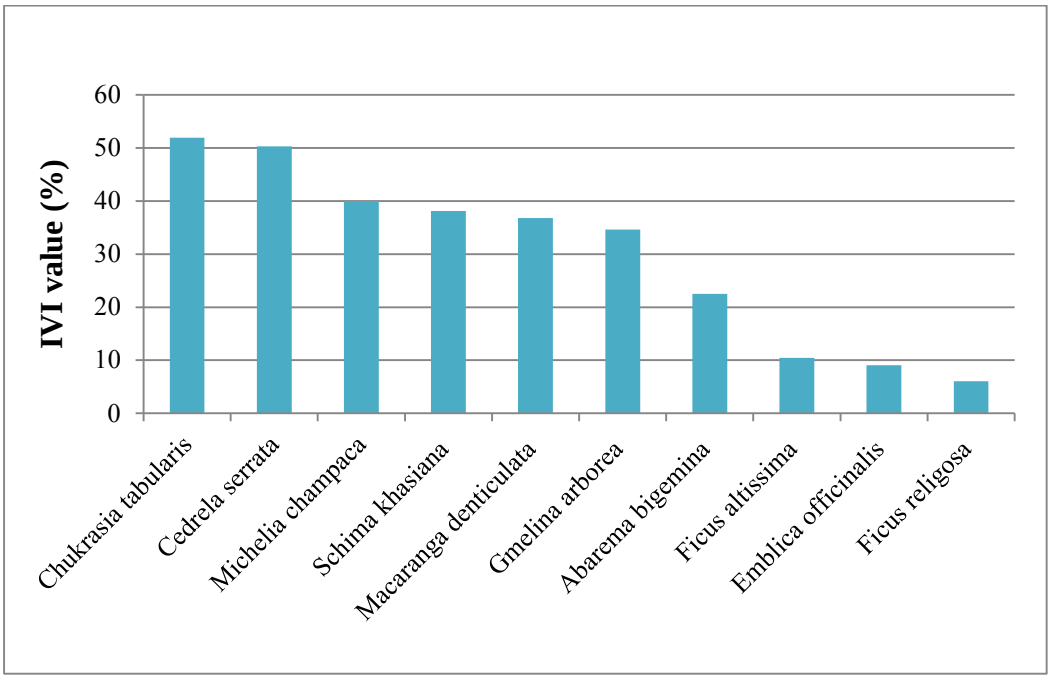


Fig 10: Important value index values of tree species around the power house site

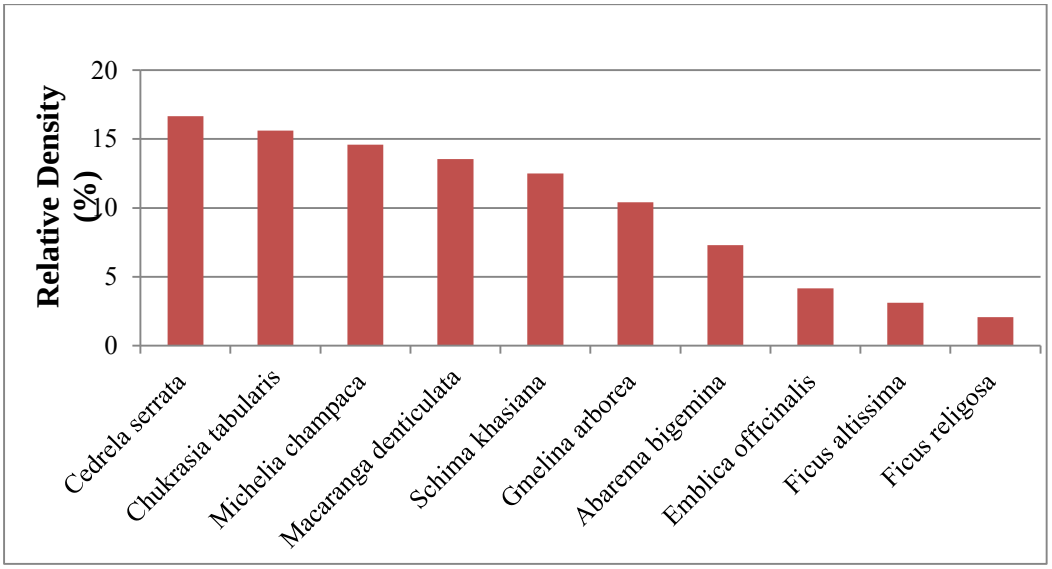


Fig 11: Relative density of tree species around the power house site

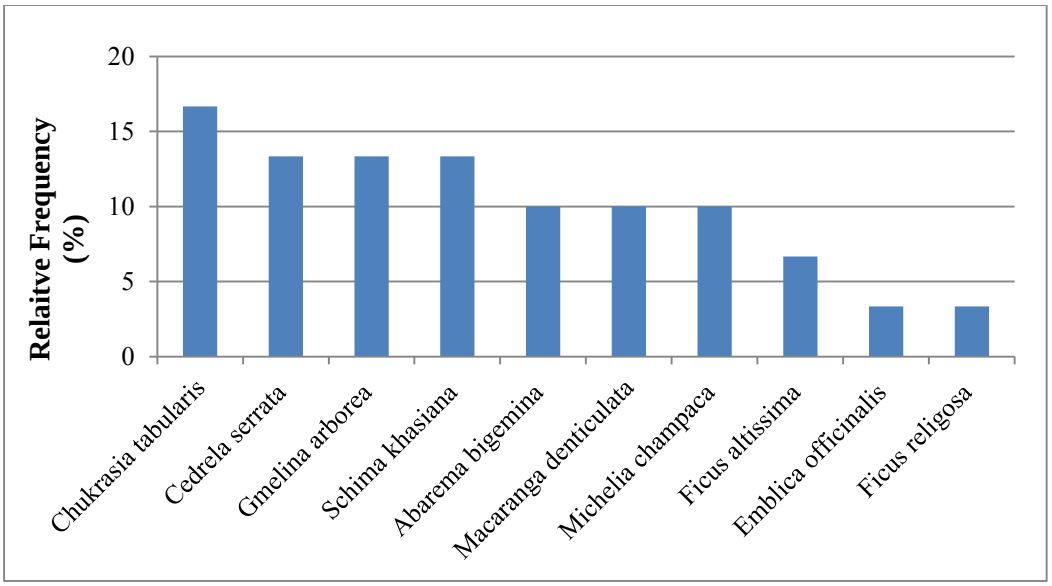


Fig 12: Relative frequency of tree species around the power house site

8.2 Fauna

(1) Habitat

The wildlife groups for the study consist of 4 groups of animals: mammals, birds, reptiles, and amphibians. The richness of the Chibwenge's wildlife has less to do with conservation efforts. The project areas have low population density and the habitats of the wildlife species are disturbed. However, human population and development pressures are increasing and consequently the wildlife population may decline throughout the area.

(2) Survey Area

The survey area is shown in Figure 13 and the survey locations of power house and dam site are listed below:

Table 7: GPS location of quadrants around dam site

Names	Quadrats	Representative GPS Points	
		Longitude	Latitude
Dam Site	1	E 098˚11′ 24.2″	N 25˚48′ 24.2″
	2	E 098˚11′ 17.7″	N 25˚48′ 24.8″
	3	E 098˚11′ 19.3″	N 25˚48′ 12.8″
	4	E 098˚11′ 21.1″	N 25˚48′ 13.3″
	5	E 098˚11′ 25.7″	N 25˚48′ 12.2″
	6	E 098˚11′ 23.7″	N 25˚48′ 12.1″

	7	E 098˚11′ 22.2″	N 25˚48′ 12.8″
	8	E 098˚09′ 25.4″	N 25˚50′ 36.6″
	9	E 098˚09′ 45.1″	N 25˚51′ 49.9″
	10	E 098˚10′ 56.7″	N 25˚48′ 23.9″
	11	E 098˚11′ 23.0″	N 25˚48′ 11.1″
	12	E 098˚10′ 55.4″	N 25˚49′ 00.0″
	13	E 098˚11′ 30.7″	N 25˚48′ 25.1″
	14	E 098˚10′ 48.5″	N 25˚49′ 01.7″
	15	E 098˚07′ 54.3″	N 25˚53′ 37.4″
	16	E 098˚10′ 31.1″	N 25˚48′ 58.0″
	17	E 098˚10′ 58.5″	N 25˚48′ 21.3″
	18	E 098˚17′ 40.5″	N 25˚53′ 25.3″

Table 8: GPS locations of quadrants around the power house

Names	**Quadrats**	**Representative GPS Points**	
		Longitude	Latitude
Power Station	1	E 098˚04′ 31.9″	N 25˚49′ 36.8″
	2	E 098˚05′ 06.98″	N 25˚50′ 07.8″
	3	E 098˚05′ 09.9″	N 25˚50′ 06.4″
	4	E 098˚05′ 13.0″	N 25˚50′ 08.8″
	5	E 098˚05′ 14.0″	N 25˚50′ 07.1″
	6	E 098˚05′ 21.3″	N 25˚50′ 04.5″
	7	E 098˚05′ 18.7″	N 25˚50′ 13.4″
	8	E 098˚05′ 11.1″	N 25˚50′ 04.8″
	9	E 098˚05′ 09.0″	N 25˚50′ 02.1″
	10	E 098˚05′ 12.9″	N 25˚50′ 12.6″
	11	E 098˚05′ 20.0″	N 25˚50′ 11.6″
	12	E 098˚05′ 00.0″	N 25˚49′ 57.0″
	13	E 098˚04′ 53.0″	N 25˚49′ 52.2″
	14	E 098˚04′ 51.4″	N 25˚49′ 49.8″
	15	E 098˚04′ 22.6″	N 25˚49′ 33.4″
	16	E 098˚04′ 19.9″	N 25˚49′ 36.9″
	17	E 098˚04′ 26.6″	N 25˚49′ 41.3″

	18	E 098˚04′ 52.0″	N 25˚50′ 09.5″
	19	E 098˚04′ 46.9″	N 25˚50′ 06.3″
	20	E 098˚04′ 42.0″	N 25˚49′ 59.1″
	21	E 098˚04′ 35.2″	N 25˚49′ 59.4″

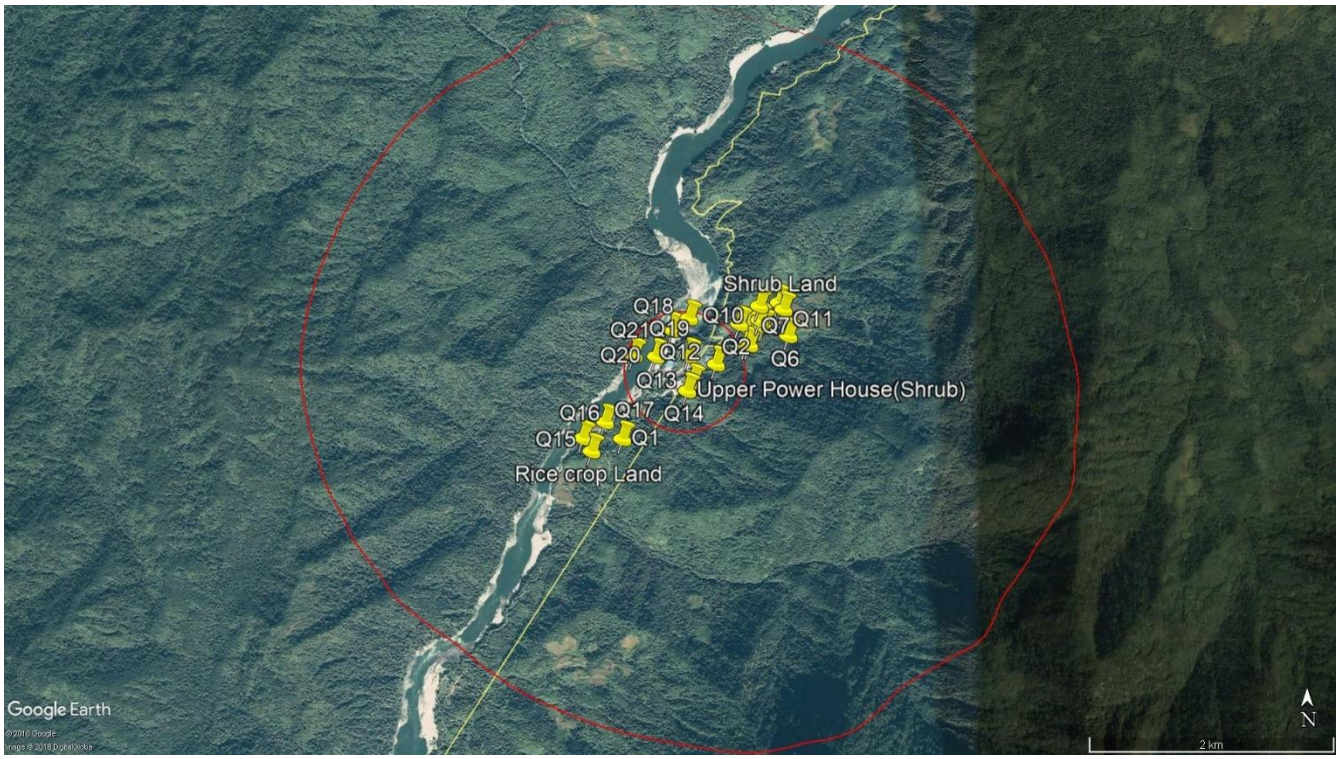


Fig 13: Locations of Fauna Survey Area around power house

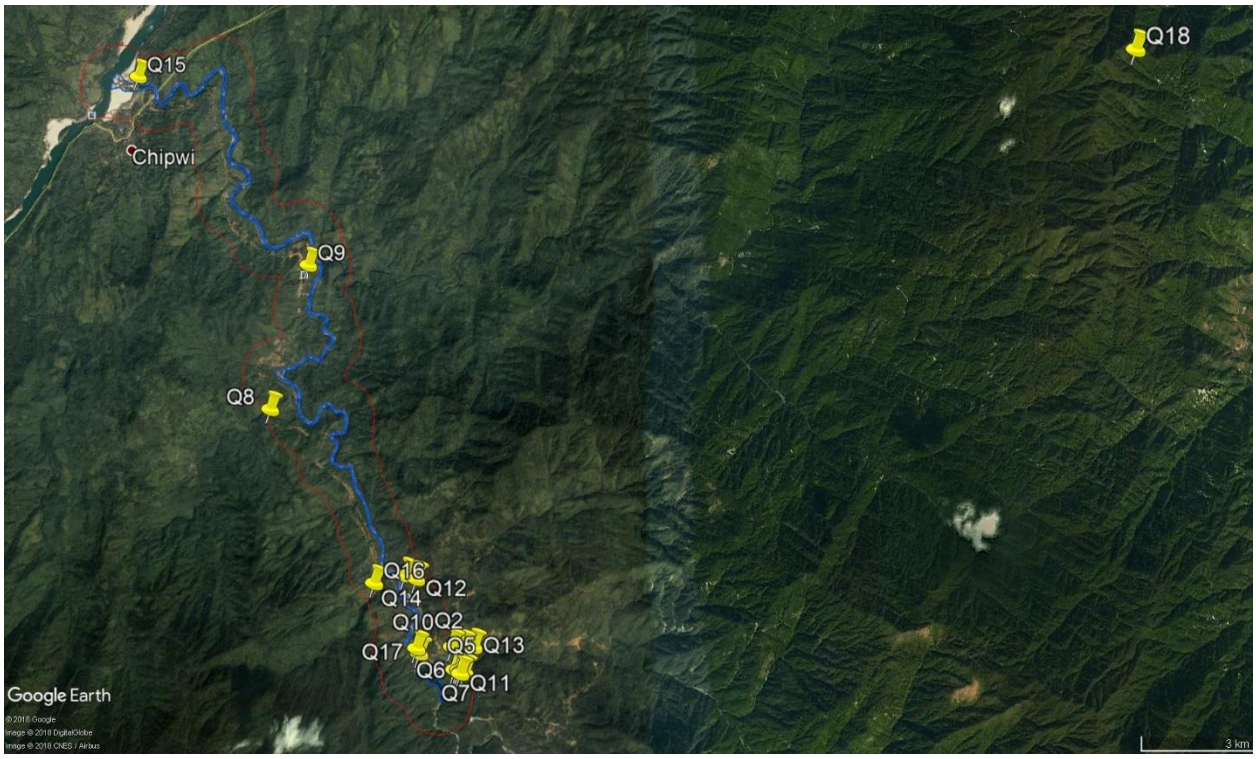


Fig 14: Loations of fauna survey area around dam site

(3) Survey Result

A total of 19 mammal species were recorded in Chibwenge dam site and Power House area. Among them 7 mammal species were listed as threatened species under IUCN Red List. Out of the recorded threatened species, 3 species were endangered species and another 4 species were recorded as vulnerable species.

A total of 78 bird species were observed in the Chibwenge dam site and Power house area. Among the observed species, 2 vulnerable species were recorded. Most of the bird species were found as resident species residing in the area for all seasons. Out of the recorded species, some species were recorded as winter visitors

A total of 3 reptile species and 1 amphibian species were recorded during the survey period at Chibwenge Dam site and Power House area. No threatened species of reptile and amphibian species was found during the survey period.

Butterfly

A total of 37 butterfly species were recorded in the proposed project area. Lepidoptera (5) families and (37) butterfly species were collected. Member of the family Nymphalidae, were found in large populations. The species Common Rose ***Pachliopta aristolochiae,*** Common Tiger *Danaus genutia,* Common Mormon ***Papilio polytes***, Lemon Emigrant ***Catopsilia Pomona***, Common Grass Yellow ***Eurema hecabe***, Plain Tiger

Danaus chrysippus, Bamboo Tree Brown ***Lethe europa***, Peacock Pansy ***Junonia almanac*** were observed as very common species. The remain butterfly species were also found as common species. The species of the genus ***Junonia*** was observed as dominant species with relatively large populations.

Table 8: List of butterfly species recorded around the power house area

No	Family Name	Scientific Name	Common Name	IUCN List
1	Hesperiidae	*Tagiades ultra*	-	Not Evaluated
2	Lycaenidae	*Cethosia cyane*	Leopard Lacewing	Not Evaluated
3	Nymphalidae	*Graphium doson*	Common Jay	Not Evaluated
4	Nymphalidae	*Junonia almanac*	Peacock Pansy	Not Evaluated
5	Nymphalidae	*Polyura hebe*	Plain Nawab	Not Evaluated
6	Nymphalidae	*Taractrocera ardonia*	-	Not Evaluated
7	Papilionidae	*Athyma reta*	Malay Staff Sergeant	Not Evaluated
8	Papilionidae	*Catopsilia pomona*	Lemon Emigrant	Not Evaluated
9	Papilionidae	*Cirrochroa orissa*	Common Mime	Not Evaluated
10	Papilionidae	*Danaus chrysippus*	Plain Tiger	Not Evaluated
11	Papilionidae	*Melanitis leda*	Common Evening Brown	Not Evaluated
12	Papilionidae	*Papilio polytes*	Common Mormon	Not Evaluated
13	Pieridae	*Chilasa clytia*	Cabbage White	Not Evaluated
14	Pieridae	*Pachliopta aristolochiae*	Common Rose	Not Evaluated

Table 9: List of butterfly species recorded around the dam site area

No	Family Name	Scientific Name	Common Name	IUCN List
1	Lycaenidae	*Athyma kanwa*	Dot dash Sergeant	Not Evaluated
2	Hesperiidae	*Graphium sarpedon*	Common Bluebottle	Not Evaluated
3	Hesperiidae	*Odontoptilum angulatum*	Chestnut Angle	Not Evaluated
4	Hesperiidae	*Parantica agleoides*	Dark Glassy Tiger	Not Evaluated
5	Lycaenidae	*Mycalesis visala*	Long Brand Bush Brown	Not Evaluated
6	Nymphalidae	*Eurema andersonii*	Anderson's Grass Yellow	Not Evaluated
7	Nymphalidae	*Eurema hecabe*	Common Grass Yellow	Not Evaluated
8	Nymphalidae	*Graphium agamemnon*	Tailed Jay	Not Evaluated
9	Nymphalidae	*Graphium antiphates*	Five Bar Swordtail	Not Evaluated
10	Nymphalidae	*Graphium evemon*	Blue Jay	Not Evaluated

11	Nymphalidae	*Junonia orithya*	Blue Pansy	Not Evaluated
12	Nymphalidae	*Lamproptera curius*	White Dragon tail	Not Evaluated
13	Nymphalidae	*Lethe europa*	Bamboo Tree Brown	Not Evaluated
14	Nymphalidae	*Parthemas sylvia*	Clipper	Not Evaluated
15	Nymphalidae	*Potanthus omaha*	Lesser Dart	Not Evaluated
16	Nymphalidae	*Sinthusa nasaka*	Narrow Spark	Not Evaluated
17	Nymphalidae	*Spindasis syama*	Club Silver line	Not Evaluated
18	Papilionidae	*Danaus genutia*	Common Tiger	Not Evaluated
19	Papilionidae	*Hebomoia glaucippe*	Great Orange Tip	Not Evaluated
20	Papilionidae	*Nacaduba pactolue*	Large Four Line Blue	Not Evaluated
21	Pieridae	*Lexias pardalis*	Archduke	Not Evaluated
22	Pieridae	*Mycalesis mineus*	Dark Brand Bush Brown	Not Evaluated
23	Pieridae	*Pieris canidia*	Cabbage White	Not Evaluated

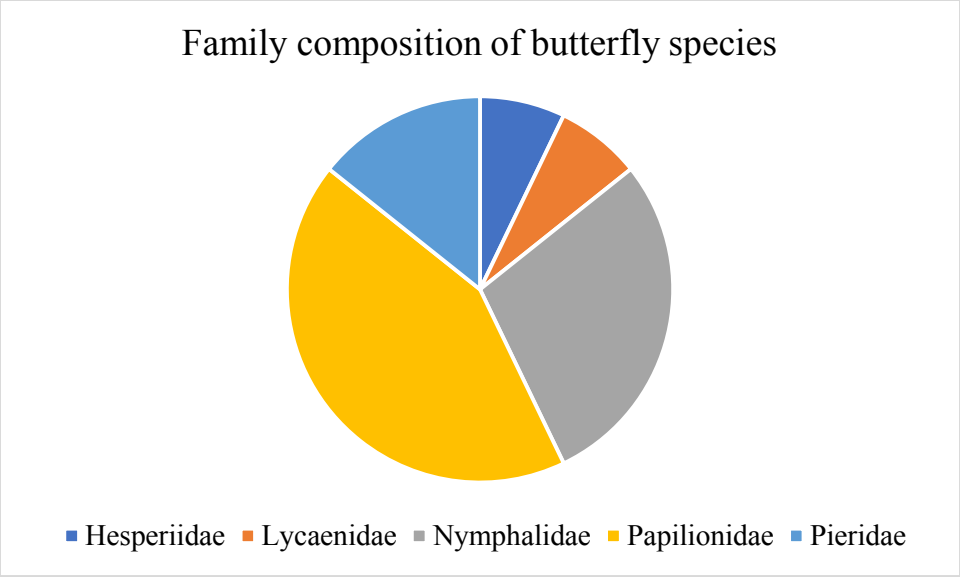


Fig 15: Photo of butterfly species population recorded around the power house area

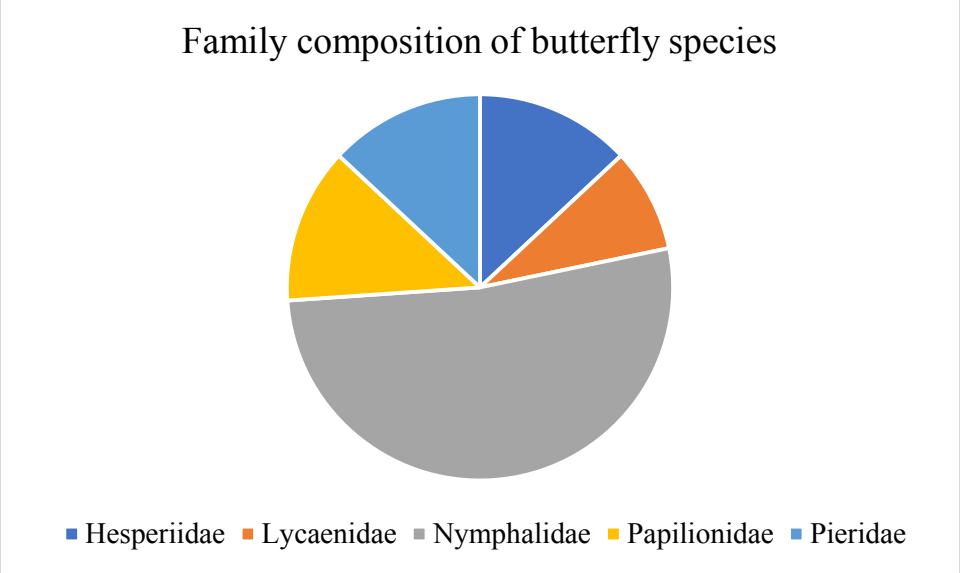
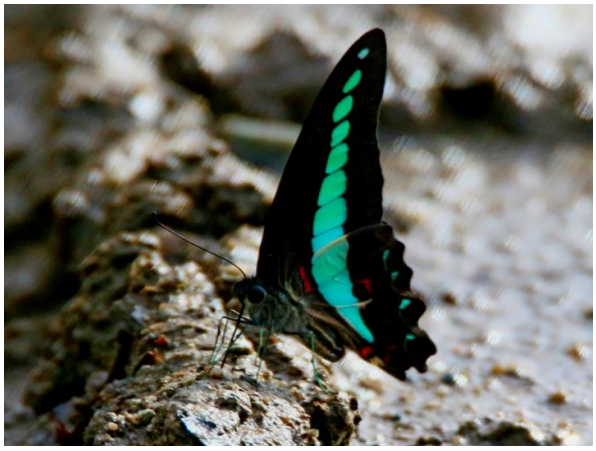


Fig 16: Butterfly species population recorded around the dam site



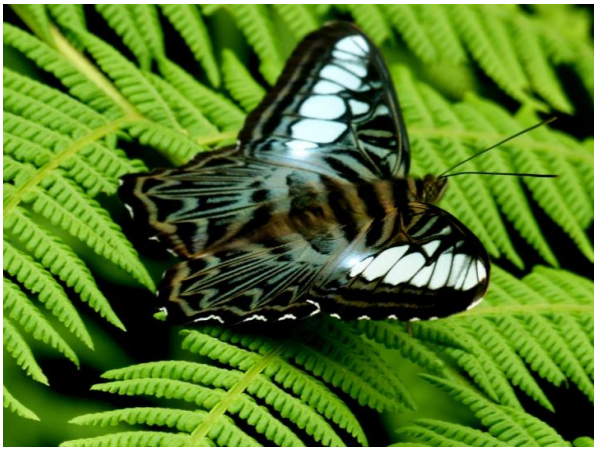
Graphium Sarpedon **(Common Bluebottle)**

Chilasa clytia clytia **(Common Mine)**

Pachliopta aristolochiae**(Common Rose)**

Lamproptera curius **(White Dragontail)**

Eurema hecabe **(Common Grass Yellow)**



Parthenos sylvia **(Clipper)**

Charaxes aristogiton **(Scarce Tawny Rajah)**

Athyma kanwa **(Dot-Dash Sergeant)**

Kallima limborgii **(Malayan Oakleaf)**

Graphium antiphates(Five Bar Swordtail)

Pieridae Group

***Papilio paris* (Paris Peacock)**

Fig 17: Some butterfly species found in survey area

Bird

A total of 105 bird's species were recorded in the proposed project area. The 2 species of Near-threatened and 1 Vulnerable were observed the project area. Member of the family Bucerotidae, Great Hornbill Buceros bicornis and Rufous-necked Hornbill Aceros nipalensis are found near the dam site and listed as forest bird's species. A part from the species family Psittadae, one bird was also observed Grey-headed Parakeet Psittacula finschii was also noted as forest birds.

Table 10: List of bird species recorded around the dam site

No.	Scientific Name	Common Name(s)	Family	IUCN Status
1	*Abroscopus superciliaris*	Yellow-bellied Warbler	Sylviidae	Least concern
2	*Acridotheres fuscus*	Jungle Myna	Sturnidae	Least concern
3	*Acridotheres tristis*	Common Myna	Sturnidae	Least concern
4	*Aegithina tiphia*	Common Iora	Aegithininae	Least concern
5	*Alophoixus flaveolus*	White-throated Bulbul	Pycnontidae	Least concern
6	*Anthus rufulus*	Paddyfield Pipit	Motacillidae	Least concern
7	*Arachnothera longirostra*	Little Spiderhunter	Nectariniidae	Least concern
8	*Arachnothera magna*	Streaked Spiderhunter	Nectariniidae	Least concern
9	*Artamus fuscus*	Ashy Woodswallow	Artimidae	Least concern
10	*Chloropsis hardwickii*	Orange-bellied Leafbird	Eurylaimidae	Least concern
11	*Copsychus saularis*	Oriental Magpie-Robin	Muscicapidae	Least concern
12	*Corvus macrorhynchos*	Large-billed Crow	Corvidae	Least concern
13	*Corvus splendens*	House Crow	Corvidae	Least concern

14	*Culicicapa ceylonensis*	Grey-headed Canary-Flycatcher	Turdidae	Least concern
15	*Cyornis unicolor*	Pale Blue-Flycatcher	Turdidae	Least concern
16	*Dendrocitta formosae*	Grey Treepie	Corvidae	Least concern
17	*Dendrocitta vagabunda*	Rufous Treepie	Corvidae	Least concern
18	*Dicaeum cruentatum*	Scarlet-backed Flowerpecker	Dicaeidae	Least concern
19	*Dicrurus aeneus*	Bronzed Drongo	Dicruridae	Least concern
20	*Dicrurus hottentottus*	Hair-crested Drongo	Dicruridae	Least concern
21	*Dicrurus leucophaeus*	Ashy Drongo	Dicruridae	Least concern
22	*Dicrurus macrocercus*	Black Drongo	Dicruridae	Least concern
23	*Dicrurus remifer*	Lesser Racket-tailed Drongo	Dicruridae	Least concern
24	*Emberiza pusilla*	Little Bunting	Emberizidae	Least concern
25	*Enicurus immaculatus*	Black-backed Forktail	Muscicapidae	Least concern
26	*Enicurus schistaceus*	Slaty-backed Forktail	Muscicapidae	Least concern
27	*Ficedula superciliaris*	Ultramarine Flycatcher	Turdidae	Least concern
28	*Gampsorhynchus rufulus*	White-hooded Babbler	Timaliidae	Least concern
29	*Garrulax chinensis*	Black-throated Laughingthrush	Timaliidae	Least concern
30	*Garrulax leucolophus*	White-crested Laughingthrush	Timaliidae	Least concern
31	*Garrulax pectoralis*	Greater Necklaced Laughingthrush	Timaliidae	Least concern
32	*Heterophasia picaoides*	Long-tailed Sibia	Timaliidae	Least concern
33	*Hirundo daurica*	Red-rumped Swallow	Hirundidae	Least concern
34	*Lanius cristatus*	Brown Shrike	Laniidae	Least concern
35	*Lanius schach*	Long-tailed Shrike	Laniidae	Least concern
36	*Lanius tephronotus*	Grey-backed Shrike	Laniidae	Least concern
37	*Leiothrix argentauris*	Silver-eared Mesia	Timaliidae	Least concern
38	*Lonchura punctulata*	Scaly-breasted Munia	Estrildidae	Least concern
39	*Motacilla alba*	White Wagtail	Motacillidae	Least concern
40	*Myophonus caeruleus*	Blue Whistling-Thrush	Turdidae	Least concern
41	*Nectarinia asiatica*	Purple Sunbird	Nectariniidae	Least concern
42	*Oriolus traillii*	Maroon Oriole	Oriolidae	Least concern
43	*Oriolus xanthornus*	Black-hooded Oriole	Oriolidae	Least concern
44	*Orthotomus sutorius*	Common Tailorbird	Sylviidae	Least concern

45	*Paradoxornis atrosuperciliaris*	Lesser Rufous-Headed Parrotbill	Timaliidae	Least concern
46	*Paradoxornis gularis*	Grey-headed Parrotbill	Timaliidae	Least concern
47	*Paradoxornis ruficeps*	Greater Rufous-headed Parrotbill	Timaliidae	Least concern
48	*Pericrocotus ethologus*	Long-tailed Minivet	Campephagidae	Least concern
49	*Pericrocotus flammeus*	Scarlet Minivet	Campephagidae	Least concern
50	*Pericrocotus solaris*	Grey-chinned Minivet	Campephagidae	Least concern
51	*Prinia flaxiventris*	Plain prinia	Cisticiolidae	Least concern
52	*Pycnonotus flavescens*	Flavescent Bulbul	Pycnontidae	Least concern
53	*Pycnonotus jocosus*	Red-whiskered Bulbul	Pycnontidae	Least concern
54	*Pycnonotus leucogenys*	Himalayan Black Bulbul	Pycnontidae	Least concern
55	*Pycnonotus melanicterus*	Black-crested Bulbul	Pycnontidae	Least concern
56	*Pyconotus blanfordi*	Streak-eared Bul Bul	Pycnontidae	Least concern
57	*Pyconotus cafer*	Red-Vented Bul Bul	Pycnontidae	Least concern
58	*Saxicola caprata*	Pie bushchat	Muscicapidae	Least concern
59	*Tarsiger chrysaeus*	Golden Bush-Robin	Muscicapidae	Least concern
60	*Yuhina castaniceps*	Striated Yuhina	Timaliidae	Least concern
61	*Yuhina flavicollis*	Whiskered Yuhina	Timaliidae	Least concern
62	*Zosterops palpebrosus*	Oriental white-eye	Zosteropidae	Least concern

Table 11: List of bird species recorded around the power house

No.	Scientific Name	Common Name(s)	Family	IUCN Status
1	*Accipiter badius*	Shikra	Accipitridae	Least concern
2	*Aceros nipalensis*	Rufous-necked Hornbill	Bucerotidae	Vulnerable
3	*Alcedo atthis*	Common Kingfisher	Alcedinidae	Least concern
4	*Anthracoceros albirostris*	Oriental Pied-Hornbill	Bucerotidae	Least concern
5	*Arborophila atrogularis*	White-cheeked Partridge	Phasianidae	Least concern
6	*Blythipicus pyrrhotis*	Bay Woodpecker	Picidae	Least concern
7	*Buceros bicornis*	Great Hornbill	Bucerotidae	Near-threatened
8	*Celeus brachyurus*	Rufous Woodpecker	Picidae	Least concern
9	*Centropus sinensis*	Greater Coucal	Cuculidae	Least concern
10	*Chalcophaps indica*	Emerald Dove	Columbidae	Least concern

11	*Chloropsis aurifrons*	Golden-fronted Leafbird	Eurylaimidae	Least concern
12	*Columba livia*	Rock Pigeon	Columbidae	Least concern
13	*Coracias benghalensis*	Indian Roller	Coraciidae	Least concern
14	*Cypsiurus balasiensis*	Asian Palm-Swift	Apodidae	Least concern
15	*Ducula aenea*	Green Imperial-Pigeon	Columbidae	Least concern
16	*Ducula badia*	Mountain Imperial-Pigeon	Columbidae	Least concern
17	*Eurystomus orientalis*	Dollarbird	Coraciidae	Least concern
18	*Gallus gallus*	Red Junglefowl	Phasianidae	Least concern
19	*Glaucidium cuculoides*	Asian Barred Owlet	Strigidae	Least concern
20	*Halcyon smyrnensis*	White-throated Kingfisher	Alcedinidae	Least concern
21	*Ictinaetus malayensis*	Black Eagle	Accipitridae	Least concern
22	*Irena puella*	Asian Fairy-bluebird	Eurylaimidae	Least concern
23	*Lophura leucomelanos*	Kalij Pheasant	Phasianidae	Least concern
24	*Macropygia unchall*	Barred Cuckoo-Dove	Columbidae	Least concern
25	*Megaceryle lugubris*	Crested Kingfisher	Alcedinidae	Least concern
26	*Megalaima asiatica*	Blue-throated Barbet	Ramphastidae	Least concern
27	*Megalaima haemacephala*	Coppersmith Barbet	Ramphastidae	Least concern
28	*Megalaima lineata*	Lineated Barbet	Ramphastidae	Least concern
29	*Megalaima virens*	Great Barbet	Ramphastidae	Least concern
30	*Merops leschenaulti*	Chestnut-headed Bee-eater	Meropidae	Least concern
31	*Merops orientalis*	Little green bee-eater	Meropidae	Least concern
32	*Merops philippinus*	Blue-tailed Bee-eater	Meropidae	Least concern
33	*Nyctyornis athertoni*	Blue-bearded Bee-eater	Meropidae	Least concern
34	*Phaenicophaeus tristis*	Green-billed Malkoha	Cuculidae	Least concern
35	*Picus flavinucha*	Greater Yellownape	Picidae	Least concern
36	*Polyplectron bicalcaratum*	Grey Peacock-Pheasant	Phasianidae	Least concern
37	*Psittacula finschii*	Grey-headed Parakeet	Psittadae	Near-threatened
38	*Sasia ochracea*	White-browed Piculet	Picidae	Least concern
39	*Streptopelia chinensis*	Spotted Dove	Columbidae	Least concern
40	*Streptopelia orientalis*	Oriental Turtle-Dove	Columbidae	Least concern
41	*Streptopelia tranquebarica*	Red Collared-Dove	Columbidae	Least concern
42	*Tringa hypoleucos*	Common Sandpiper	Scolopacidae	Least concern
43	*Vanellus indicus*	Red-wattled Lapwing	Charadriidae	Least concern

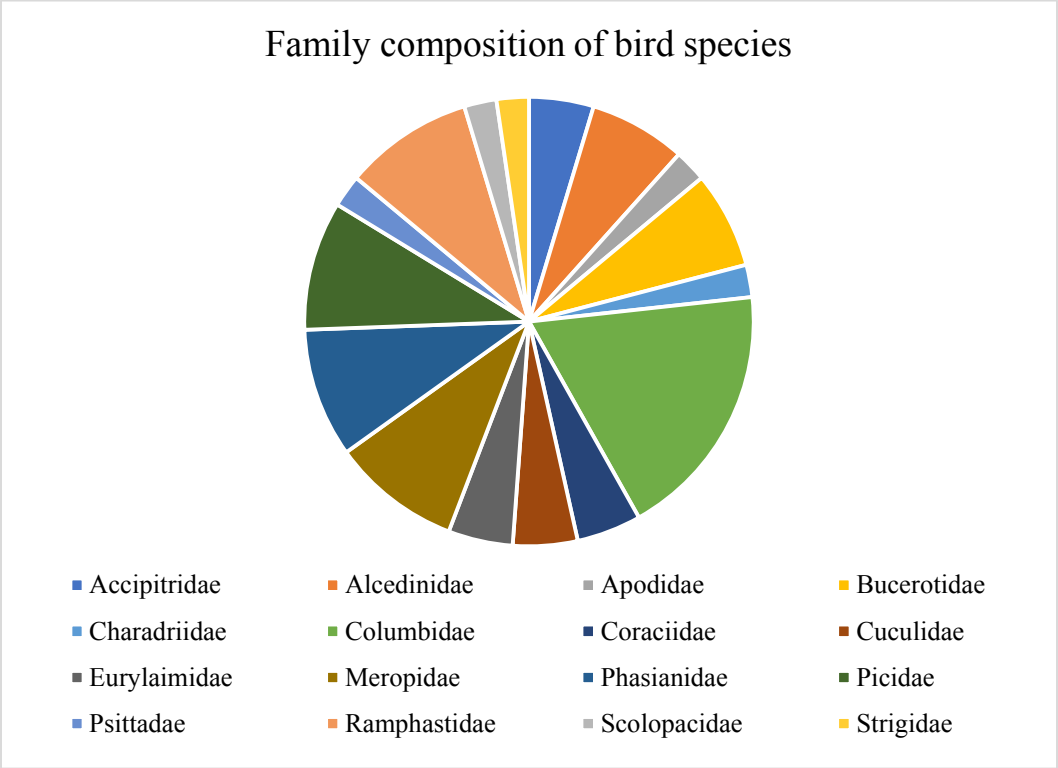


Fig 18: Family composition of bird species recorded around the power house area

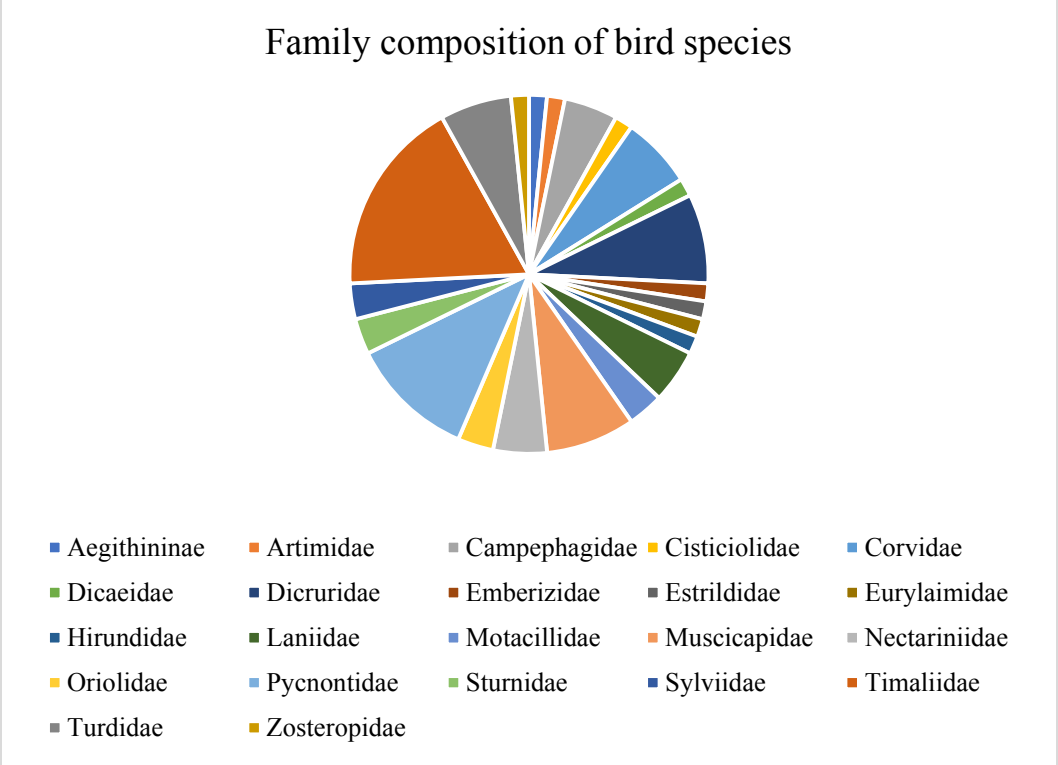


Fig 19: Family composition of bird species recorded around the dam site

Conservation Status for *Buceros bicornis* (Great Hornbill)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Aves	Bucerotiformes	Bucerotidae

Scientific Name:	*Buceros bicornis*
Species Authority:	Linnaeus, 1758
Common Name(s): English – Great Hornbill	
Taxonomic Source(s):	del Hoyo, J., Collar, N.J., Christie, D.A., Elliott, A. and Fishpool, L.D.C. 2014. *HBW and BirdLife International Illustrated Checklist of the Birds of the World*. Lynx Edicions BirdLife International.

Assessment Information

Red List Category & Criteria:	Near Threatened ver 3.1
Year Published:	2015
Date Assessed:	2013-11-03
Assessor(s):	BirdLife International
Reviewer(s):	Butchart, S.
Contributor(s):	Bishop, K.
Facilitator/Compiler(s):	Benstead, P., Gilroy, J., Khwaja, N. & Taylor, J.
Justification: Although this species has a large range, it occurs at low densities and is patchily distributed. It may have a moderately small population and is likely to be declining moderately rapidly throughout its range; it is therefore listed as Near Threatened as it almost qualifies for listing as threatened under criteria A2cd+3cd+4cd; C1.	
Previously published Red List assessments:	2013 – Near Threatened (NT) 2012 – Near Threatened (NT) 2008 – Near Threatened (NT) 2004 – Near Threatened (NT) 2000 – Lower Risk/near threatened (LR/nt) 1994 – Lower Risk/least concern (LR/lc) 1988 – Lower Risk/least concern (LR/lc)

Geographic Range

Range Description:	*Buceros bicornis* has a wide distribution, occurring in **China** (rare resident in west and south-west Yunnan and south-east Tibet), **India** (locally fairly common, but declining), **Nepal** (local and uncommon, largely in protected areas), **Bhutan** (fairly common), Bangladesh (vagrant), **Myanmar** (scarce to locally common resident throughout), **Thailand** (widespread, generally scarce but locally common), **Lao PDR** (formerly common; currently widespread but scarce and a major decline has clearly occurred), **Viet**

	Nam (rare and declining resident), **Cambodia** (rare), peninsular **Malaysia** (uncommon to more or less common) and **Indonesia**: the species is now uncommon on Sumatra where it has shown a significant decline following recent devastation of the island's lowland forest (K. D. Bishop *in litt.* 2012).
Countries occurrence:	**Native**: Bhutan; Cambodia; China; India; Indonesia; Lao People's Democratic Republic; Malaysia; Myanmar; Nepal; Thailand; Viet Nam **Introduced:** Singapore **Vagrant:** Bangladesh

Habitat and Ecology

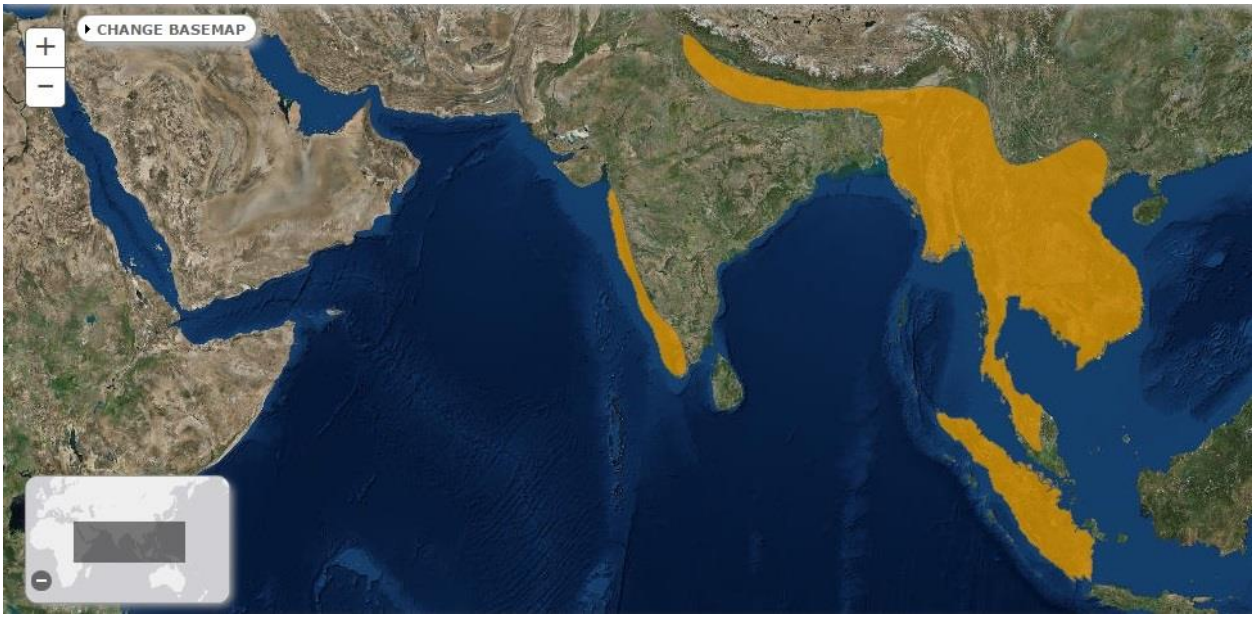
Habitat and Ecology:	This species frequents wet evergreen and mixed deciduous forests, ranging out into open deciduous areas to visit fruit trees and ascending slopes to at least 1,560 m (Mudappa and Raman 2009). The abundance of this species tends to be correlated with the density of large trees, and it is therefore most common in unlogged forest; indeed, recent work has shown a significant nesting preference for larger trees, usually in old-growth forest (James and Kannan 2009).
Systems:	Terrestrial
Continuing decline in area, extent and/or quality of habitat:	Yes
Generation Length (years):	18.4
Movement patterns:	Not a Migrant

Threats

Major Threat(s):	Logging is likely to have impacted on this species throughout its range, particularly as it shows a preference for forest areas with large trees that may be targeted by loggers. Forest clearance for agriculture is also likely to have contributed to declines. It is particularly susceptible to hunting pressure as it is large and visits predictable feeding sites (such as fruiting trees), and its casques are kept or sold as trophies. It is also probably impacted by the pet trade (Eames 2008).

Conservation Actions

Conservation Actions:	**Conservation Actions Underway** CITES Appendix I. The species is captively bred in zoos (Jensen 2008). It occurs in protected areas including Anamalai Tiger Reserve in the Western Ghats, India (Mudappa and Raman 2009). **Conservation Actions Proposed** Monitor populations across its range to determine the magnitude of declines and rates of range contraction. Campaign for the protection of remaining extensive tracts of lowland forest throughout its range. Develop the existing captive breeding population to support future reintroduction and supplementation efforts.



Range Map for *Buceros bicornis* (Great Hornbill)

Source: IUCN.org

Conservation Status for *Aceros nipalensis* (Rufous-necked Hornbill)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Aves	Bucerotiformes	Bucerotidae

Scientific Name:	*Aceros nipalensis*
Species Authority:	(Hodgson, 1829)
Common Name(s): English – Rufous-necked Hornbill, Rufous-cheeked Hornbill	
Taxonomic Source(s):	del Hoyo, J., Collar, N.J., Christie, D.A., Elliott, A. and Fishpool, L.D.C. 2014. *HBW and BirdLife International Illustrated Checklist of the Birds of the World*. Lynx Edicions BirdLife International.
Identification information:	117 cm. Large hornbill with distinctive rufous head and underparts. Males are black above with white-tipped outer primaries, white tail with black basal half, pale yellowish bill with row of vertical dark ridges on upper mandible and almost no casque, blue orbital skin and red gular skin. Female has black head, neck and underparts and slightly duller orbital skin. Juvenile is like male but bill smaller without dark ridges, tail feathers may be narrowly dark-tipped. **Voice** Loud barking *kup* or *kok* notes.

Assessment Information

Red List Category & Criteria:	Vulnerable A2cd+3cd+4cd ver 3.1
Year Published:	2012

Date Assessed:	2012-05-01
Assessor(s):	BirdLife International
Reviewer(s):	Butchart, S. & Symes, A.
Contributor(s):	Bishop, K., Eames, J.C., Ghose, D. & Praveen, J.
Facilitator/Compiler(s):	Benstead, P., Bird, J., Davidson, P., Derhé, M., Mahood, S., Peet, N., Tobias, J.
Justification: This large hornbill qualifies as Vulnerable because it has a small, rapidly declining population as a result of destruction of evergreen forest and hunting (BirdLife International 2001).	
Previously published Red List assessments:	2008 – Vulnerable (VU) 2004 – Vulnerable (VU) 2000 – Vulnerable (VU) 1996 – Vulnerable (VU) 1994 – Vulnerable (VU) 1988 – Threatened (T)

Geographic Range

Range Description:	*Aceros nipalensis* is currently known from **Bhutan**, north-east **India**, **Myanmar**, southern Yunnan and south-east Tibet, **China**, **Thailand**, **Laos** and **Vietnam**. It has declined dramatically and is now very rare across much of its historical range. It is thought to be extinct in Nepal, and to be close to extinction in Vietnam (J. C. Eames *in litt.* 2007); it has also disappeared from many areas in Thailand. While still widespread and fairly common in Bhutan (K. D. Bishop *in litt.* 2007), healthy populations elsewhere survive only in Namdapha National Park, India, Nakai-Nam Theun National Biodiversity Conservation Area, central Laos and perhaps also Huai Kha Khaeng, west Thailand, and Xishuangbanna Nature Reserve, China. Population densities in these strongholds have led some to suppose that the species is more widespread and common than field surveys suggest (Kinnaird and O'Brien 2007). It is perhaps locally common in north Myanmar, and there are recent records from West Bengal (D. Ghose *in litt*. 2005) and Eaglenest Wildlife Sanctuary, Arunachal Pradesh, India (Choudhury 2003, Datta 2009).
Countries occurrence:	Native: Bhutan; China; India; Lao People's Democratic Republic; Myanmar; Thailand; Viet Nam Regionally extinct: Nepal

Habitat and Ecology

Habitat and Ecology:	It inhabits mature broadleaved forests, generally between 600-1,800 m (maximum altitude 2,200 m), but locally down to 150 m. It has also been recorded in dry woodland (K. D. Bishop *in litt.* 2007). It nests (usually March-June) in tall, wide-girthed trees. Evidence suggests that some populations make seasonal movements between forested areas in response to variations in the abundance of fruiting trees.
Systems:	Terrestrial
Continuing decline in area, extent and/or quality of	Yes

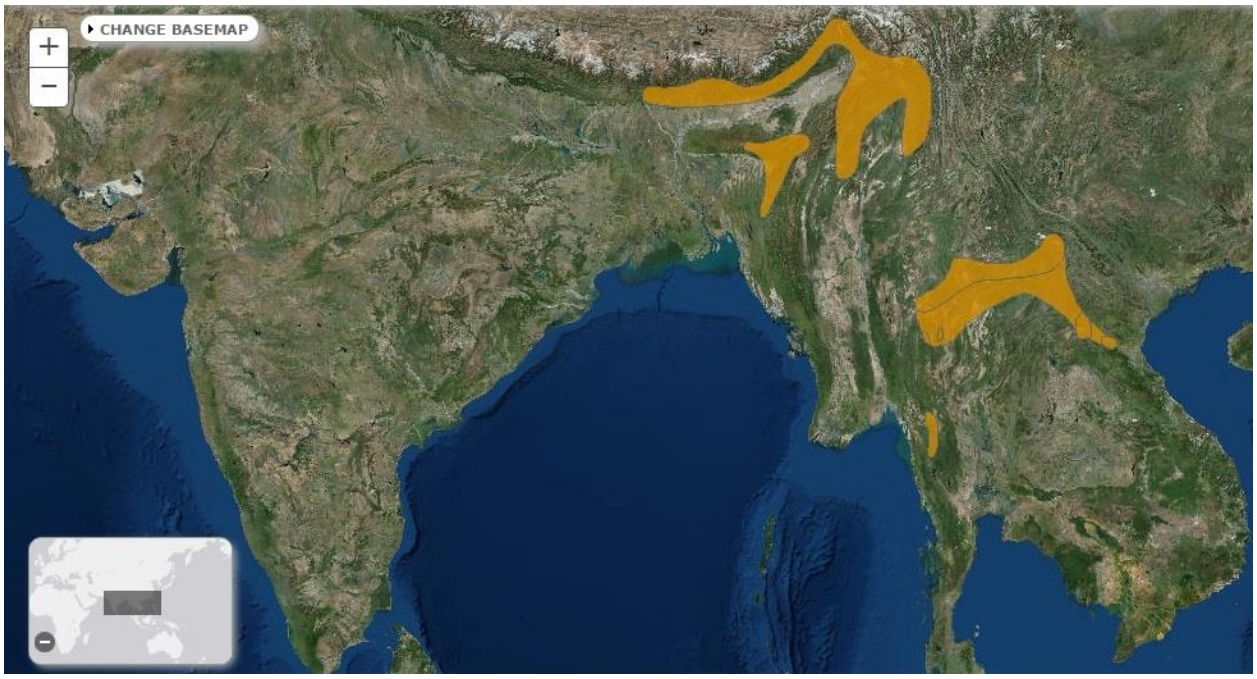
habitat:	
Generation Length (years):	19
Movement patterns:	Not a Migrant

Threats

Major Threat(s):	Its dependence on large trees for feeding and nesting makes it especially susceptible to deforestation and habitat degradation through logging, shifting cultivation and clearance for agriculture. Furthermore, viable populations require vast tracts of forest to survive, exacerbating its susceptibility to habitat fragmentation. These problems are compounded by widespread hunting and trapping for food, and trade in pets and casques. Hunting is the primary threat to the species in Arunachal, India (Datta 2009).

Conservation Actions

Conservation Actions:	**Conservation Actions Underway** CITES Appendix I and II. The following protected areas support important populations: Xishuangbanna Nature Reserve, China, Thrumshing La National Park, Bhutan, Namdapha National Park, Arunachal Pradesh, India, Nakai-Nam Theun National Biodiversity Conservation Area, Laos, and Um Phang and Maewong National Parks and Huai Kha Khaeng and Thung Yai Wildlife Sanctuaries, Thailand. Field surveys were conducted in Namdapha National Park, Kamlang Wildlife Sanctuary, Jairampur Forest Division and Deomali Forest Division, Arunachal Pradesh, India, during 1996-1999 and 2002-2004 (Datta 2009). **Conservation Actions Proposed** Conduct further surveys to clarify its distribution and status. Monitor trends in selected key populations. Protect remaining extensive tracts of forest, extend existing protected areas where appropriate, and strictly control hunting in protected areas. Lobby for improved logging practices that leave patches of old growth or large trees. Design and implement hornbill conservation programmes aimed at reducing hunting levels.



Range map for *Aceros nipalensis* (Rufous-necked Hornbill, Rufous-cheeked Hornbill)

Source: IUCN.org

Conservation Status for *Psittacula finschii* (Grey-headed Parakeet)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Aves	Psittaciformes	Psittacidae

Scientific Name:	*Psittacula finschii*
Species Authority:	(Hume, 1874)
Common Name(s): English – Grey-headed Parakeet	
Taxonomic Source(s):	del Hoyo, J., Collar, N.J., Christie, D.A., Elliott, A. and Fishpool, L.D.C. 2014. *HBW and BirdLife International Illustrated Checklist of the Birds of the World*. Lynx Edicions BirdLife International.

Assessment Information

Red List Category & Criteria:	Near Threatened ver 3.1
Year Published:	2013
Date Assessed:	2013-11-01
Assessor(s):	BirdLife International
Reviewer(s):	Butchart, S.

Contributor(s):	Choudhury, S., Duckworth, J.W., Gray, T., Mahood, S., Rainey, H., Round, P., Timmins, R. & Zhang, M.
Facilitator/Compiler(s):	Butchart, S., Ekstrom, J. & Taylor, J.
Justification: This species has been uplisted from Least Concern on the basis of new information about its population trend. It is listed as Near Threatened because it is suspected to be undergoing a moderately rapid population decline owing to on-going habitat loss and trapping pressure.	
Previously published Red List assessments:	2012 – Least Concern (LC) 2009 – Least Concern (LC) 2008 – Least Concern (LC) 2004 – Least Concern (LC) 2000 – Lower Risk/least concern (LR/lc) 1994 – Lower Risk/least concern (LR/lc) 1988 – Lower Risk/least concern (LR/lc)

Geographic Range

Range Description:	*Psittacula finschii* is distributed from eastern **India**, **Bhutan** and **Bangladesh**, through southern and central **Myanmar**, northern and central **Thailand** and **Cambodia**, **Laos**, **Vietnam** and south-western **China** (central Szechuan and northern Yunnan) (Juniper and Parr 1998). The species is subject to fluctuations, with declines noted in some parts of its range (Juniper and Parr 1998). It is described as generally scarce to rare in Cambodia, and absent from large areas of superficially suitable habitat (S. Mahood *in litt*. 2013, H. Rainey *in litt*. 2013), but is locally common in Mondulkiri, in the east of the country (F. Goes *in litt*. 2013, T. Gray *in litt*. 2013). It may have been extirpated from south-western Cambodia (F. Goes *in litt*. 2013). Likewise, the species's range has contracted in northern Laos, where favoured habitats are characterised as scarce and fragmented (J. W. Duckworth *in litt*. 2013). It is very rare in Bangladesh, and was believed to have been extirpated; the only recent sighting is from the Chittagong Hill Tracts (S. U. Choudhury *in litt*. 2013). In contrast, the species is characterised as common in parts of Myanmar (C. Robson *in litt*. 2013) and relatively widespread in Thailand (P. Round *in litt*. 2013). Overall, the population is suspected to be in on-going decline.
Countries occurrence:	Native: Bangladesh; Bhutan; Cambodia; China; India; Lao People's Democratic Republic; Myanmar; Thailand; Viet Nam

Habitat and Ecology

Habitat and Ecology:	This species frequents oak, teak, cedar and pine forest, open wooded hillsides and cultivated areas with tall trees, at up to 3,800 m (Juniper and Parr 1998). In Cambodia, it may more regularly occur in deciduous hill forest, and in areas with evergreen and semi-evergreen vegetation (S. Mahood *in litt*. 2013, R. J. Timmins *in litt*. 2013), and is noted to be patchily distributed in both lowland deciduous forest and degraded hill forest on the Sen Monorom plateau (T. Gray *in litt*. 2013). It is noted to extensively use habitats in anthropogenically modified open landscapes (R. J. Timmins *in litt*. 2013). In Myanmar, it is

	described as common in deciduous forest and partly cultivated areas (C. Robson *in litt*. 2013). It feeds on leaf buds, seeds, fruit and flowers. In central Myanmar, it breeds in January-March (Juniper and Parr 1998).
Systems:	Terrestrial
Continuing decline in area, extent and/or quality of habitat:	Yes
Generation Length (years):	7.5
Movement patterns:	Altitudinal Migrant

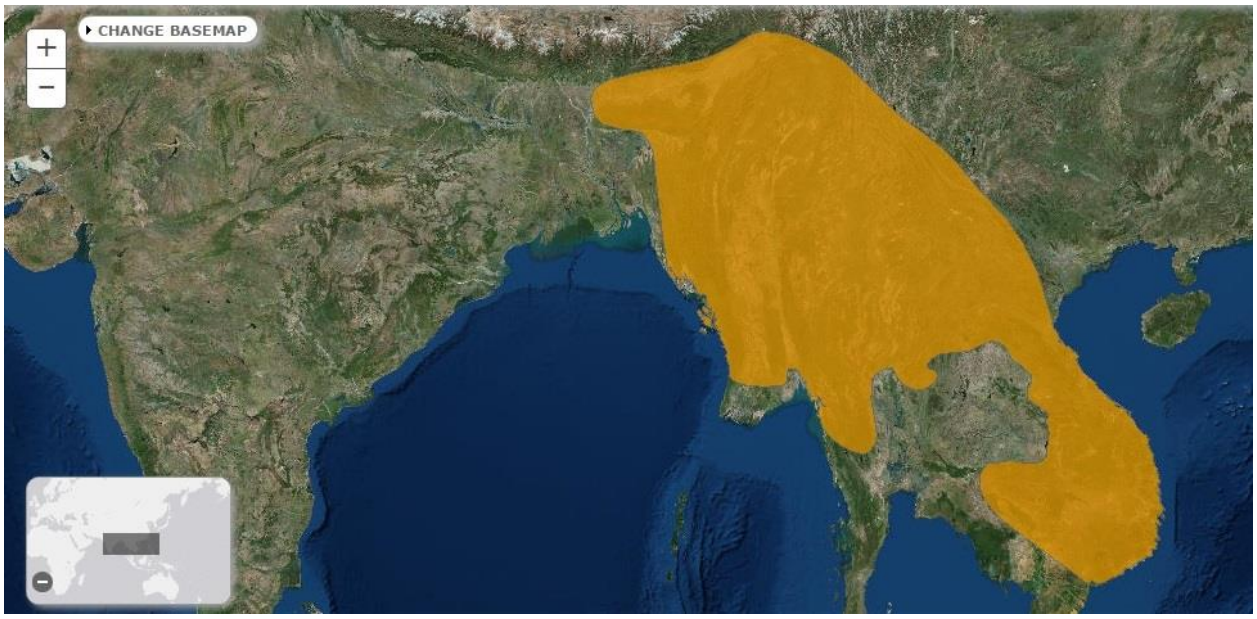
Threats

Major Threat(s):	The species is widely captured for the cage-bird trade and is locally kept as a pet, for example in Laos and China (J. W. Duckworth *in litt*. 2013, M. Zhang *in litt*. 2013). In China, poaching and illegal trade of this species continue: it is reported that in one village, every family has one individual of this species as a pet, and they carry an asking price of up to US$80 (M. Zhang *in litt*. 2013). Trapping pressure may also be contributing to the observed decline in Cambodia (F. Goes *in litt*. 2013). Lowland forests in Indochina are under intense pressure, particularly in Cambodia, owing to clearance for large-scale industrial agriculture. This particularly affects areas with evergreen or semi-evergreen forest, rather than deciduous forest, owing to better conditions for cultivation (S. Mahood *in litt*. 2013). This species's apparent reliance on patches of evergreen and semi-evergreen forest may make it more susceptible to the impacts of logging, particularly because it is likely to rely on large trees for nesting. In habitats where large trees are scarce, such as hill forest and landscapes with a mixture of deciduous forest, patches of evergreen and semi-evergreen forest are under particular pressure from logging, even for local use (S. Mahood *in litt*. 2013). Habitat loss in Cambodia is expected to have a devastating impact on this species during the next decade, although there may be a lag before the true effects are observed in the population (H. Rainey *in litt*. 2013). In Laos, the species's presence in hilly areas may have buffered it from the worst impacts of logging and habitat clearance (J. W. Duckworth *in litt*. 2013).

Conservation Actions

Conservation Actions:	**Conservation Actions Underway** The species is known to occur in some protected areas across its range, such as Mondulkiri Protected Forest, Cambodia (T. Gray *in litt*. 2013). **Conservation Actions Proposed** Conduct regular range-wide surveys to monitor the species's population trend. Monitor rates of habitat loss and degradation within the species's range. List the species under CITES. Quantify the impacts of capture for trade. Conduct awareness-raising activities to reduce trapping pressure and trade. Increase

	the area of suitable habitat within protected areas.



Range map for *Psittacula finschii* (Grey-headed Parakeet)

Source: IUCN.org

***Buceros bicornis* (Great Hornbill)**

***Aceros nipalensis* (Rufous-necked Hornbill)**

Grey-headed Parakeet *(Psittacula finschii)*

Fig 20: Some bird species recorded in survey area

Mammals

A total of 19 mammal species were recorded in Chibwenge dam site and Power House area. Among them 7 mammal species were listed as threatened species under IUCN Red List. Out of the recorded threatened species, 2 species were endangered species, 1 species was recorded as critically endangered and another 2 species were recorded as vulnerable species.

Table 12: List of mammal species recorded around the dam site

Sr. No.	Scientific name	Common name	Family	IUCN Status	Remark
1	*Martes flavigula*	Yellow-throated Marten	Mustelidae	LR	Interview
2	*Viverricula indica*	Small Indian Civet	Viverridae	LR	Interview
3	*Paradoxurus hermaphrodites*	Common Palm Civet	Viverridae	LR	Observed
4	*Herpestes Javanicus*	Small Asian Mongoose	Herpestidae	LR	Interview
5	*Prionailurus bengalensis*	Leopard Cat	Felidae	LC	Interview
6	*Catopuma temminckii*	Asian Golden Cat	Felidae	NT	Interview
7	*Sus scrofa*	Eurasian Wild Pig	Suidae	LR	Tracks
8	*Rusa unicolor*	Sambar	Cervidae	VU	Tracks
9	*Muntiacus muntjak*	Red Muntjac	Cervidae	LR	Tracks
10	*Ratufa bicolor*	Black Giant Squirrel	Sciuridae	LR	Observed
11	*Callosciurus erythraeus*	Pallaus's Squirrell	Sciuridae	LR	Observed

12	*Atherurus macrourus*	Brush-tailed Porcupine	Hystricidae	LR	Interview

Table 13: List of mammal species recorded around the power house

Sr. No.	Scientific name	Common name	Family	IUCN Status	Remark
1	*Manis pentadactyla*	Chinese Pangolin	Manidae	CR	Interview
2	*Macaca mulatta*	Rhesus Macaque	Cercopithecidae	LC	Observed
3	*Macaca assamensis*	Assamese Macaque	Cercopithecidae	NE	Interview
4	*Hoolock hoolock*	Hoolock gibbon	Hylobatidae	EN	Voice
5	*Cuon alpinus*	Dhole	Canidae	EN	Tracks
6	*Ursus thibetanus*	Asian Black Bear	Ursidae	VU	Sign
7	*Helarctos malayanus*	Sun Bear	Ursidae	VU	Interview

EN = Endangered

NT = Near Threatened

LR = Lower Risk

VU = Vulnerable

LC = Least Concerned

Note: (1) Conservation Status for *Manis pentadactyla* (Chinese Pangolin) was changed to Critically Endangered (CR) at IUCN Red List version 3.1, 2016-2.

(2) Conservation Status for *Manis Macaque* (Assamese *assamensis*) was changed to Not Evaluated (NE) at IUCN Red List version 3.1, 2016-2.

(3) Conservation Status for *Catopuma temminckii* (Asian Golden Cat) was changed to Near Thratened (NT) at IUCN Red List version 3.1, 2016-2.

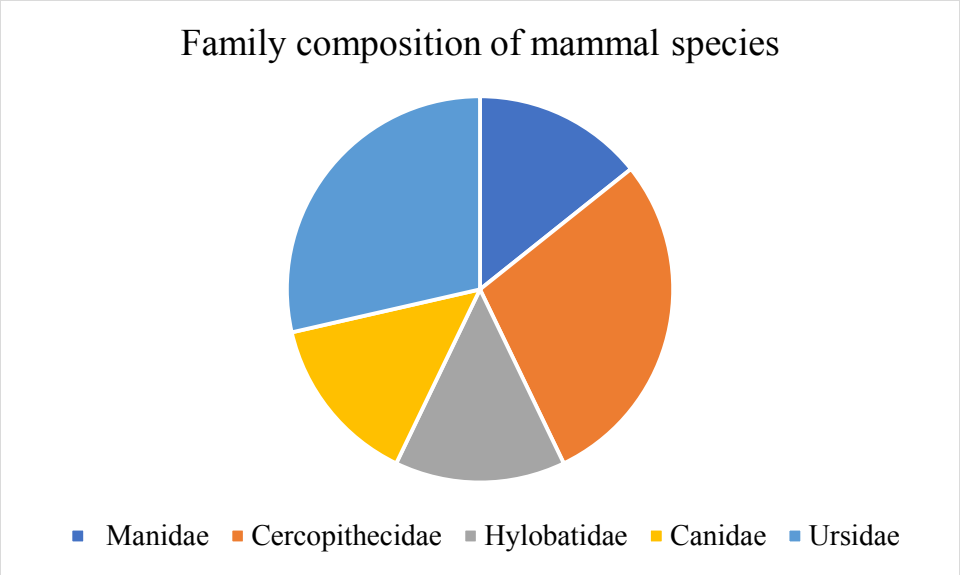


Fig 21: Family composition of mammal species recorded around the power house area

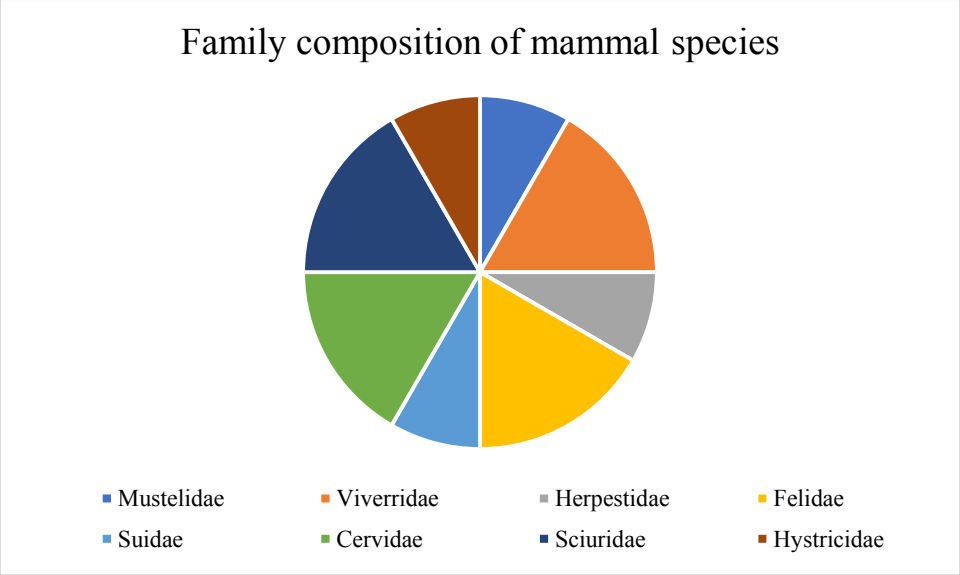


Fig 22: Family composition of mammal species recorded around the dam site

Conservation Status for *Manis pentadactyla* (Chinese Pangolin)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Pholidota	Manidae

Scientific Name:	*Manis pentadactyla*

Species Authority:	Linnaeus, 1758
Common Name(s):	English – Chinese Pangolin French – Pangolin de Chine, Pangolin à queue courte Spanish – Pangolín Chino

Assessment Information

Red List Category & Criteria:	Critically Endangered A2d+3d+4d ver 3.1
Year Published:	2014
Date Assessed:	2013-06-26
Assessor(s):	Challender, D., Baillie, J., Ades, G., Kaspal, P., Chan, B., Khatiwada, A., Xu, L., Chin, S., KC, R., Nash, H. & Hsieh, H.
Reviewer(s):	Duckworth, J.W.
Justification: This species is listed as Critically Endangered A2d+3d+4d due to high levels of poaching for meat and scales, both targeted and untargeted, across its range. Although this species has been used locally across its range historically, which continues today, much poaching is now for international trade, driven largely by market demand in China. Over the time frame of three generations (21 years, generation length estimated at seven years) this species has been heavily exploited for international trade based on trade figures, while the subspecies, *M. p. pusillia*, which occurs on Hainan Island, has been reduced to remnant populations. Evidence indicates that poaching has now shifted to the south and west of this species' range and there has been a very heavy unrecorded and therefore likely illicit trade involving an estimated ten of thousands of animals in international trade in the last decade. There are predicted continuing declines of <90% over the next 21 years or three generations.	
Previously published Red List assessments:	2008 – Endangered (EN) 1996 – Lower Risk/near threatened (LR/nt)

Geographic Range

Range Description:	This species occurs in the Himalayan foothills of Nepal, southern Bhutan and north and northeastern India, possibly northeastern Bangladesh, northern and western Myanmar, to northern and Annamite regions of Lao PDR and northern Viet Nam, northwest Thailand, and through southern China (south of the Chiangjiang - the Yangtze River) to Hainan, Taiwan (P.R. China) and Hong Kong SAR. However, it has likely been extirpated from parts of its current range, the limits of which are poorly known and may never be elucidated, due to high levels of exploitation historically. It exists at high altitudes, especially in the southern and western parts of its range, though also occurs at much lower altitudes, for example in Hong Kong and likely in the northeast of its range. Its latitudinal range is thought to overlap considerably with that of *Manis javanica*, with *Manis pentadactyla* tending to occur in hills and mountains and the former more generally found at lower altitudes. However, recent interviews with hunters in Viet Nam suggest that the two species can be found in the same areas of forest, and that the differences between them are ecological, relating to diet and habitat use, rather than altitude (P. Newton pers. comm. 2008). The species is marginally present in northern India (Bihar) and has been recorded in northeastern India

	(Arunachal Pradesh, Assam, Meghalaya, Nagaland, Manipur, Tripura, Mizoram, Sikkim and the northern part of West Bengal) (Srinivasulu and Srinivasulu 2012, Tikader 1983, Zoological Society of India 2002). The species occurs in southern Bhutan (though potentially central and western areas only) and Nepal, where it is confined to elevations below approximately 2,000 m asl (Baral and Shah 2008, Mitchell 1975, Srinivasulu and Srinivasulu 2012). It has been recorded as present in the Suklaphanta wildlife reserve in southwest Nepal within the last four years and in Jajarkot district in mid-west Nepal (H.S. Baral pers. comm. 2013). This species has been recorded in north and central Lao PDR, however, there are too few locality records to determine the geographic and altitudinal range of the species in the country with any accuracy (Duckworth *et al*. 1999; Timmins and Evans 1996). In China this species' distribution extends from the southern border as far north as Changjiang, including on the island of Chusan at the mouth of the Changjiang (Allen and Coolidge 1940). Available evidence indicates it extends to the provinces of Sichuan, Guizhou, Yunnan, Anhui, Jiangsu, Zhejiang, Jiangxi, Hunan, Guangdong, and Fujian, and in the Autonomous Regions of Guangxi Zhuang, Tibet as well as Hainan Island, though it is replaced here by the subspecies *Manis pentadactyla pusilla* (Heath 1992, Zhang *et al*. 1997). It has been recorded in several sites in the central and northeast New Territories, as well as in Hong Kong SAR (including Lantau Island, but not on the smaller outlying islands), where it occurs at low altitudes (Reels 1996). In Taiwan (P.R. China), the species is replaced by the subspecies *Manis pentadactyla pentadactlya* (Formosan Pangolin, Chao *et al.* 2005) which occurs on the periphery of the Central Mountain Range, the Western Foothill Range, the Taoyuan Tableland, the Ouluanpi Tableland, the East Coast Mountain Range, the Tatun Volcano Group, Taipei Basin, Puli Basin, and the Pingtun Plain (Chao Jung-Tai 1989, Chao Jung-Tai *et al*. 2005). The upper limit of occurrence in Taiwan is around 2,000 m asl (Chao Jung-Tai 1989). The species is plausibly widespread in northern Myanmar, although there are few records and its exact distribution is not well known (Salter 1983, Corbet and Hill 1992, J.W. Duckworth pers. comm. 2006). The only records of the species in Thailand are from: Doi Inthanon (formerly Doi Angka) in Changwat, Chiang Mai (northern Thailand), sometime in 1937 and 1939 (Allen and Coolidge 1940) and Doi Sutep, Chiangmai (northern Thailand) in 1901. All records of the species in Viet Nam are from the northern half of the country, as far south as Quang Tri Province and up to 1,000 m asl though actual upper altitudinal limits here are unknown (Bourret 1942, van Peenen *et al*. 1969, Do Tuoc pers. comm. 2006, P. Newton pers. comm. 2008). Little is known about the species' distribution in Bangladesh (CITES 2000).
Countries occurrence:	Native: Bhutan; China; Hong Kong; India; Lao People's Democratic Republic; Myanmar; Nepal; Taiwan, Province of China; Thailand; Viet Nam

Habitat and Ecology

Habitat and Ecology:	This species is found in a wide range of habitats, including primary and secondary tropical forests, limestone forests, bamboo forests, broad-leaf and coniferous forests, grasslands and agricultural fields (Chao Jung-Tai 1989, Gurung 1996). The species digs its own burrows, or enlarges passages made by termites. Indications are that home ranges are relatively large, although concrete data are lacking (Heath and Vanderlip 1988). Hunters interviewed in Viet Nam indicate that *Manis pentadactyla* digs its own, long burrows underground, which they use both to eat termites and in which to sleep (P. Newton pers. comm. 2008). The main way hunters catch this species is by using dogs, tracking them and digging them out of burrows (Newton *et al.* 2008, P. Newton pers. comm. 2008). This species is solitary, primarily nocturnal (sometimes crepuscular), and largely terrestrial although it is fully capable of climbing trees and, like other pangolins, swims well (Heath and Vanderlip 1988; Chao Jung-Tai 1989). Little is known about the species' life history, although in China and Taiwan, young (normally one and occasionally two) are reportedly born in spring (Allen and Coolidge 1940, Chao Jung-Tai 1989). Hunters in Viet Nam reported that they never find this species in trees and it seems likely that it is far more terrestrial than the more arboreal *Manis javanica* (P. Newton pers. comm. 2008). Its diet consists of ants and termites and it has been noted that in China, there appears to be a close correlation between its distribution and the distribution of two termite species (*Coptotermes formosanus* and *Termes* (*Cyclotermes*) *formosanus*) which are assumed to form a major component of its diet (Allen and Coolidge 1940, Heath and Vanderlip 1988).
Systems:	Terrestrial
Continuing decline in area, extent and/or quality of habitat:	Yes
Generation Length (years):	7
Movement patterns:	Not a Migrant

Threats

Major Threat(s):	The primary threat to this species is hunting and poaching, both targeted and untargeted, for local, i.e. national level use as well as international trade, which is now driven largely by market demand in China, and this species is evidently subject to very heavy collection pressure across much of its range (Anon. 1999, Challender 2011, CITES 2000, Pantel and Chin 2009, Wu and Ma 2007). As has occurred historically, exploitation for consumptive, medicinal and spiritualistic reasons locally continue to take place (Anon. 1992, Anon. 1999, CITES 2000), but evidence suggests local use is often forgone in

favour of entering animals into national and international trade given their high monetary value (Newton *et al.* 2008). This is despite the introduction of CITES zero export quotas for wild-caught animals traded commercially in the year 2000 (Newton et al. 2008). Within the last decade trade in this species is estimated to have involved a minimum of tens of thousands of individuals (Challender *et al.* in prep.) and market demand in China, where pangolin meat is consumed as a luxury product and its scales used in traditional medicines, appears to driving this trade (Wu and Ma 2007, Zhang *et al.* 2008, Challender *et al.* in prep.). Here pangolin meat is consumed conspicuously as a luxury wild meat dish for which affluent consumers are willing to pay high prices. This species also appears in both Chinese and Vietnamese traditional medicinal literature which prescribes the use of scales in traditional medicines to: treat skin conditions, improve blood circulation and to stimulate milk secretion in lactating women (Ellis 2005). In China, pangolin scales continue to be prescribed for these and other ailments, including cancer (Yue 2008), through designated outlets such as hospitals, but also through traditional medicine retailers, as in Viet Nam. However, given the decline in this species historically, especially in China (see below), it is difficult to determine if scales sold today are those from stockpiles of scales maintained by the State Forestry Administration in China, or from the Sunda pangolin *Manis javanica* or other species of Asian pangolin.

As a result of past and ongoing exploitation, and within the time frame of three generations of this species (estimated at 21 years; generation length estimated at seven years), it has been inferred that *Manis pentadactyla* is commercially extinct in China (SATCM 1996, Wu *et al.* 2004), though remnant populations are understood to remain and further research is needed to confirm presence/absence (P.L.B. Chan pers. comm. 2013). Similarly, extensive fieldwork on Hainan Island between 1997 and 2013 suggests the subspecies *M. p. pusilla* is commercially extinct and has been reduced to remnant populations only (P.L.B. Chan pers. comm. 2013).

It is significant that this species is reported to be an easier species to locate and hunt in the wild, compared to the Sunda pangolin *Manis javanica* (P. Newton pers. comm.). This is because it is more terrestrial, and is thus: a) easier to track their scent using specialised hunting dogs (the scent of *Manis javanica* is often lost at points at which the animal climbed a tree); and b) has conspicuous soil burrows that are more easily accessed than the tree hollows favoured by *Manis javanica* (P. Newton pers. comm.). For these reasons, the hunting threat to *Manis pentadactyla* is perhaps even greater than that to *Manis javanica* (P. Newton pers. comm.).

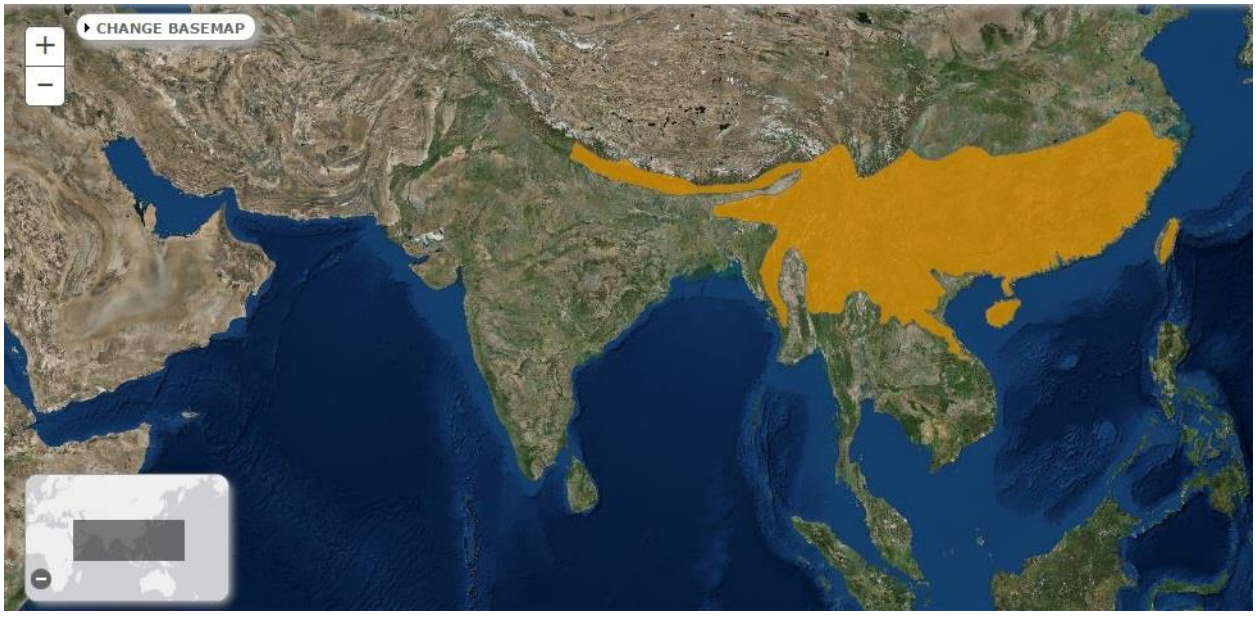
Unfortunately, very little research has been conducted on pangolins or their hunting, poaching and trade in Asia, though one exception is research conducted by Newton *et al.* (2008) in Viet Nam. Here, every hunter interviewed (N = 84) reported that they now sell all pangolins that they catch (P. Newton pers. comm. 2008). Prices are so high that local, subsistence use of pangolins for either meat or their scales has completely halted in favour or selling to the national/international trade (P. Newton pers. comm. 2008). The only occasions on which a hunter might eat a pangolin is if it is already dead when they retrieve it from a trap and then they would use the meat and sell the scales (P. Newton pers. comm. 2008). MacMillan and Nguyen (2013) report similar findings and it is likely this circumstance is

	prevalent across Asia. The price per kg of pangolin (in Viet Nam, at least) has escalated rapidly (at a rate greater than that of annual inflation) since the commercial trade in wild pangolins began to expand in about 1990 (P. Newton pers. comm. 2008). Prices paid to hunters now exceed US$95 per kg (Viet Nam, P. Newton pers. comm. 2008) which is reflected up the trade chain with retail prices in China and Viet Nam having increased in recent years (D.W.S. Challender pers. comm. 2013).

Conservation Actions

Conservation Actions:	This species is listed in CITES Appendix II and zero annual export quotas were established for wild-caught specimens traded for primarily commercial purposes in 2000 (CoP11). It is listed as a protected species in national or sub-national legislation in all range states, except Bhutan. While it has been recorded in, and may still occur in, some protected areas, protected area designation alone is insufficient to protect this species. Greater enforcement and management within protected areas to prevent poaching is needed as is strict enforcement along national and international trade routes, the identification and verification of strongholds where conservation efforts should be focused, and efforts to reduce consumer demand in key markets. In Bangladesh, this species is protected by the Wildlife (Conservation & Security) Act 2012. In China *Manis pentadactyla* is a State Category II protected species under the Protection of Wildlife Act (1989). It is also afforded protection under the Regulations on the Implementation of Protection of Terrestrial Wild Animals (1992) and the Regulations on Management of Import and Export of Endangered Species of Wild Fauna and Flora 2006, which implements CITES. It also received further protection in the year 2000, following the promulgation of two judicial interpretations, which defined criteria for punishing crimes involving pangolins specifically. Similarly, a notification issued by national Chinese agencies in 2007 strengthened regulation for species used in traditional medicines, including pangolins, meaning hunting licenses for pangolins here are not to be issued and existing stockpiles of pangolin scales are to be subject to verification, certification and subject to retail trade only through designated outlets such as hospitals. In Hong Kong SAR this species is protected under the Wild Animals Protection Ordinance 1976 (amended 1980, 1996) and the Protection of Endangered Species of Animals and Plants 2006. In Taiwan (P.R. China), all *Manis* spp. have been protected since August 1990 under the 1989 Wildlife Conservation Law (amended 1994). In India, this species is completely protected being listed in Schedule I of the Wildlife Protection Act 1972 (amended 2003, 2006). In Thailand, all *Manis* spp. are classified as Protected Wild Animals under the 1992 Wild Animals Reservation and Protection Act B.E. 2535.

	In Nepal, this species is listed as a Protected Animal in Schedule I of the National Parks and Wildlife Protection Act (1973, as amended 1993). In Lao PDR *Manis pentadactyla* is listed in the Prohibition category of Lao PDR's Wildlife and Aquatic Law (2007) as a rare, near extinct, high value or species of special importance in the development of socio-economic, environmental, educational and scientific research. In Myanmar, this species is listed as a completely protected animal under the Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994). In Viet Nam this species is listed as legally protected in Group IIB of Decree 32 on the Management of Endangered, Precious and Rare species of wild plants and animals (2006). However, section 9 of this law permits pangolins seized from illicit trade to legally be sold back into trade. Lack of an appropriate solution for confiscated pangolins continues to be a major problem for enforcement agencies in Viet Nam.



Range map for *Manis pentadactyla* (Chinese Pangolin)

Source: IUCN.org

Conservation Status for *Hoolock hoolock* (Hoolock Gibbon)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Primates	Hylobatidae

Scientific Name:	*Hoolock hoolock*
Species Authority:	(Harlan, 1834)
Common Name(s): English – Western Hoolock Gibbon, Hoolock Gibbon, Western Hoolock French – Gibbon Hoolock Occidental, Hoolock Spanish – Gibón Hulock	
Synonym(s):	*Bunopithecus hoolock* ssp. *hoolock* (Harlan, 1834) *Hylobates hoolock* (Harlan, 1834) [*pro parte*
Taxonomic Notes:	This taxon is now considered monotypic; it was formerly considered conspecific with *Hoolock leuconedys*. The previous generic name, *Bunopithecus*, was changed by Mootnick and Groves (2005) to *Hoolock* (Haimoff *et al.* 1984).

Assessment Information

Red List Category & Criteria:	Endangered A2acd+3cd+4acd ver 3.1
Year Published:	2008
Date Assessed:	2008-06-30
Assessor(s):	Brockelman, W., Molur, S. & Geissmann, T.
Reviewer(s):	Mittermeier, R.A. & Rylands, A.B. (Primate Red List Authority)
Justification: Listed as Endangered as there is reason to believe the species has declined by at least 50% over the past 40 years (approximately three generations) due primarily to hunting and habitat loss. Over the coming 40 years, this decline is likely to reach similar proportions due to continuing habitat loss.	
Previously published Red List assessments:	2000 – Endangered (EN)

Geographic Range

Range Description:	This species is found in eastern Bangladesh, northeastern India (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura), and northwestern Myanmar (west of the Chindwin River). It might possibly occur in China (extreme southeastern Tibet). The distribution in India is restricted to points south of the Brahmaputra and east of the Dibang (Dingba Qu) Rivers (Choudhury 2001). Animals that once were common in the plains of Arunachal Pradesh (northeasternmost India) before that habitat was cultivated for agriculture and tea are not so anymore (Islam and Feeroz 1992). The boundary between the two species of *Hoolock* is the Chindwin River, which flows into the Ayerawady (Irrawady) River. At the headwaters in the north there is a hybrid zone or cline between the two species (since they are almost certainly not reproductively isolated). Das *et al*. (2006) reported the discovery of a population of *H. leuconedys* in Arunachal Pradesh, northeast India, which has traditionally been considered to be part of the range of *H. hoolock*.
Countries occurrence:	**Native:** Bangladesh; India (Assam); Myanmar

Habitat and Ecology

Habitat and Ecology:	This species is a forest-dweller that, depending on its locale, inhabits tropical evergreen rainforests, tropical evergreen and semi-evergreen forests, tropical mixed deciduous forests, and subtropical broadleaf hill forests. It has also been noted in bamboo "brakes" and hollock (*Terminalia myriocarpa*) and ajhar (*Largerstroemia flosreginae*) plantations. One gibbon pair in the Borajan Reserved Forest (north-east India) was observed to habitually descend from the trees to move over scrub and short bamboo especially while trying to reach the isolated food trees inside a village. This pair was found sleeping at heights of 0 m or less in bamboo clumps (Kakati 1997). Although gibbons may be moving through, or sleeping in, bamboo forest or plantations, they cannot survive in monocultures (W. Brockleman pers. comm.). Additionally, the species has been observed in two plains forest locations (Choudhury 1991). Its preferred habitat, however, is dense evergreen and semi-evergreen forests (Choudhury 2001). It has been recorded at altitudes of up to 2,500 m in Manipur, northeast India (Choudhury 2001). Home ranges in most populations range from 8-63 ha (Ahsan 2001; Alfred 1992; Alfred and Sati 1986, 1990; Feeroz and Islam 1992; Gittins and Tilson 1984; Islam and Feeroz 1992; Kakati 2004; Mukherjee 1986; Tilson 1979), but unusually large home ranges of 200-400 ha were reported from Tripura and Arunachal Pradesh, northeast India (Mukherjee 1982; Mukherjee *et al*. 1988). The western hoolock is a frugivorous species, with ripe fruits composing a majority of its diet (Ahsan 2001; Alfred and Sati 1986, 1994; Feeroz and Islam 1992; Islam and Feeroz 1992; Kakati 1997; Tilson 1979). A dominantly folivorous diet was reported during studies carried out in Assam's Borajan Reserved Forest, and in Tripura (Kakati 1997; Mukherjee 1986), and gibbons living in small forest fragments were observed to experience a period of almost total lack of fruit in their diet at the end of the dry season (Kakati, 2004). Low fruit availability may contribute to the relatively large home range sizes of some populations. In northeast India, the hoolock gibbon is recognized as being an important disperser of undigested seeds from large and small fruit-bearing trees (Das 2003).
Systems:	Terrestrial

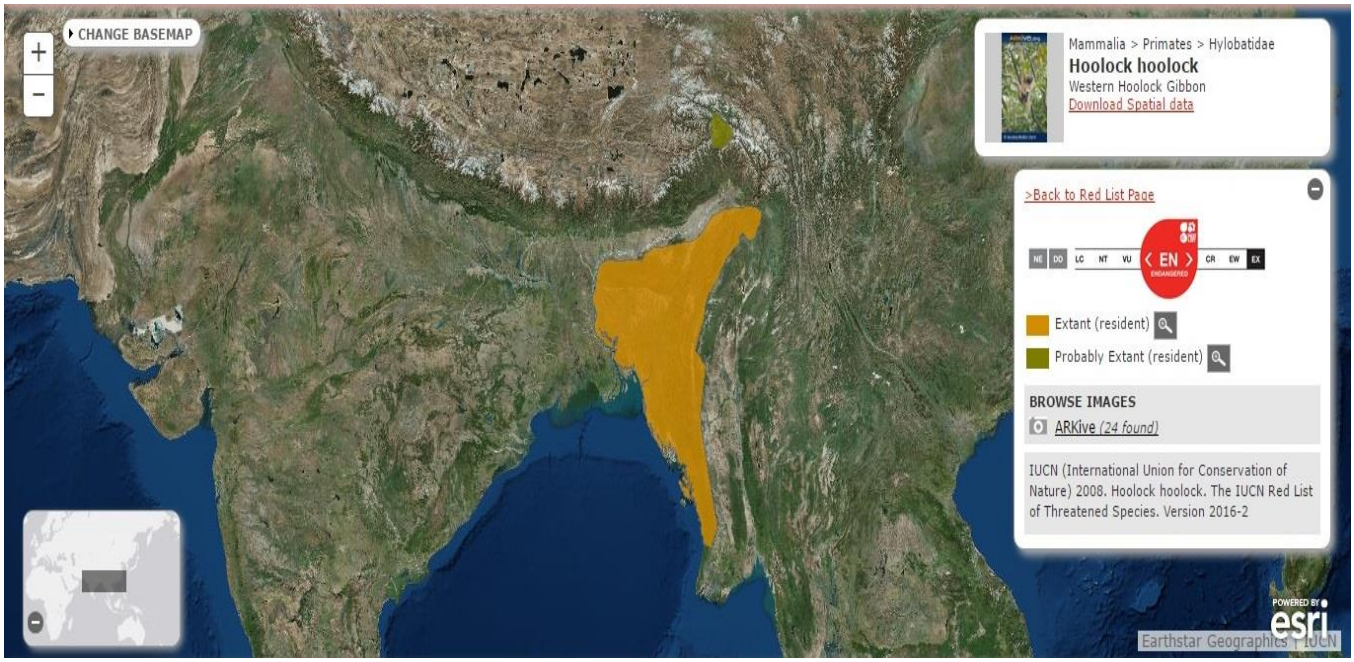
Threats

Major Threat(s):	In Bangladesh, the main threats are the combined effects of habitat loss, fragmentation, human interference and hunting (Islam and Feeroz 1992; Molur *et al.* 2005). Hunting is universal all over Bangladesh as well as India, and may be in Myanmar also. In China, the Tibetan population could be under threat from hunting for food or non-targeted hunting, but this is not established. In some Indian locales, these animals are rare due to large scale hunting for food and because some ethnic groups believe the gibbons have medicinal properties (Gupta 2005; J. Das pers. comm.). Additionally, jhoom cultivation threatens the habitats of Indian populations, some of which are

	relatively isolated already (Choudhury 1991). Affecting all northeastern Indian primate populations are harvesting of bamboo for paper mills, oil mining and exploration, and coal mining, which deplete habitat and cause pollution and disturbance (Choudhury 2001). Habitat fragmentation and loss are major threats in India (Molur *et al.* 2005). Small and restricted groups may not be viable because of genetic and demographic instabilities and because they are more affected by hunting pressure and habitat loss. Many small forest fragments are reported to have only one or a few gibbon groups. These have limited chances of surviving more than a few generations without translocation. In Myanmar, shifting cultivation is a major threat, and so is hunting. Although logging is restricted on the western side of the Chindwin, it is still considered a threat for this species. Political and ethnic conflicts have prevented the Myanmar government to promote development and conservation activities effectively in areas of northwestern and central western Myanmar along the borders with India and Bangladesh. Thus, most conservation efforts have been concentrated within the range of *H. leuconedys*.

Conservation Actions

Conservation Actions:	This species is listed on CITES Appendix I and on schedule I of the Indian Wildlife (Protection) Act of 1972. Overall, it is found in 30 protected areas in India (Choudhury 2001) and many others throughout its range.



Range map for *Hoolock hoolock* (Hoolock Gibbon)

Source: IUCN.org

Conservaiton Status for *Cuon alpinus* (Dhole)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Carnivora	Canidae

Scientific Name:	*Cuon alpinus*
Species Authority:	(Pallas, 1811)
Common Name(s): English – Dhole, Red Dog, Indian Wild Dog, Asiatic Wild Dog French – Chien sauvage d'Asie, Cuon d'Asie Spanish – Perro Salvaje Asiático	
Synonym(s):	*Canis alpinus* Pallas, 1811
Taxonomic Notes:	Mivart (1890) distinguished two species of *Cuon*, the northern Dhole (*C. alpinus*) and the southern Dhole (*C. javanicus*), based on differences in body size and the second upper and second lower molars. Dholes were later recognized as a single species (Ellerman and Morrison-Scott 1966), but separated into as many as 11 subspecies based on differences in coat length and colour (Durbin *et al*. 2004). The validity of many of these subspecies is doubtful, and a genetics study found no clear subspecies distinctions (Iyengar *et al*. 2005). However, samples used by Iyengar *et al*. (2005) came exclusively from the southern half of the Dhole distribution, so the genetic distinctiveness between northern and southern Dholes remains unknown. Examination of the auditory bulla showed at least one northern subspecies, from the Tian Shan Mountains, to be morphologically distinct from other subspecies (Ivanoff 2007). Further research is needed to clarify the morphological and genetic differences between northern and southern dholes, especially because conservation efforts would need to employ different strategies for the two groups, as they occupy vastly different habitats and prey on different species. The putative northern-Dhole group historically occurred throughout East Asia to as far south as the Himalayan Mountains and the Yangtze River, and would include the following five subspecies described by Durbin *et al*. (2004): *C. a. alpinus*, *C. a. primaevus*, *C. a. laniger*, *C. a. hesperius*, and *C. a. fumosus*. The putative southern-dhole group would include the remaining six subspecies described by Durbin *et al*. (2004): *C. a. lepturus*, *C. a. dukhumensis*, *C. a. adjustus*, *C. a. infuscus*, *C. a. sumatrensis*, and *C. a. javanicus*. Within the southern-Dhole group, Iyengar *et al*. (2005) found two major phylogeographic genetic groupings on the mainland, and stated that the subspecific status of Dholes on Sumatra and Java was unclear and requires further study.

Assessment Information

Red List Category & Criteria:	Endangered C2a(i) ver 3.1
Year Published:	2015
Date Assessed:	2015-05-07
Assessor(s):	Kamler, J.F., Songsasen, N., Jenks, K., Srivathsa, A., Sheng, L. & Kunkel, K.
Reviewer(s):	Hoffmann, M. & Sillero-Zubiri, C.

Contributor(s):	Andayani, N., Ario, A., Budiawan, S., Chakma, S., Ying, C., Coudrat, C.N.Z., Darcy, L., Dinata, Y., Eames, J.C., Gumal, MG, Htun, S., Linkie, M., Karanth, K., Karanth, U., Kawanishi, K., Khatiwada, A., Maisch, H., Martyr, D., Naing, H., Pickles, R.S., Rasphone, A., Robichaud, W., Rode-Margono, E.J., Simpson, R., Sunarto, S., Suzuki, A., Thresher, S., Zhou, Y., Willcox, D.H.A., Hedges, S., Duckworth, J.W. & Tyson, M.
Facilitator/Compiler(s):	Hoffmann, M.
Justification: Dholes have disappeared from most of their historical range. Populations are still declining in most areas due to several main threats which include depletion of prey base, habitat loss, persecution due to livestock predation, disease transmission from domestic dogs, and possibly interspecific competition. Although there is uncertainty in our estimation, we calculate a total population of 4,500-10,500 individuals, of which only 949-2,215 are mature individuals. Most if not all current subpopulations of Dholes are relatively small and isolated, and often exhibit severe fluctuations in numbers. One of the largest remaining subpopulations of dholes was estimated to contain 207-304 individuals, of which only 44-64 were mature individuals. Therefore, Dholes warrant listing as Endangered under criterion C2a(i).	
Previously published Red List assessments:	2008 – Endangered (EN) 2004 – Endangered (EN) 1996 – Vulnerable (VU) 1994 – Vulnerable (V) 1990 – Vulnerable (V) 1988 – Vulnerable (V) 1986 – Vulnerable (V)

Geographic Range

Range Description:	Historically, Dholes occurred throughout South and East Asia, to as far north as the southern parts of the Russian Federation (including the Amur region and upper Lena River north of Lake Baikal), and as far west as the mountains ranging from eastern Kazakhstan to northern Pakistan (Altai, Tian Shan, Pamir and western Himalayan mountains; Heptner and Naumov 1967). Dholes have disappeared from >75% of their historic range, and most remaining populations are fragmented and still appear to be declining based on scattered surveys and personal observations. Their current distribution, based on recent information we consider reliable, is described below. **Central and East Asia**: there have been no confirmed reports of Dholes in more than 30 years from the Russian Federation, Mongolia, Kazakhstan (formerly in the Altai and Tian Shan mountains), Kyrgyzstan (formerly in the Tian Shan and Pamir mountains), Afghanistan (formerly in Pamir Mountains), Tajikistan (formerly in Pamir Mountains) or Uzbekistan (formerly in Tian Shan Mountains), and they are likely extirpated from these regions (A. Poyarkov and N. Ovsyanikov in litt., D. Miquelle pers. comm.). **Bangladesh**: Dholes still occur in some forest reserves in the Sylhet area in northeastern Bangladesh, as well the Chittagong Hill Tracts in southeastern region. However, these areas are unlikely to contain

viable populations because Dholes are usually sighted only as solitary individuals, or in small groups of two to three adults. Dhole numbers appear to be decreasing in these areas due to a decreasing prey base (S. Chakma pers. comm.).

Bhutan: Although Dholes were nearly extirpated in Bhutan in the 1970s and early 1980s due to poisoning campaigns, this species began to re-occupy the country starting in the 1990s (Wangchuk 2004, Thinley *et al*. 2011). Based on sign and interviews with park managers, they now occur in most, if not all, protected areas in the country (J. Kamler unpubl. data).

Cambodia: There are recent (under five years old) records of Dholes in the Cardamom Mountains (FFI-Cambodia Programme unpubl. data), the northern plains landscape (WCS Cambodia Program unpubl. data), the eastern plains landscape (J. Kamler unpubl. data), and northeastern Cambodia (Siem Pang Province; D. Willcox unpubl. data). Dholes do not likely exist in viable populations outside of these areas. A recent outbreak of canine distemper in 2011-2012, thought to have originated in local domestic dogs, caused the near-extirpation of Dholes in both the eastern and northern plains landscapes (J. Kamler and A. Suzuki unpubl. data), but it appears these populations are slowly recovering as of 2015.

China: Historically Dholes occurred throughout China, but their current status and distribution is highly uncertain, and they are likely extirpated throughout most of the country. Despite extensive surveys throughout the country, recent (<10 years) records from China come only from six provinces: Gansu, Sichuan, Shaanxi, Yunnan, Tibet Autonomous Region (TAR) and Xinjiang. In northern Gansu Province, Dholes were recently reported from the Qilian Shan Mountains as a pack was observed there in 2003 (Harris 2006) and a mother with pups was photographed in Yanchiwan Nature Reserve in 2013 (Riordan *et al*. 2015). As the Qilian Shan Mountains extend into northern Qinghai Province, Dholes still might occur there as well. In southeastern Xinjiang Province, camera traps recorded Dholes during 2012-2013 in the Altun (Altyn-Tagh) Mountains (Xue *et al*. 2014). In western Xinjiang Province, there were sightings by local people during 2011-2013 in Taxkorgan Nature Reserve (Riordan *et al*. 2015). In central Sichuan, a Dhole was photographed in 2012 in Heishuihe Nature Reserve in the Qionglai Mountains (Y. Zhou pers. comm.). Although one Dhole was observed in 2003 in Tangjiahe Nature Reserve in northern Sichuan (Y. Zhou pers. comm.), there have been no camera trap photos or other confirmed records in the past 10 years (S. Li pers. comm.). Dholes may occur in the Minshan Mountains (northern Sichua) and Daxue Shan Mountains (western Sichuan), as there are former records from there and current prey densities are relatively high (S. Li pers. comm., Li *et al*. 2010). In Shaanxi Province, a Dhole was recently recorded during a camera trap study in Guanyinshan Nature Reserve in the Qinling Mountains (Liu *et al*. 2013). However, camera trap studies in several other nature reserves in Shaanxi failed to record Dholes (S. Li pers. comm.), so their numbers must be extremely low in the area. In Yunnan Province, Dholes were photographed in camera traps in both the Nangunhe and Xishuangbanna nature reserves in 2012-13 near the border with Myanmar (Wildlife Institute, Beijing Forestry University, unpubl.), but Dhole numbers are likely low there due to highly fragmented habitat, high poaching, and extremely low prey densities (S. Li pers. comm.). In TAR, camera traps recorded Dholes in 2014 in Motuo (Mêdog) County (southeastern TAR; S. Li pers.

comm.). Although there are few recent records, Dholes may still occur in the southern parts of TAR, as this species was recorded in the Mt. Qomolangma (Mt. Everest) Nature Reserve (Hu *et al*. 2014). In southeastern China, the last two records of Dholes come from Jiangxi Province: the unconfirmed report of one captured in early 2000s (C. Bellamy pers. comm.), and an unconfirmed photo taken by a camera trap in Taohongling Nature Reserve in 2010 (S. Li pers. comm.). However, there have been no confirmed reports or additional records from other areas, and they are now likely extirpated from the region. Interviews with local people suggested that Dholes disappeared from large areas of central and southern China during the 1980s and early 1990s, after locals starting poisoning carcasses in retaliation for livestock losses from Dholes (S. Li pers. comm.).

India: Dholes occur in several regions of India, and this country undoubtedly contains the largest numbers of Dholes. That said, Dholes have disappeared from 60% of their historic range in India during the past 100 years (Karanth *et al*. 2010). Relatively high populations of Dholes are still found in the Western Ghats and central Indian forests, due to high prey numbers and extent of protected forests, whereas lower numbers of Dholes are found in the Eastern Ghats (Karanth *et al*. 2009). Dholes are also found in the northeastern states, although numbers are low and decreasing in this region due to a decreasing prey base and retaliatory killings from livestock predation (Gopi *et al*. 2012, Lyngdoh *et al*. 2014). Dholes are found in some areas of Terai region in northern India (Karanth *et al*. 2009), although their exact distribution there is unknown. In the Himalayan region, Dholes were recently reported from Sikkim (Bashir *et al*. 2014), and in 2008 near Tso Kar in Ladakh (R. Simpson pers. comm.), thus they may occur in other areas of Ladakh as well.

Indonesia (Sumatra and Java): Historically, Dholes occurred throughout both Sumatra and Java; however, their current distribution on both islands is fragmented and greatly reduced. On Sumatra, Dholes have recently been confirmed in several national parks along the Barisan Mountain range, ranging from the northern to southern parts of the island (e.g., Gunung Leuser, Kerinci Seblat and Bukit Barisan Selatan National Parks; FFI, WCS and WWF country programs unpubl. data). Dholes also have been recently confirmed in several protected areas in lowland forests in the east-central part of the island (e.g., Tesso Nilo and Bukit Tigapuluh National Parks, Harapan Rainforest and Batang Hari Protection Forest; FFI and WWF country programs unpubl. data). On Java, Dholes have recently been confirmed in national parks only in the extreme western (e.g., Gunung Gede Pangrango, Ujung Kulon and Gunung Halimum Salak National Parks) and eastern (e.g., Baluran National Park and Alas Purwo National Park) parts of the island (A. Ario pers. comm.). They are likely extirpated in other regions of the island.

Korean peninsula: Historically, Dholes occurred on the Korean peninsula, but were likely extirpated throughout most of their range by the 1970s (Won and Smith 1999). In the 1980s Dholes were confirmed to still occur on Mt. Pakdoo in northeastern Korea DPR, near the Chinese border (Won and Smith 1999). However, there have been no available data since that time, so their status in Korea DPR remains uncertain. They are certainly extirpated from the Republic of Korea.

Lao PDR: There are recent (under five years old) records of Dholes from northern Lao PDR (Nam Et-Phou Louey [NEPL] and Nam Ha protected areas) and in central Lao PDR (Nakai-Nam Theun and Nam Kading protected areas; WCS-Lao PDR program unpubl. data, C. Coudrat pers. comm.). The most studied and perhaps largest population of Dholes in the country is in NEPL (Kamler *et al*. 2012). There are no recent records of Dholes in southern Lao PDR, and they are probably extirpated from this region.

Malaysia (peninsula): The historical range of Dholes likely included the entire Malaysian peninsula, possibly even what is now Singapore. Dholes are now extirpated from Singapore and the southern forests of the Malaysian peninsula (Endau-Rompin complex; WCS Malaysia Program, unpubl.). Based on recent camera trapping surveys, Dholes still occur in the central (Taman Negara) and northern (Belum-Temengor complex) forested areas of the Malaysian peninsula (K. Kawanishi pers. comm.).

Myanmar: The current distribution of Dholes in Myanmar is uncertain. In the late 1990s and early 2000s, they were recorded by camera traps at 11 of 15 survey areas scattered across the country (Durbin *et al*. 2004). However, numbers and distribution may have decreased since that time. For example, Dholes had been recorded in Chatthin Wildlife Sanctuary in western Myanmar, where they reportedly predated on livestock. Apparently, local people persecuted Dholes in retribution, and consequently Dholes were not detected in Chatthin during recent camera-trapping surveys (N. M. Shwe unpubl. data). Since 2005, Dholes have been recorded from several protected areas in Myanmar, including the northern region (Hukaung Valley Wildlife Sanctcuary and Htamanthi Wildlife Sanctuary), west-central region (Mahamyaing Wildlife Sanctuary and Namataung National Park), southwestern region (Rakhine Yoma Elephant Range), and peninsula region (Tanintharyi Nature Reserve; WCS Myanmar Program unpubl. data). From 1999-2002, Dholes were recorded in at least eight additional forest tracts and protected areas the in northern, western, and central parts of the country (WCS Myanmar Program unpubl. data), thus Dholes may still occur throughout these regions. There are few confirmed records of Dholes from eastern Myanmar, although they likely occur near the tri-border area with Lao PDR and Thailand, as there are records in that area from those countries. There are recent records of dholes from camera-trap studies in Karen (Kayin) State (R. McEwing pers. comm.), but their status in other areas of eastern Myanmar is not known.

Nepal: Dhole sightings in Nepal are not common, yet there are recent reports of this species in several areas of country. In the Himalayan region, Dholes reportedly occur in the western (Rara and Khaptad National Parks, Dhorpatan Hunting Reserve; R. D. Choudhary pers. comm., A. Aryal in litt.) and extreme eastern parts (Kanchenjunga Conservation Area; Khatiwada 2011) of the country. In southern Nepal, Dholes are found throughout much of the Terai Arc Landscape, including Chitwan and Bardia national parks (Thapa *et al*. 2013, A. Khatiwada pers. comm.), and Parsa and Shuklaphanta Wildlife Reserves (A. Khatiwada pers. comm.). Dholes also are reported in several districts of Nepal outside protected areas, but all populations are extremely low and threatened by low prey base, poisoning and habitat loss (A. Khatiwada pers. comm.).

	Pakistan: Although there are no confirmed records of Dholes from Pakistan, they historically occurred in the western Himalayan Mountains in the northern part of the country. They might still occur in the Ladakh region of northern Parkistan, as Dholes recently have been recorded in the India-administered region of Ladakh. **Thailand**: Dholes have been extirpated from most areas of Thailand, and are now absent from the peninsula and eastern parts of the country. Dholes are still found in fragmented populations in several large protected-area complexes, including the south-central region (Phayayen-Khao Yai and Eastern Forest complexes), north-central region (Phumieng-Phuthong and Phukhieo-Namnow complexes), northwestern region (Srilanna-Khutan and Doi Phucar-Maeyom complexes), and western region (Western Forest Complex; Jenks *et al.* 2012; Department of National Park, Wildlife and Plant Conservation, Thailand). It is not yet known how stable are these isolated populations, and if the protected-area complexes are large enough to conserve viable Dhole populations in the long term. **Viet Nam**: There are very few recent confirmed records on Dholes in Viet Nam. The last confirmed records of Dholes were in Pu Mat National Park in 1998-99 (D. Willcox pers. comm.) and in Yok Don National Park in 2003 (J. Eames pers. comm.) despite extensive camera trapping in >25 protected areas throughout the country. Along with other large carnivores, Dholes are likely extirpated from Viet Nam, although individuals may occasionally enter the country from neighboring Cambodia or Lao PDR
Countries occurrence:	**Native:** Bangladesh; Bhutan; Cambodia; China; India; Indonesia; Lao People's Democratic Republic; Malaysia; Myanmar; Nepal; Thailand **Possibly extinct:** Viet Nam **Regionally extinct:** Afghanistan; Kazakhstan; Korea, Republic of; Kyrgyzstan; Mongolia; Russian Federation; Singapore; Tajikistan; Uzbekistan

Habitat and Ecology

Habitat and Ecology:	The Dhole is a habitat generalist, and can occur in a wide variety of vegetation types, including: primary, secondary and degraded forms of tropical dry and moist deciduous forests; evergreen and semi-evergreen forests; temperate deciduous forests; boreal forests; dry thorn forests; grassland–scrub–forest mosaics; temperate steppe; and alpine steppe. Consequently, their elevation range is from sea level to as high as 5,300 m asl in Ladakh (R. Simpson pers. comm.). They have not been recorded in desert regions. The Dhole is one of only three canid species with specialized dental adaptations for an exclusively carnivorous diet, termed hypercarnivory (Van Valkenburgh 1991). Although Dholes consume a wide variety of prey species, ranging from small rodents and hares to Gaur (*Bos gaurus*; Karanth and Sunquist 1995, Andheria *et al*. 2007, Ramesh *et al*. 2012, Selvan *et al*. 2013a), the preferred prey are ungulates with a body mass of 40-60 kg (Selvan *et al*. 2013b). However, if this prey size is not available, Dholes will selectively prey upon both smaller and larger ungulate species (Kamler *et al*. 2012). Seasonal changes occur in the Dhole diets, reflecting seasonal changes in availability and

	numbers of prey (Thinley *et al*. 2011). In India, Dholes form relatively large packs (usually five to 10, but up to 25 adults) to efficiently hunt large numbers of prey, as well as to protect litters, which are usually large (usually five to 10, but up to 12 pups; Johnsingh 1982, Venkataraman *et al*. 1995, Durbin *et al*. 2004). However, in tropical evergreen forests of Southeast Asia, Dholes appear to persist in smaller packs and presumably have smaller litters, probably due the low prey biomass and small size of ungulate prey in these habitats (Kawanishi and Sunquist 2008). Due to the demands imposed by hypercarnivory, sufficient numbers of ungulate prey are the Dhole's major habitat requirements. In India, tropical dry and moist deciduous forest may represent optimal habitats, based on the areas thought to hold the largest Dhole populations. Ungulate biomass, particularly that of cervid species, is highest in these habitat types when compared to other habitats in the same region (A. Venkataraman and V.N. Babu unpubl.). Besides prey numbers, other important factors that may influence habitat use include levels of human disturbance, water availability, tiger presence, and suitability of breeding sites (Steinmetz *et al*. 2013, Srivathsa *et al*. 2014, J.F. Kamler unpubl. data). Home range sizes of Dholes reportedly ranged from 23-199 km^2 in India (Johnsingh 1982, Venkataraman *et al*. 1995, Karanth and Sunquist 2000, Acharya 2007) and from 60-80 km^2 in Thailand (Grassman *et al*. 2005, K. Jenks unpubl. data).
Systems:	Terrestrial
Generation Length (years):	5

Threats

Major Threat(s):	**Depletion of prey base**: This may be the single greatest factor that contributed to the range collapse of Dholes in the northern half of their former distribution, and might be the primary factor for the continued decline of Dholes in the southern half of their distribution. Throughout Cambodia, Lao PDR, Viet Nam, and southeastern China, ungulate populations are well below carrying capacity due to over hunting by humans, even within protected areas (Durbin *et al*. 2004). All ungulate species, except perhaps Muntjac (*Muntiacus* spp.) and Wild Pig (*Sus scrofa*), are ecologically or fully extinct across extensive parts of the region (Durbin *et al*. 2004). This situation will likely hinder any possibility of recovery by the region's Dhole populations, even if the other issues could be addressed. Dholes can probably persist as fragmented populations in large protected areas of Bhutan, Malaysia, Myanmar, Nepal, Indonesia (Sumatra and Java) and Thailand, as long as prey numbers remain sufficient and other threats are controlled. In large protected areas in southern and central India, Dhole numbers are stable where prey densities are high. In northeastern India, prey depletion is contributing to the decline of Dholes in the region (Gopi *et al*. 2012). **Habitat loss and transformation**: Habitat loss and degradation are serious threats to Dholes in southern Asia, particularly because this threat is closely associated with prey depletion and high levels

of human disturbance. Although extensive areas of natural or semi-natural vegetation remain in Lao PDR and Cambodia, habitat conversion and fragmentation are proceeding unabated. In Viet Nam, very few natural areas greater than 50 km^2 remain. Habitat loss and fragmentation is a major threat to protected areas in Indonesia, particularly those on Sumatra. Habitat loss is driven by several different factors, including logging, palm and rubber plantations, agriculture expansion, rural biomass extraction, livestock grazing and major infrastructure expansion (e.g., hydropower dams, irrigation projects, new highways, etc.).

Persecution: Persecution of Dholes stems mainly from retaliatory killings due to livestock predation, and this factor is driving some Dhole populations towards local extinction (Lyngdoh *et al*. 2014). Dholes appear to be especially susceptible to poisoning of carcasses using strychnine or other rodenticides, which often are readily available to rural people in southern Asia. Consequently, unsystematic but consistent poisoning of carcasses can easily wipe out Dholes within an area, especially because the entire pack will feed on a carcass. For example, poisoning of livestock carcasses apparently wiped out Dholes from Bhutan in the 1970s and early 1980s, although this species began to re-occupy the country starting in the 1990s (Wangchuk 2004, Thinley *et al*. 2011). Killing of Dholes by poisoning livestock carcasses also has been reported in China, Nepal, India and Indonesia, and is likely is widespread in southern Asia. Poisoning campaigns also were thought to have contributed to the extirpation of Dholes in the countries of the former Soviet Union (Ginsberg and Macdonald 1990).

Dholes reportedly have been shot by humans, as Dhole carcasses with gun-shot wounds were found near the boundary of protected areas in Thailand (K. Jenks and N. Songsasen unpubl.). Dholes are probably susceptible to non-selective snaring, particularly where this activity is widespread such as in Viet Nam, Cambodia, China and Lao PDR. In India, and possibly elsewhere, Dholes living outside or on the edge of core protected areas are particularly vulnerable to human kleptoparasitism.

Disease and pathogens: Dholes are susceptible to rabies, canine distemper, canine parvovirus and sarcoptic mange among others (Durbin *et al*. 2004), which are usually contracted from domestic village dogs that act as reservoirs. Dholes appear to be especially susceptible to disease epizootics due their large pack sizes and high levels of amicable behaviour within packs, even among adults (Johnsingh 1982). Such behaviours likely result in relatively high intraspecific contact rates, which are conducive for disease epizootics, at least compared to other wild canids such as jackals (*Canis aureus*) which are more solitary. Disease epizootics may contribute to the sudden disappearance of Dholes from protected areas, and often cause severe local population fluctuations resulting in relatively small pack sizes (Karanth and Sunquist 2000, J. Kamler pers. obs.). In Cambodia, a recent outbreak of canine distemper in 2011-2012, thought to have originated in local domestic dogs, caused the near-extirpation of Dholes from protected areas in the eastern and northern parts of the country (J. Kamler unpubl.), although populations appear to be recovering; mortalities associated with canine distemper also have been observed in a protected area in Thailand (N. Songsasen and K. Jenks unpubl). The range-wide effects of diseases on Dhole population dynamics is unknown, but it is likely significant across southern Asia, and might result in an increased probability of extirpation for Dhole populations in isolated protected

	areas. **Competition with other species**: Aside from humans, the main competitors of Dholes for limited resources are Tigers (*Panthera tigris*) and Leopards (*P. pardus*). Although Dholes are much smaller in body size, packs of Dholes reportedly have killed both Tigers and Leopards, although the reverse also has been reported (Burton 1940). The dominance hierarchy between Dholes and Tigers is not clear, although Dholes likely avoid tigers especially if packs are small. Dholes appear to be behaviourally dominant over Leopards, and packs of Dholes often tree this species when they interact (Venkataraman 1995). Whether large felids can negatively affect Dhole numbers is unknown, although the exploitive and interference competition between them likely becomes more intense as prey populations are reduced by humans, possibly resulting in spatial exclusion where prey numbers are lowest. Free-ranging dogs also may compete with Dholes for limited food resources where prey numbers are low.

Conservation Actions

Conservation Actions:	**Legal protection** It is included in CITES – Appendix II (2013). Dholes are legally protected in the countries where they occur. However, enforcement of laws is insufficient to provide effective protection of Dholes in many of their range countries. Local governments sometimes may still offer bounties on Dholes to reduce livestock predation, as was recently the case in western Myanmar. In Thailand, Dholes were recently blamed for the decline of wild ungulates in some protected areas, and as a result some government officials have proposed to eliminate Dholes from those areas (K. Jenks and N. Songsasen unpubl.). Dholes also may have been intentionally extirpated from some protected areas by local officials in southeastern China in an attempt to boost ungulate numbers (S. Li pers. comm.). Providing compensation, incentives or insurance for livestock-Dhole conflicts to reduce retaliatory killing of Dholes may be a good conservation strategy and should be tested (Dickman *et al.* 2011, Gurung *et al*. 2011). Similarly, incentives for conservation of habitat, Dholes and their prey should be explored. **Presence in protected areas** Although this species occurs in protected areas throughout its range, there are no conservation measures specifically focused on Dholes, except for a few isolated localities like eastern Nepal. For the putative northern Dholes, their occurrence in China was recently confirmed by camera traps in several isolated nature reserves. However, lack of data on numbers of Dholes and their prey in these reserves prevent a valid assessment as to their potential for conserving Dholes in the long-term. For the putative southern Dholes, both Project Tiger and Project Elephant in India have the potential to conserve populations of Dholes and their prey in areas where they coexist with tigers and elephants. However, Dholes require up to five times the land area as tigers to maintain viable long-term populations, and consequently Dholes have disappeared from more reserves than have tigers (Woodroffe and Ginsberg 1998). Thus, relatively large (>750 km^2) reserves in India might be the most effective for conserving Dhole populations. Large protected-area complexes for Tiger conservation in Bhutan, Malaysia, Myanmar, Nepal, Indonesia (Sumatra), and Thailand, also are conserving Dhole populations, thus these

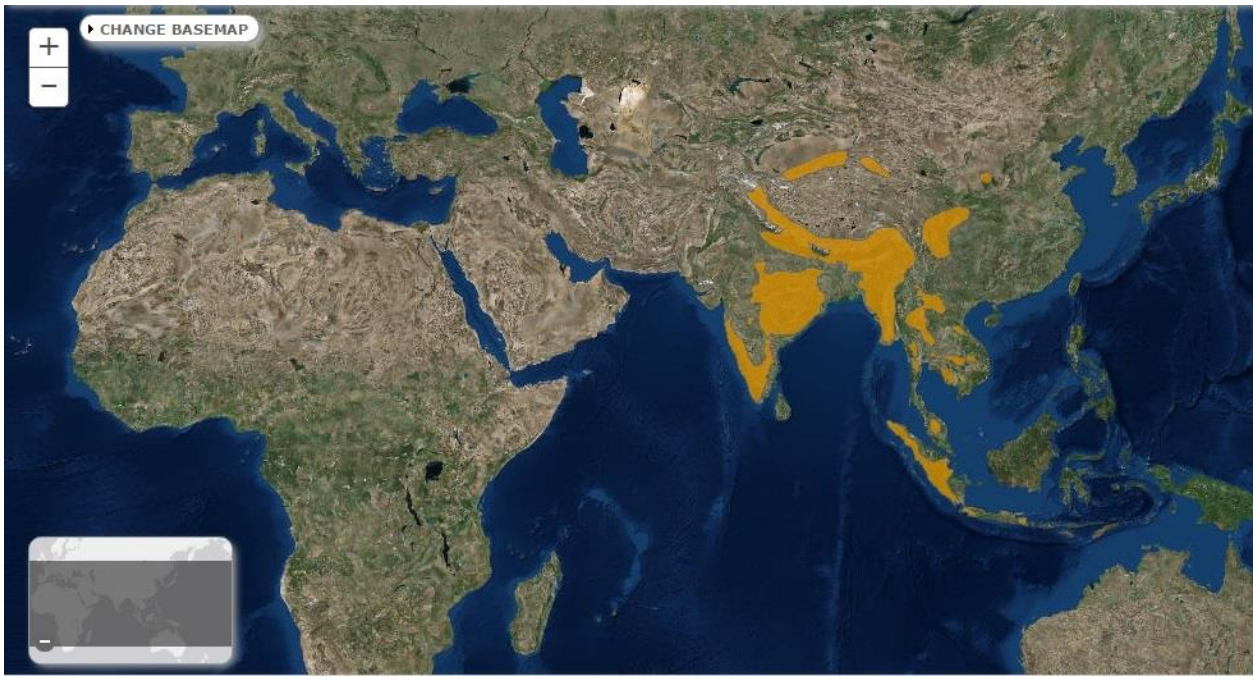
areas hold the greatest potential for the long-term conservation of Dholes in South and Southeast Asia. Consolidating more forest areas and including them in protected area networks would greatly enhance the conservation of Dholes in these regions.

Presence in captivity

As of August 2013, there were at least 223 Dholes in 38 zoos worldwide (International Species Information System [ISIS] unpubl.), including zoos in Europe (24 zoos), Asia (nine zoos), North America (four zoos), and Australia (one zoo). There also are captive Dholes in additional zoos and breeding farms which are not members of ISIS. The origin of most captive Dholes is unclear, and their subspecific classification is probably wrong. The most numerous subspecies in captivity is listed as *C. a. lepturus*, which occurs in at least 20 zoos worldwide and is the most common Dhole in European zoos. Firstly, inbreeding may be an issue because captive Dholes listed as *lepturus* trace their origin to only three founders: a single Dhole from a game farm in North America with an unknown origin (H. Maisch pers. comm.), and Dholes from the Moscow Zoo, which originated from only two individuals captured in Qinghai Province, China in 1957 (Sosnovskii 1967). Secondly, the Dholes captured in Qinghai Province should represent either *C. a. hesperius* or *C. a. fumosus*, from the putative northern Dhole group, rather than *lepturus* which historically occurred only south of the Yangtze River and is part of the southern Dhole group (Durbin et al. 2004). The putative southern Dholes are represented in several Indian zoos (probably *C. alpinus dukhunensis*), and in zoos in Phnom Penh, Cambodia, and Sydney, Australia (*C. alpinus infuscus*). Other zoos do not list subspecies, thus it is likely that putative subspecies from different origins have been interbred (M. Boeer pers. comm.), such as that done in Singapore Zoo. The European Endangered Species Programme (EEP) does not consider subspecies, but it does regard Dholes in European zoos as a Chinese ecotype, and prevents mixing this type with Dholes from other origins (e.g., India, Cambodia). Nevertheless, the value of any of captive Dholes for potential reintroduction efforts is uncertain, at least until genetic studies can confirm their origin and subspecific classification. Until that time, we recommend that captive Dholes from the putative northern and southern groups be managed separately, such as that done by the EEP.

Research needs

More research is needed on Dholes to better understand their ecology and assist conservation efforts. These include: 1) develop cost-effective surveys to determine the abundance of Dholes, as data on Dhole numbers would allow us to better understand their conservation status; 2) investigate the genetic and morphological differences between the putative northern and southern Dholes, and the distinctiveness of other putative subspecies such as the Sumatran and Javan Dholes; 3) determine the area and prey requirements needed to maintain a viable Dhole population; 4) investigate the effects of disease on Dhole population dynamics, and; 5) investigate effects of Dholes on ecosystems, specifically their interactions with other large carnivores, and their impacts on prey and smaller carnivores.



Range map for *Cuon alpinus* (Dhole)

Source: IUCN.org

Conservation Status for *Ursus thibetanus* (Asian Black Bear)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Carnivora	Ursidae

Scientific Name:	*Ursus thibetanus*
Species Authority:	G. [Baron] Cuvier, 1823
Common Name(s):	English – Asiatic Black Bear, Himalayan Black Bear French – Ours du Tibet, Ours à collier, Ours de l'Himalaya, Ours noir d'Asie Spanish – Oso de Collar, Oso Negro de Asia
Taxonomic Notes:	The principal color phase is black, with a white "crescent moon" on the chest. Rare brown phases are also known, and recently a blond (and mixed blond and black) color phase was discovered in Cambodia, Thailand, and Lao PDR (Galbreath *et al*. 2000).

Assessment Information

Red List Category & Criteria:	Vulnerable A2cd+3d+4d ver 3.1
Year Published:	2008
Date Assessed:	2008-06-30

Assessor(s):	Garshelis, D.L. & Steinmetz, R. (IUCN SSC Bear Specialist Group)
Reviewer(s):	McLellan, B.N. & Garshelis, D.L. (Bear Red List Authority)
Justification: Widespread illegal killing of bears and trade in parts, combined with loss of habitat indicate that this species is likely declining in most parts of its range, especially in Southeast Asia and China. Questionnaire surveys also indicate declining numbers in Taiwan, with areas of local extirpation caused by habitat degradation and illegal hunting. Japan appears to be the only range country that has documented an increasing number of Asiatic black bears, reflected by an increasing area of occupied range (Oi and Yamazaki 2006). Although actual data on population sizes or trends are lacking, it seems likely, given the rate of habitat loss and uncontrolled exploitation that the world population has declined by 30–49% over the past 30 years (3 bear generations) and that this rate will continue during the next 30 years unless abated by the implementation of significant conservation measures.	
Previously published Red List assessments:	1996 – Vulnerable (VU) 1994 – Vulnerable (V) 1990 – Vulnerable (V)

Geographic Range

Range Description:	Fossil remains of the Asiatic black bear have been found as far west as Germany and France, but in historic times the species has been limited to Asia. This species occupies a narrow band from southeastern Iran (Gutleb and Ziaie 1999) eastward through Afghanistan and Pakistan, across the foothills of the Himalayas, to Myanmar. It occupies all countries in mainland Southeast Asia except Malaysia. It has a patchy distribution in southern China, and is absent in much of east-central China. Another population cluster exists in northeastern China, the southern Russian Far East, and into North Korea. A small remnant population exists in South Korea. They also live on the southern islands of Japan (Honshu and Shikoku) and on Taiwan and Hainan. The species now occurs very patchily through much of its former range, especially in Iran, Afghanistan, Pakistan, mainland southeast Asia and China. Its distribution in parts of China and Myanmar remains very poorly known. The distribution of the Asiatic black bear roughly coincides with forest distribution in southern and eastern Asia (FAO 2006), except that in central and southern India this species is replaced by the sloth bear (*Melursus ursinus*), in southern Thailand and into Malaysia it is replaced by the sun bear (*Helarctos malayanus*) and north and west of the Russian Far East it is replaced by the brown bear (*Ursus arctos*). However, the Asiatic black bear overlaps the ranges of each of these species, especially the sun bear in a large portion of Southeast Asia.
Countries occurrence:	Native: Afghanistan; Bangladesh; Bhutan; Cambodia; China; India; Iran, Islamic Republic of; Japan; Korea, Democratic People's Republic of; Korea, Republic of; Lao People's Democratic Republic; Myanmar; Nepal; Pakistan; Russian Federation; Taiwan, Province of China; Thailand; Viet Nam

Habitat and Ecology

Habitat and Ecology:	Asiatic black bears occupy a variety of forested habitats, both broad-leaved and coniferous, from near sea level to an elevation of 4,300 m (in northeastern India, A. Choudhury, Rhino Foundation for Nature pers. comm.). They also infrequently use open alpine meadows. Individual bears move to different habitats and elevations seasonally (Izumiyama and Shiraishi 2004), tracking changes in food abundance. Foods include succulent vegetation (shoots, forbs and leaves) in spring, turning to insects and a variety of tree and shrub-borne fruits in summer, and finally nuts in autumn (Bromlei 1965, Reid *et al*. 1991, Huygens *et al*. 2003). In some places the diet contains a sizeable portion of meat from mammalian ungulates (which they either kill or scavenge, Hwang *et al*. 2002) In temperate forests, Asiatic black bears rely heavily on hard mast in autumn, in part to put on sufficient fat reserves for winter denning (hibernation). Therefore, these bears tend to focus their activities in habitats with high abundance of oak acorns, beechnuts, walnuts, chestnuts, hazelnuts, or stone pine seeds (Schaller *et al*. 1989, Hashimoto *et al*. 2003). When Asiatic black bears feed in hard mast trees they often break branches, and pile them up in the canopy, forming what appears to be a platform or "nest". Males may socially exclude females from rich stands of hard mast (Huygens and Hayashi 2001, Hwang 2003). In northern latitudes, where food becomes unavailable in winter, both sexes hibernate. In the most northerly parts of their range, bears enter dens as early as October and exit as late as the end of May (Seryodkin *et al*. 2003). They den in rock crevices, in hollow trees or stumps, under upturned trees, in dug-out earthen dens, or in ground nests. In Russia, Asiatic black bears have been reported to select flat river bottoms for denning (Seryodkin *et al*. 2003), whereas in central China they move to high elevation rocky outcrops on steep slopes (Reid *et al*. 1991). Hunters often have knowledge of the sorts of places and types of dens that the bears tend to use. Denning and active black bears are also subject to predation by other Asiatic black bears, brown bears, and tigers (Seryodkin *et al*. 2005). In the tropics, Asiatic black bears generally do not hibernate, except females giving birth during winter (Hwang and Garshelis 2007). They still make use of hard mast, but additionally consume numerous species of soft fruits. In Thailand, for example, Asiatic black bears were found to feed on >160 species of tree-borne fruits. Sympatric sun bears also eat most of these same fruits. Both species most often climb (apparently for feeding) trees in the cinnamon (Lauraceae) and teak (Labiatae) families. Both species live together in lowland habitats (<1,200 m), but Asiatic black bears predominate at higher elevations (R. Steinmetz, in prep.). Asiatic black bears also use regenerating forests, which may have a high production of berries or young bamboo shoots. They also feed in plantations, where they may damage trees by stripping the bark and eating cambium, and in cultivated areas, especially corn and oat fields and fruit orchards (Carr *et al*. 2002, Yamazaki 2003, Mizukami *et al*. 2005, Gong and Harris 2006, Vinitpornsawan *et al*. 2006). Asiatic black bears generally breed during June–July and give birth during November–March;

	however, timing of reproduction is not known for all portions of the range. Age of first reproduction is 4–5 years, and they normally produce litters of 1 or 2 cubs every other year (at most). Maximum lifespan is over 30 years, but average lifespan is less in the wild.
Systems:	Terrestrial

Threats

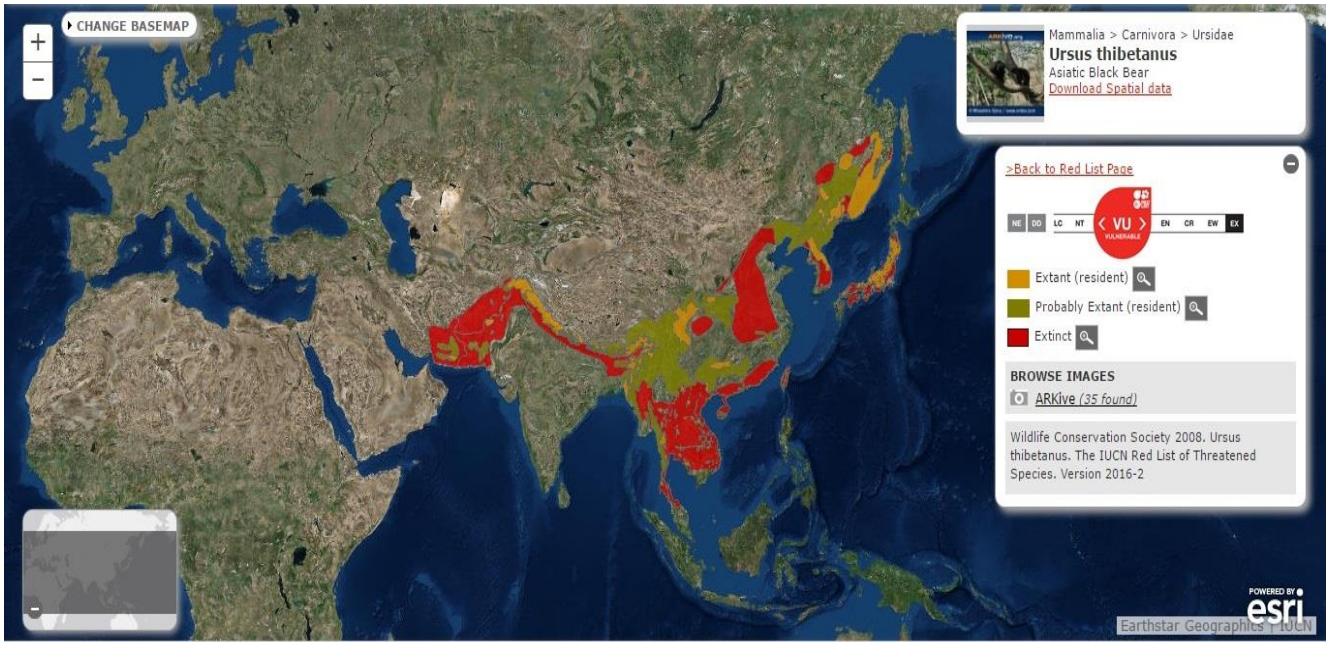
Major Threat(s):	Habitat loss due to logging, expansion of human settlements, roadway networks, and hydro-power stations, combined with hunting for skins, paws and especially gall bladders are the main threats to this species. Habitat loss and degradation is most severe in the southern portion of the range. In India, <10% of the species' range is within protected areas (PAs), and areas outside PAs are subject to development projects and extraction of wood for fuel and livestock fodder (Sathyakumar 2006). In Bangladesh, where forest cover is now <7% of the land area, Asiatic black bears survive only in small remnant patches in the east, generally near the Myanmar border. Myanmar, although still well forested (nearly 50%), is fourth in the world in the annual rate of loss of forested area (among countries occupied by all species of bears, it is second only to Indonesia: FAO 2006). Thailand has lower forest cover (<30%), but much of its remaining forests are within PAs, and about half of these are occupied by black bears (Vinitpornsawan *et al*. 2006). Forest area has recently been increasing in Viet Nam, but much of the present remaining forest is highly degraded from both legal and illegal lumbering (Nguyen Xuan Dang 2006). Forest area is increasing rapidly in China, which is now first in the world in terms of area gained per year. This increasing forest area stems from mandated government programs aimed mainly toward reducing flooding and erosion; the replanted trees may or may not be particularly suitable for bears. However, good forest habitat does persist in northeastern China, Taiwan, Korea, Russia, and Japan. In Japan, black bear range has expanded with increasing forest area and diminishing rural human populations (Oi and Yamazaki 2006). Meanwhile, the number of people killed or injured by Japanese black bears has been on the rise (presumably reflective of the increasing bear population), and the same may be true in some parts of China (J. Gong, Sichuan Forestry Dept., Chengdu pers. comm.). The major threat to bears in China and Southeast Asia is the commercial trade in live bears and bear parts, especially gall bladders (bile). China initiated commercial bear farming in 1984, ostensibly to satisfy the demand for bile by practitioners of Traditional Chinese Medicine (TCM; and also, Traditional Korean Medicine, TKM). The bile is periodically drained, so the captive bears do not have to be killed; it was claimed that this practice would thereby reduce the taking of wild bears. However, these farms were initially stocked with wild bears, and although the Chinese farms are purportedly now mainly self-propagating (with some continuing exceptions), there is no evidence that their existence has reduced the killing (poaching) of wild bears. In Viet Nam, many small-scale bile farms have been started, which were stocked by several thousand bears removed from the wild (from Viet Nam as well

	as from neighbouring countries). The condition in which these bears are kept precludes successful breeding and cub rearing; in fact, most of these farms do not attempt to breed their bears. Moreover, although this practice has been illegal since 1992, with regulations strengthened in 2002, the number of wild-caught farmed bears in Viet Nam is estimated to have increased by an order of magnitude in less than a decade (J. Robinson and G. Cochrane, Animals Asia Foundation pers. comm.). A surplus of bile is produced by the 8000–10,000 bears currently kept on Chinese bear farms, spurring efforts to find markets in non-traditional uses of bile (e.g., lotions, shampoos, cosmetics); meanwhile, many practitioners of TCM/TKM believe that bile from wild bears is more effective at healing various ailments, and are thus willing to pay higher prices for this product and may be disinclined to use substitutes (Chang *et al.* 1995, Kang and Phipps 2003). The market for bear paws also appears to be increasing commensurate with an increasing number of wealthy people who find it within their means to indulge in this very expensive delicacy. The demand for these bear products has fuelled a growing network of international trade throughout Southeast Asia, and has turned many subsistence hunters into commercial hunters. Most commercial trade routes eventually terminate in China (Saw Htun 2006; C. Shepherd, TRAFFIC SE Asia pers. comm.). However, it is difficult to assess the true extent of this trade because only a small fraction of the parts is confiscated. Moreover, with no reliable population estimates or monitoring system it is not possible to evaluate the actual impacts on populations. Nevertheless, it seems highly probable that this commercially-driven trade in parts is unsustainable and therefore causing populations to decline. The capture of live bears presents yet another threat to this species. In several Southeast Asian countries, Asiatic black bears are routinely confiscated from people attempting to raise them as pets. In Pakistan, several thousand bears were taken from the wild for exhibitions (referred to as bear baiting) in which individual bears (with canines and claws removed) fight with dogs. This practice was made illegal in 2001, but continues to some extent.

Conservation Actions

Conservation Actions:	The most beneficial conservation measure for Asiatic black bears would be to substantially lessen the demand for bear products, and thus reduce hunting and trade. The species is protected under both international and national laws, but often these laws are not enforced. It has been included on CITES Appendix I since 1979. The so-called Baluchistan bear, a subspecies (*U. thibetanus gedrosianus*) living in the arid thorn forest in the Baluchistan region of southern Pakistan and Iran, was listed as Critically Endangered (B1+2abc, C2a) in the 1996 IUCN Red List, and is nationally listed as critically endangered in Pakistan. Authorities have proposed a protected area to assist in the recovery of this very small, isolated population (Sheikh 2006). In most range countries Asiatic black bears are listed as a protected species. For example, they are protected under Class 2 of China's Wildlife Protection Law (a limited number of permits are issued to

	kill nuisance animals), and under Schedule I of the Indian Wildlife (Protection) Act. In South Korea, they are designated as a national monument (No. 329) within the Cultural Properties Protection Law and also as an Endangered Wild Animal. In Japan, this species is listed under the Law for Conservation of Endangered Species of Wild Fauna and Flora, which for trade requires certification of legal take; however, gall bladders and paws are exempted. Throughout Southeast Asia this species is totally protected in every range country, with the exception of Myanmar, where this species is classified as "normally protected", meaning that it may be killed with a special license (although such licenses are rarely issued; Saw Htun, Wildlife Conservation Society, Myanmar pers. comm.). In Afghanistan, *U. thibetanus* is listed as a protected species, imposing a Government ban on all hunting and trading of this species within the country. Sport hunting of Asiatic black bears is legal only in Japan and Russia. Russia reports a legal harvest of 75-100 bears/year and an estimated illegal take of about 500 bears/year. Sport harvests of black bears in Japan average about 500/year and have been slowly declining since the late 1980s due to diminishing interest in hunting (Oi and Yamazaki 2006). However, a high number (generally 1,000–2,000, but as many as 4,000) of nuisance black bears are killed annually (using guns, traps, and snares) in towns or agricultural areas of Japan. Farming bears for bile presents another conservation difficulty that needs to be resolved. In Viet Nam, bears are still being removed from the wild to supply farms. In China, whereas the farms themselves may not require restocking from the wild, the excessive bile produced may fuel the market, and thus may actually increase demand for bile from wild bears. In South Korea, where wild Asiatic black bears have been nearly extirpated, 2000 bears are kept and propagated in captivity and it is believed that bile and other parts from this captive population supply an illicit market. Efforts are underway in South Korea to restore the wild bear population through restocking, initially with captive-born bears, but more recently with orphaned wild bears from Russia. Some Southeast Asian countries, like Cambodia and Thailand are also considering reintroducing bears from captivity. Throughout much of the southern portion of the range of this species, efforts to reduce habitat degradation outside PAs and to increase the number and/or area of PAs would be highly beneficial. An increasing number of PAs are being established in China, India, and a few other countries within the range of Asiatic black bears (Chape *et al*. 2003), mainly to protect other species, but serving as well to increase protection for bears. Additionally, the recently amended (2003) Indian Wild Life (Protection) Act provides options for new categories of PAs that could be established to form travel corridors between existing PAs.



Range map for *Ursus thibetanus* (Asian Black Bear)

Source: IUCN.org

Conservation Status for *Helarctos malayanus* (Sun Bear)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Carnivora	Ursidae

Scientific Name:	*Helarctos malayanus*
Species Authority:	(Raffles, 1821)
Common Name(s):	English – Sun Bear, Malayan Sun Bear French – Ours Malais, Ours des cocotiers Spanish – Oso de Sol, Oso Malayo
Synonym(s):	*Ursus malayanus* Raffles, 1821
Taxonomic Notes:	Sun Bears on Borneo (*Helarctos malayanus euryspilus*) are sufficiently different from those on the Asian mainland and Sumatra, representing the typical form (*H. m. malayanus*), as to warrant subspecific differentiation (Meijaard 2004).

Assessment Information

Red List Category & Criteria:	Vulnerable A2cd+3cd+4cd ver 3.1
Year Published:	2008

Date Assessed:	2008-06-30
Assessor(s):	Fredriksson, G., Steinmetz, R., Wong, S. & Garshelis, D.L. (IUCN SSC Bear Specialist Group)
Reviewer(s):	McLellan, B.N. & Garshelis, D.L. (Bear Red List Authority)
Justification: Given the Sun Bear's dependence on forest, it is clear that the large-scale deforestation that has occurred throughout southeast Asia over the past three decades has dramatically reduced suitable habitat for this species. Although quantitative data on population sizes or trends are lacking, it is suspected that the global population of Sun Bears has declined by > 30% over the past 30 years (3 bear generations). Deforestation has reduced both the area of occupancy (AOO) and extent of occurrence (EOO) of Sun Bears, and has also reduced habitat quality in remaining forest. In Malaysia and Indonesia, deforestation will likely continue as long as accessible forest areas with high value timber stock are available. This will result in a highly-fragmented range for sun bears, with forest mainly conserved at higher altitudes where forest clearing and harvesting are either difficult or not economically viable. In addition, Sun Bear numbers have been reduced by uncontrolled exploitation for body parts. It is expected that commercial exploitation will continue during the next 30 years unless abated by the implementation of significant anti-poaching measures.	
Previously published Red List assessments:	1996 – Data Deficient (DD) 1994 – Vulnerable (V) 1990 – Vulnerable (V)

Geographic Range

Range Description:	Sun bears occur in mainland Southeast Asia as far west as Bangladesh and northeastern India (Chauhan 2006), as far north as southern Yunnan Province in China, and south and east to Sumatra and Borneo, respectively. It now occurs very patchily through much of its former range, and has been extirpated from many areas, especially in mainland southeast Asia. Its current distribution in eastern Myanmar and most of Yunnan is unknown. Reports of sun bears formerly occupying Nepal appear to be erroneous. Sun bear fossils from the Pleistocene have been found much further north into China and on the island of Java (Erdbrink 1953), but sun bears did not occur there in historical times. Sun bears are uncommon at the northern and western edges of their range (southern Yunnan province, southeastern Tibet, northeast India, and Bangladesh; (Chauhan 2006, Gong and Harris 2006); this lower abundance was apparent in historical times (e.g., in India; Higgins 1932) so is probably a natural gradient unrelated to human exploitation.
Countries occurrence:	**Native:** Bangladesh; Brunei Darussalam; Cambodia; China; India; Indonesia; Lao People's Democratic Republic; Malaysia; Myanmar; Thailand; Viet Nam **Regionally extinct:** Singapore

Habitat and Ecology

Habitat and	Sun bears rely on tropical forest habitat. Two ecologically distinct categories of tropical forest occur

Ecology:	within its range, distinguished by differences in climate, phenology, and floristic composition. Tropical evergreen rainforest is the sun bear's main habitat in Borneo, Sumatra, and Peninsular Malaysia. This aseasonal habitat receives high annual rainfall that is relatively evenly distributed throughout the year. Tropical evergreen rainforest, includes a wide diversity of forest types used by sun bears, including lowland dipterocarp, peat swamp, freshwater swamp, limestone/karst hills, hill dipterocarp, and lower montane forest. In contrast, sun bears in mainland Southeast Asia inhabit seasonal ecosystems with a long dry season (3–7 months), during which rainfall is <100 mm per month. Seasonal forest types are usually interspersed in a mosaic that includes semi-evergreen, mixed deciduous, dry dipterocarp (<1,000 m elevation), and montane evergreen forest (>1,000 m). The range of sun bears overlaps that of Asiatic black bears (*Ursus thibetanus*) in this seasonal forest mosaic. Sun bears also have been reported in mangrove forest, although their occurrence in this forest type probably depends on proximity to other, more favored habitats. Sun bears use selectively logged areas (Wong *et al.* 2004, Meijaard *et al*. 2005), and oil palm plantations near forest edges (Nomura *et al*. 2004). However, there is no evidence that sun bears can survive in deforested or agricultural areas in the absence of nearby forest (Augeri 2005). Sun bears occur from near sea level to over 2,100 m elevation, but appear to be most common in lower elevation forests. In Indonesia and western Thailand, for example, sun bears occur primarily below 1,200 m (Augeri 2005, Vinitpornsawan *et al*. 2006). Sun bears have been observed up to 2,100 m in Myanmar (Saw Htun 2006), 1,600 m in Lao PDR (Steinmetz *et al*. 1999), and 2,143 m in Sumatra (Augeri 2005). Sun bears are omnivores, feeding primarily on termites, ants, beetle larvae, bee larvae and honey, and a large variety of fruit species, especially figs (*Ficus* spp.), when available (McConkey and Galetti 1999, Wong *et al*. 2002, Augeri 2005, Fredriksson *et al*. 2006). Occasionally, growth shoots of certain palms and some species of flowers are consumed (Fredriksson *et al*. 2006), but otherwise vegetative matter rarely occurs in the diet. In Bornean forests, fruits of the families Moraceae, Burseraceae and Myrtaceae make up more than 50% of the fruit diet (Fredriksson *et al*. 2006), whereas in western Thailand fruits of Lauraceae and Fagaceae are the most commonly consumed (Vinitpornsawan *et al*. 2006). In Thailand sun bears and Asiatic black bears use many of the same habitats and have extensive overlap in diet. However, in montane forests >1,200 m elevation (where ground cover is sparse) Asiatic black bears are more abundant than sun bears (Vinitpornsawan *et al*. 2006). Little is known about social structure or reproduction in sun bears. Except for females with their offspring, sun bears are usually solitary. They may congregate to feed from large fruiting trees, but this behavior appears to be rare. Sun bears do not seem to have a defined breeding season anywhere in their range and usually give birth to only one cub (less commonly two; Schwarzenberger *et al*. 2004). Female bears use cavities of either standing or fallen large hollow trees as birthing sites. As sun bears

	occur in tropical regions with year-round available foods, they do not hibernate.
Systems:	Terrestrial

Threats

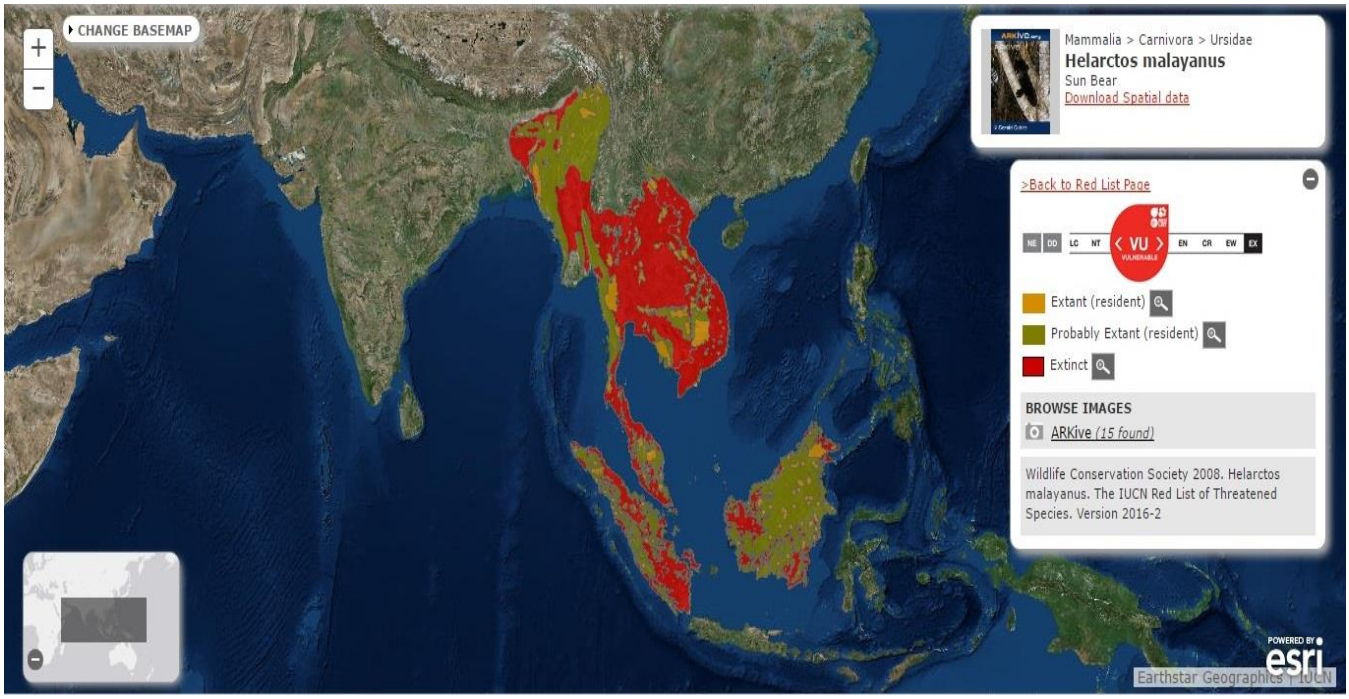
Major Threat(s):	The two major threats to sun bears are habitat loss and commercial hunting. These threats are not evenly distributed throughout the range of the species. In areas where deforestation is actively occurring, sun bears are mainly threatened by the loss of forest habitat and forest degradation arising from: clear-cutting for plantation development, unsustainable logging practices (Augeri 2005, Meijaard *et al*. 2005, Tumbelaka and Fredriksson 2006, Wong 2006), illegal logging both within and outside protected areas (Fuller *et al.* 2004), and forest fires (Fredriksson *et al*. 2007). These threats are prevalent in Indonesia and Malaysia on the islands of Sumatra and Borneo (Sundaland), where large-scale conversion of forest to oil palm (*Elaeis guineenis*) or other cash crops is proceeding at the rate of 1,000s of km² per year (Holmes 2002). Human-caused fires in parts of Sundaland are also diminishing habitat quality for sun bears. These fires are more extensive during El Niño-related droughts. On Borneo, periods of prolonged drought have disrupted fruiting patterns (e.g., Harrison 2000), which in combination with reduced habitat availability due to logging and fires, resulted in starvation among sun bears, even in primary forest areas (Wong *et al*. 2005, Fredriksson *et al*. 2006b). Commercial poaching of bears for the wildlife trade is a considerable threat in most countries (Meijaard 1999, Nea and Nong 2006, Nguyen Xuan Dang 2006, Saw Htun 2006, Tumbelaka and Fredriksson 2006, Wong 2006), and is the main threat where deforestation is currently negligible (for example in Thailand where nearly all remaining forest is within protected areas; Vinitporsawan *et al*. 2006). Killing bears is illegal in all range countries but is largely uncontrolled. In Thailand, local hunters in one area estimated that commercial poaching reduced the abundance of sun bears by 50% in 20 years (Steinmetz *et al*. 2006). In Myanmar, Thailand, Lao PDR, Cambodia and Viet Nam, sun bears are commonly poached for their gall bladders (i.e., bile) and bear-paws; the former is used as a Traditional Chinese Medicine, and the latter as an expensive delicacy. In China and Viet Nam, bile is milked from commercially-farmed bears; however, as there are few sun bears in China, farms there contain mainly Asiatic black bears. Conversely, both sun bears and Asiatic black bears are farmed in Viet Nam, in small private enterprises. Bears are routinely removed from the wild to stock or restock these small farms (Nguyen Xuan Dang 2006, B. Long, MOSAIC and WWF-Viet Nam pers. comm.). Other motivations for killing bears include: preventing damage to crops (Fredriksson 2005), subsistence use, fear of bears near villages, and capture of cubs for pets (the mother being killed in the process). Although few sun bears exist in India, villagers there still kill sizeable numbers (Chauhan and Singh 2006).

	Despite significant poaching within extant forest areas, sun bear populations appear to persist longer than some other heavily-exploited large carnivores. For example, tiger (*Panthera tigris*) populations have been severely reduced or extirpated in 12 of 15 protected areas surveyed in Myanmar, whereas sun bears were still encountered relatively frequently in 13 of these areas (Lynam 2003, Saw Htun 2006). Similarly, in Thailand tigers are close to extirpation in the Khao Yai forest complex, but sun bears and their signs are still consistently encountered there (Lynam *et al*. 2006, Vinitpornsawan *et al*. 2006).

Conservation Actions

Conservation Actions:	Killing of sun bears is strictly prohibited under national wildlife protection laws throughout their range. However, little enforcement of these laws occurs. The sun bear has been listed on CITES Appendix I since 1979. Conservation measures and priorities vary by country. None of the range countries have established specific conservation measures for sun bears, and some taking is permitted (Servheen 1999). General measures to reduce forest loss and poaching would help conserve the species. The most beneficial conservation measure in Indonesia and Malaysia would be protection of remaining forests from conversion to other land-uses, eliminating unsustainable logging practices, and prevention of forest fires. Establishment of new and effectively managed protected areas in Indonesia and Malaysia should be promoted in order to preempt land conversion (Augeri 2005, Tumbelaka and Fredriksson 2006, Wong 2006). Reducing the trade in bear parts would be highly beneficial for the survival of the species in mainland Southeast Asia. However, given available resources, the patrolling and monitoring of entire protected areas is currently an overwhelming task. To make this problem more manageable, a network of small bear recovery zones (100–200 km²) could be established within key protected areas. The patrolling efforts of rangers could then be focused on these zones. Recovery zones should be locations with plentiful bear foods such as trees from the families Lauraceae, Moraceae, Burseraceae, Myrtaceae and Fagaceae. Such zones would provide a biologically meaningful, geographically focused, and logistically realistic way for the efforts of protected area staff to be translated into population recovery for bears (and other wildlife species). Recently, the Bear Specialist Group mapped the current, range-wide distribution of sun bears. Important habitat blocks for long-term survival of sun bears were identified (Bear Conservation Units-BCUs). Anti-poaching efforts within these BCUs should be a high priority. Trends in bear occurrence and relative abundance within BCUs could be monitored using standardized sign surveys and camera trapping. Results of such monitoring could indicate which management or ecological conditions promote successful bear conservation, and which do not, and provide a means to assess the results of conservation efforts (e.g., future range expansion and/or increased bear density being indicative of

	effective conservation efforts). Additional field studies also would be helpful in this regard; few intensive studies have been conducted on this species.



Range map for *Helarctos malayanus* (Sun Bear)

Source: IUCN.org

Conservation Status for *Catopuma temminckii* (Asian Golden Cat)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Carnivora	Felidae

Scientific Name:	*Catopuma temminckii*
Species Authority:	(Vigors & Horsfield, 1827)
Common Name(s):	English – Asiatic Golden Cat, Temminck's Cat, Golden Cat French – Chat de Temminck, Chat doré d'Asie Spanish – Gato Dorado Asiático
Synonym(s):	*Felis temminckii* Vigors & Horsfield, 1827 *Pardofelis temminckii* (Vigors & Horsfield, 1827)
Taxonomic Source(s):	Sicuro, F.L. and Oliveira, L.F.B. 2011. Skull morphology and functionality of extant Felidae (Mammalia: Carnivora): a phylogenetic and evolutionary perspective. *Zoological Journal of the Linnean*

	Society 161(2): 414–462.
Taxonomic Notes:	Taxonomy is currently under review by the IUCN SSC Cat Specialist Group. The Asiatic Golden Cat resembles the African Golden Cat, but on the basis of genetic analysis it was grouped with the Marbled Cat in *Pardofelis* (Johnson *et al.* 2006, O'Brien and Johnson 2007). However, an evaluation of skull morphology by Sicuro and Oliveira (2011) revealed that skull structure in *Pardofelis* is quite different to that of *Catopuma*. Moreover, *Pardofelis* has a flexible ankle joint and elongated tail as adaptations to arboreality, which are lacking in *Catopuma*. Based on these differences, the IUCN SSC Cat Specialist Group retains Asiatic Golden Cat in *Catopuma*.

Assessment Information

Red List Category & Criteria:	Near Threatened ver 3.1
Year Published:	2016
Date Assessed:	2014-04-20
Assessor(s):	McCarthy, J., Dahal, S., Dhendup, T., Gray, T.N.E., Mukherjee, S., Rahman, H., Riordan, P., Boontua, N. & Wilcox, D.
Reviewer(s):	Nowell, K., Hunter, L., Duckworth, J.W., Breitenmoser-Würsten, C., Lanz, T. & Breitenmoser, U.
Contributor(s):	Kawanishi, K., Datta, A., Sanderson, J., Wilting, A., Sunarto, S., Hearn, A. & Ross, J.

Justification: The Asiatic Golden Cat is assessed as Near Threatened. However, there is a general paucity of data for this species, with no density estimates or population data, making an assessment of the true status of the species difficult. The data that we do have indicate that the species has likely experienced population declines of over 20%, and approaching 30% in recent years due to extensive habitat loss and poaching across their range. This pattern is likely to continue in the future, and indicates that the Asiatic Golden Cat is very close to qualifying for a Vulnerable status under criterion A.

The Asiatic Golden Cat has been documented from twelve countries in Southeast Asia. Yet, despite this fairly wide distribution, its presence in India, Bangladesh and Nepal is limited and patchy (Datta *et al.* 2008, Khan 2008, Ghimrey and Pal 2009, Bashir *et al.* 2011, H. Rahman pers. comm.). It is reported infrequently from eastern Cambodia, Lao PDR, Viet Nam, and south China, with records in both China and Viet Nam declining drastically in recent years (Duckworth *et al.* 1999; Johnson *et al.* 2007; Gray *et al.* 2012, 2014; Wilcox *et al.*2014; P. Riordan pers. comm.). It has not been recorded in Viet Nam since 2005, and extensive surveys carried out in Yunnan, Sichuan, Guangxi and Jiangxi Provinces of China have recorded Asiatic Golden Cat on only three occasions (Wilcox *et al.* 2014, Beijing Forestry University unpublished data, Chinese State Forestry Administration unpublished data). It is likely to be extirpated from these two countries in the very near future. The Asiatic Golden Cat is distributed more widely throughout Bhutan, Myanmar, Thailand, Malaysia, and Indonesia, but the is thought to be experiencing population declines in these areas as well (Linkie and Ridout 2009, Sunarto 2012, McCarthy 2013, McCarthy *et al.* 2015, K. Kawanishi pers. comm., S. Dahal pers. comm).

The most significant threats to the Asiatic Golden Cat are thought to be habitat loss and poaching. Although the species has occasionally been recorded from degraded or altered habitats, it is primarily a forest dependent species, and thus is threatened

by the significant habitat loss and fragmentation throughout its range (Nowell and Jackson 1996, Holden 2001, Grassman *et al.* 2005, Choudhury 2007, Wang 2007, McCarthy 2013, McCarthy *et al.* 2015). Although deforestation rates in Southeast Asia have slowed slightly, they are still among the highest in the world at roughly one million hectares/year between 2000 and 2010 (FAO 2011). Land conversion is also a threat to the Asiatic Golden Cat, and even in countries such as Bhutan, where the species is thought to enjoy a relatively protected status, an increase in hyrdopower projects has the potential to negatively impact the species. Poaching of the species is thought to be increasing in many areas, as it is often targeted for the sale of its pelt and body parts (Nowell and Jackson 1996, Duckworth *et al.* 1999, Lynam *et al.* 2006, Khan 2008, Aiyadurai *et al.* 2010, Pusparini *et al.* 2014, H. Rahman pers. comm., P. Riordan pers. comm., S. Mukherjee pers. comm., T. Gray pers. comm., S. Dahal pers. comm., A. Datta pers. comm., D. Willcox pers. comm.). Increasingly, the species may be targeted as a substitute for Tiger pelts and bones. In Viet Nam, there have been several incidences of confiscated Asiatic Golden Cat pelts that were painted to resemble that of a Tiger (D. Willcox pers. comm.). It is also the victim of indiscriminate snaring and hunting in some areas (Holden 2001, Khan 2008, D. Willcox pers. comm.). Finally, there are indications that the species is increasingly being killed in retribution for preying on livestock (mainly poultry) (Sunquist and Sunquist 2002, McCarthy 2013).

The lack of reliable density estimates severely limit our ability to accurately assess the population status and trend of the species. However, the decrease, or sudden absence, of Asiatic Golden Cat records from many areas, in combination with an apparently increased level of poaching, lead us to believe that the population is declining across its range. More rigorous scientific data for this species is needed, and may provide a strong basis on which to base change in status to Vulnerable.

Previously published Red List assessments:	2008 – Near Threatened (NT) 2002 – Vulnerable (VU) 1996 – Lower Risk/near threatened (LR/nt) 1994 – Indeterminate (I) 1990 – Indeterminate (I) 1988 – Indeterminate (I) 1986 – Indeterminate (I)

Geographic Range

Range Description:	The Asiatic Golden Cat has been recorded rarely and patchily from the Northeastern states of India (Assam, Arunachal Pradesh, and Sikkim), through eastern Bangladesh (Northeast and the Chittagong Hill Tracts) and eastern Nepal (Datta *et al.* 2008, Khan 2008, Ghimrey and Pal 2009, Bashir *et al.* 2011, Lyngdoh *et al.* 2011, Lalthanpuia *et al.*2012, Borah *et al.* 2013, Velho 2013, H. Rahman pers. comm.). It is reported infrequently from eastern Cambodia, Lao PDR, Viet Nam, and south China, and records in Viet Nam and south China have decreased drastically in recent years, with strong indications that the species may face extirpation there in the next several years (Duckworth *et al.* 1999; Johnson *et al.* 2006; Gray *et al.* 2012, 2014; Wilcox *et al.* 2014; P. Riordan pers. comm.). It is distributed more widely throughout Bhutan, Myanmar, Thailand, and Malaysia (Tempa *et al.* 2013, T. Dhendup pers. comm., K. Kawanishi pers. comm., S. Dahal pers. comm.). It is widely reported from the island of Sumatra, but not present on other Indonesian islands (Ridout and Linkie 2009, Sunarto 2011, McCarthy 2013, McCarthy *et al.* 2015).

	This distribution may be somewhat generous, particularly in China and Viet Nam. In Viet Nam, there have been several Asiatic Golden Cat pelts confiscated recently in local markets, however, they are of undetermined origin. A live individual has not been recorded in the country since 2005, despite numerous camera trap studies. It is likely that the species has been extirpated from most of the country due to widespread and indiscriminate snaring. In China, extensive surveys carried out with local protected area and provincial government teams in Yunnan, Sichuan, Guangxi and Jiangxi provinces have recorded the Asiatic Golden Cat on only three occasions (Beijing Forestry University, unpublished data, Chinese State Forestry Administration, unpublished data). It is likely that the species is, or will soon be, extirpated from large areas of its range in south China as well.
Countries occurrence:	Native: Bangladesh; Bhutan; Cambodia; China; India; Indonesia (Sumatera); Lao People's Democratic Republic; Malaysia; Myanmar; Nepal; Thailand; Viet Nam

Habitat and Ecology

Habitat and Ecology:	The Asiatic Golden Cat is primarily found in forested areas, particularly tropical and subtropical moist evergreen forests, mixed evergreen forests, and dry deciduous forests. (Nowell and Jackson 1996, McCarthy 2013, McCarthy *et al.* 2015). Two radio collared individuals (a male and a female) in Thailand occurred most often in closed forest habitats (Grassman *et al.* 2005). However, the species has also been recorded from open areas such as shrub or grasslands, or open rocky areas, and from degraded or fragmented forest landscapes (Duckworth *et al.* 1999, Holden 2001, Grassman *et al.*2005, Choudhury 2007, Wang 2007, McCarthy 2013). A radio collared female in Sumatra was frequently recorded outside of a protected area in remnant fragments of forest located between coffee plantations (McCarthy 2013). Records of the Asiatic Golden Cat have a wide altitudinal variation. The species was documented at elevations up to 3,960 m in the Khangchendzonga Biosphere Reserve Sikkim, India, at 3,738 m in the Jigme Sigye Wangchuk National Park in Bhutan, at 2,896 m in Trongsa, and at 3,900 m in Wangduephodrang (Wang 2007, Bashir *et al.* 2011, S. Dahal pers. comm.). However, in some areas it appears to be more common in lowland forests. In Kerinci Seblat National Park in Sumatra, it was only recorded by camera traps at low elevations. The Asiatic Golden Cat is remarkably polymorphic in its pelage. The most common coat color is golden or red brown, but it may also be dark brown or even grey. Melanistic individuals have been reported and may be predominant in some areas of its range (Holden 2001). There is also a spotted form which is called an “ocelot morph” due to its ocelot-like rosettes. To date, this form has been reported from China (in Sichuan and Tibet) and from Bhutan (Wang 2007). The most distinct features of this cat are the white lines bordered with dark brown to black running across the cheeks, from the nostrils towards the cheeks, at the inner corner of the eyes, and up the crown. The rounded ears have black backs with a grey spot. The chest, abdomen and inner side of the upper legs are white with light speckling. The legs and tail are grey to black at the distal ends. The terminal half of the tail is white on the underside and is often carried with the end curled dorsally. Males are larger than females.

	Little is known about the ecology and behaviour of the Asiatic Golden Cat. It was once thought to be primarily nocturnal, however, recent data indicates that it may be more crepuscular or diurnal. Two radio-collared Golden Cats in Thailand's Phu Khieu National Park showed mainly diurnal and crepuscular activity peaks (Grassman *et al.* 2005). In addition, most camera trap photographs of Asiatic Golden Cats in the Kerinci Seblat and Bukit Barisan Selatan National Parks in Sumatra were taken during the day (Holden 2001, McCarthy 2013). The home ranges of two radio collared Golden Cats in Thailand's Phu Khieu National Park were 33 km² (female) and 48 km² (male) and overlapped in significantly (Grassman *et al.* 2005). One confirmed scat contained the remains of Indochinese Ground Squirrel (Grassman *et al.* 2005). Scats from Sumatra contained rat and muntjac remains, and the stomach contents of a carcass in Thailand's Kaeng Krachan National Park included the remains of a small snake (Grassman 1998).
Systems:	Terrestrial
Continuing decline in area, extent and/or quality of habitat:	Yes
Generation Length (years):	6

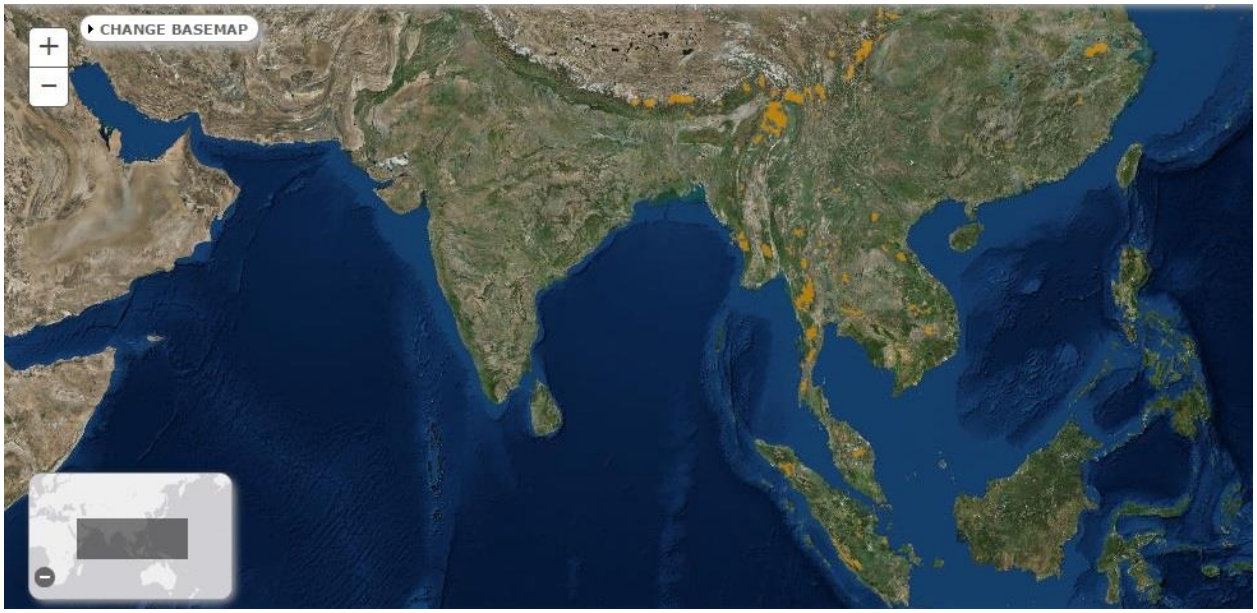
Threats

Major Threat(s):	As a forest, dependent species, the Asiatic Golden Cat is threatened by habitat loss throughout it's range. Although deforestation rates in Southeast Asia have slowed substantially, they are still among the highest in the world (FAO 2011). An increasing number of hydropower projects in countries such as Bhutan, also have the potential to negatively impact the species. In addition, the species is threatened by increasing levels of illegal hunting and poaching for consumption, and for the sale of pelts and body parts (Nowell and Jackson 1996, Duckworth *et al.* 1999, Lynam *et al.* 2006, Khan 2008, H. Rahman pers. comm., P. Riordan pers. comm., S. Mukherjee pers. comm., T. Gray pers. comm., S. Dahal pers. comm.). There is thought to be some level of poaching or hunting of the species in every country across its range. Pelts have been recorded being traded along the Myanmar-Thailand border, and in Sumatra (Duckworth *et al.* 1999, Pusparini *et al.* 2014), and skins are reported from several sites in northeast India (Aiyadurai *et al.*2010, A. Datta pers. comm.). Poaching pressure is particularly high in China and Viet Nam, where the species may soon face extirpation. In Viet Nam, there is some evidence that the species is increasingly targeted as a substitute for Tiger skins and parts, as Tigers become more difficult to obtain. There have been several incidences of confiscated Golden Cat pelts which were painted to resemble that of a Tiger (D. Willcox pers. comm.). Snaring appears to be on the rise across much of mainland Southeast Asia, and constitutes a major threat to the species D. Willcox pers. comm.). In Bangladesh, several recent

	specimens indicate that the species is commonly hunted by indigenous peoples in the Chittagong Hill Tracts. Conflict with humans due to livestock depredation is also thought to be an issue for the species. Retribution killing of the species in response to chicken depredation was recorded in Sumatra (McCarthy 2013).

Conservation Actions

Conservation Actions:	The Asiatic Golden Cat is listed under Appendix I of CITES (as *Catopuma temminckii*), and is officially protected over most of its range by national legislation. Legal hunting is prohibited in Bangladesh, Cambodia, China, India, Indonesia, Peninsular Malaysia, Myanmar, Nepal, Thailand and Viet Nam, and is regulated in Lao PDR. However, there are indications of increasing illegal hunting and poaching in many range countries. Research on the ecology of this species is essential in order to understand population trends and implement effective conservation strategies.



Range map for *Catopuma temminckii* (Asian Golden Cat)

Source: IUCN.org

Conservation Status for *Rusa unicolor* (Sambar)

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Cetartiodactyla	Cervidae

Scientific Name:	*Rusa unicolor*

Species Authority:	(Kerr, 1792)
Common Name(s): English – Sambar, Indian Sambar, Sambar Deer	
Synonym(s):	*Cervus unicolor* Kerr, 1792
Taxonomic Notes:	Most 19th and 20th century sources placed the Sambar in the genus *Cervus*, as *C. unicolor*, but Grubb (1990) resurrected the genus *Rusa* for this and allied species. This was followed by Groves (2003) and Grubb (2005). Groves (2006) pointed out that Chinese Sambar has not traditionally been separated, even at a subspecific level, from Indomalayan *R. u. equinus*, despite karyotype differences (Groves and Grubb 1987) and some clear pelage differences, indicating that taxonomic revision may be forthcoming. Later still Groves and Grubb (2011) divided Sambar into two species, Southeast Asian Sambar *C. equinus* of SE Asia (including NE India) and southern China, and residual Indian Sambar *C. unicolor* of South Asia, based on a variety of morphological differences (no mention was made of 'Chinese Sambar'). They gave no sample sizes or information on animals in the area where the two forms abut, making it difficult to assess the validity of the proposal. This warrants priority investigation because the distributions of the two species mean that the western form is relatively secure, with large subpopulations in many well-managed protected areas, whereas the eastern form has very few apparently secure subpopulations and would, if assessed separately, warrant a Red List Category at least one level more threatened than that for the western form. Throughout at least Indochina there is a predictable flow of reports of 'novel' variation in large deer, with the implication that a new species may be involved (e.g. Pham Trong Anh *et al.* 1996 and, particularly, surveys through local people by overseas consultants); these stems from Sambar (often young animals) with unbranched antlers.

Assessment Information

Red List Category & Criteria:	Vulnerable A2cd+3cd+4cd ver 3.1
Year Published:	2015
Date Assessed:	2014-11-17
Assessor(s):	Timmins, R., Kawanishi, K., Giman, B, Lynam, A., Chan, B., Steinmetz, R., Sagar Baral, H. & Samba Kumar, N.
Reviewer(s):	González, S. & McShea, W.J.
Contributor(s):	Duckworth, J.W., Chakma, S., Brodie, J., Brook, S.M., Fellowes, J., Gray, T.N.E., Jathanna, D., Mudappa, D., Prakash, N., Anwarul Islam, M., Evans, T. & Hedges, S.
Justification: Sambar is listed as Vulnerable through sustained declines across its range. These vary in severity between regions, and in some areas considerably exceed the threshold for Vulnerable. In the last three generations (taken to be 24–30 years), declines in mainland South-east Asia (Viet Nam, Lao PDR, Thailand, Cambodia, Myanmar, Malaysia), Bangladesh, and possibly Borneo and Sumatra have exceeded 50%, probably by a substantial margin. Despite this Sambar remains common in some localized logged, unprotected areas on Borneo, such as the Hose Mountains of Sarawak (where a national park is proposed but not yet enforced), but only where human access is difficult. The overall decline rate in India has been less, given the presence of	

large populations in a fair number of well-secured protected areas which have probably remained stable, but a decline rate averaging 30% is reasonable in India outside these areas (i.e. in the less effective protected areas and outside the protected areas network), and in Sri Lanka and Nepal. The situation in China is unclear as in some areas, for example Hainan, population recovery may be occurring, whilst major declines in other regions may have taken place prior to the 24–30-year assessment window; the population on Taiwan appears to be relatively stable. Although declines seem to be reversing very locally in a few sites, these numbers are a very small proportion of the whole population. There is no indication that declines will, at the species level, slow until populations are extinguished outside well-secured protected areas, which currently comprise only a small proportion of protected areas holding the species. Current trends of wild meat and antler marketing in South-east Asia and China suggest declines have probably sped up in some areas especially Lao PDR, Cambodia and Viet Nam. Since the 2008 assessment trends in wildlife exploitation and natural habitat conversion in mainland Southeast Asia, have if anything increased, thus although the relative size of the Southeast Asian population subcomponent has probably decreased compared with that in South Asia, the rate of decline has probably increased. The global population trend is still considered to be a decline somewhere between 30 and 50 % over three generations, for the past, present and future. The fact that Sambar is at least locally common in a number of high profile protected areas, such as Khao Yai National Park, Thailand and Cat Tien National Park, Viet Nam, and is commonly kept captive and proliferates in menageries in the region, was probably a significant factor in the failure to recognize the plight of the species prior to the 2008 reassessment. These same factors no doubt still to some degree cloud the issue.	
Previously published Red List assessments:	2008 – Vulnerable (VU) 1996 – Lower Risk/least concern (LR/lc)

Geographic Range

Range Description:	The Sambar extends from India and Sri Lanka east along the southern Himalayas (including Nepal and Bhutan) through much of south China (including Hainan Island) to Taiwan (where it occurs in the central and eastern parts; Lin, C.-Y. and Lee, L.-L. pers. comms. 2008). Further south it occurs in Bangladesh, throughout mainland Southeast Asia (Myanmar, Thailand, Lao PDR, Cambodia, Viet Nam, West Malaysia) and many of the main islands of the Greater Sundas (excepting Java): Sumatra, Siberut, Sipora, Pagi and Nias islands (all Indonesia), and Borneo (Malaysia, Indonesia, and Brunei) (Grubb 2005). The current distribution is now highly fragmented in much of this range (see Population). Payne *et al*. (1985) also listed the Philippines, but the Sambar does not occur there. A record from Ujung Kulon, Java, in van Schaik and Griffiths (1996: 107) is presumably an error for Javan Deer *R. timorensis*. The Sambar has been introduced widely outside its native range, e.g.: San Luis Obispo Country, California; the Gulf Prairies and Edwards Plateau regions of Texas (Ables and Ramsey 1974); the St. Vincent Islands, Franklin Country, Florida (Lewis *et al*. 1990); Australia (Slee 1984, Freeland 1990); New Zealand (Kelton and Skipworth 1987); and Western Cape Province, South Africa (Lever 1985). These introduced populations are not included on the distribution map.
Countries occurrence:	Native: Bangladesh; Bhutan; Brunei Darussalam; Cambodia; China (Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Yunnan); India; Indonesia (Sumatera); Lao People's Democratic Republic; Malaysia; Myanmar; Nepal; Sri Lanka; Taiwan, Province of China; Thailand; Viet Nam Introduced: Australia; New Zealand; South Africa (Western Cape); United States (California, Florida, Texas)

Habitat and Ecology

Habitat and Ecology:	No large Indian ungulate has adapted itself to a wider variety of forest types and environmental conditions than has Sambar (Schaller 1967). Within India, Sambar occurs in the thorn and arid forests of Gujarat and Rajasthan, in the moist and dry deciduous forests throughout peninsular India, in the pine and oak forests at the Himalayan foothills, and in the evergreen and semi-evergreen forests of northeastern India and the Western Ghats (Sankar and Acharya 2004, N.S. Kumar pers. comm. 2008). Outside India it extends into temperate-latitude and alpine-zone woodlands of Taiwan (Lin, C.-Y. and Lee, L.-L. pers. comm. 2008). This habitat flexibility is permitted by its broad diet: Sambar has been documented to eat 130–180 species of plants in India alone (Schaller 1967, Johnsingh and Sankar 1991, N.S. Kumar pers. comm. 2008), with food requirements less specialised than those of other deer (Schaller 1967). Sambar grazes or browses depending upon the forage available at that time (Schaller 1967, Richardson 1972, Martin 1977, Bentley 1978, Dinerstein 1979, Kelton and Skipworth 1987, Ngampongsai 1987, Sankar 1994, Semiadi *et al*. 1995). Across the very wide altitudinal range occupied in Taiwan, the diet varies reflecting major changes in plant communities (Lin, C.-Y. and Lee, L.-L. pers. comm. 2008). Sambar was found to live in much higher densities in moist than in dry deciduous forests of Nagarahole National Park (Karanth and Sunquist 1992) and there are no doubt also patterns of habitat selection across the rest of its range. Although the highest densities of Sambar so far recorded were in the semi-arid forests of Ranthambore (Kumar 2000), across most of its Indian range Sambar seems to thrive best in well-watered, moist deciduous hilly terrain (N.S. Kumar pers. comm. 2008). The Sambar occurs up to at least 3,825 m on Siouguluan Mountain, the highest peak of the Central Mountains in Taiwan; elsewhere on the island it ranges down to 150 m asl, mostly living at 2,000–3,500 m (Lin, C.-Y. and Lee, L.-L. pers. comm. 2008). It occurs up to 3,000 m on Gunung Kinabalu, Sabah, Borneo (Payne *et al*. 1985). In Myanmar, recent camera-trap photographs spanned the range of 0–2,150 m asl (Saw Htun pers. comm. 2008). Sambar is largely restricted to hilly terrain in the Terai Arc Landscape (Johnsingh *et al*. 2004), although how much this reflects real habitat selection and how much it is an artificial pattern produced by human effects (habitat conversion and hunting) is unclear. More widely in India, there does seem to be a marked preference for undulating terrain (N.S. Kumar pers. comm. 2008). Kushwaha *et al*. (2004) found that in Kumaon Himalaya (India), Sambar usage was greater of the higher than the lower altitude area. However, it makes wide use of plains areas elsewhere, where these have not been destroyed, e.g. the Hukaung Valley in Myanmar (J.W. Duckworth pers. comm. 2008). In Borneo, while Payne *et al*. (1985) considered Sambar “most common in secondary forests of gently-sloping terrain” they also knew of occurrence in “tall dipterocarp forests on steep terrain and in swamp forests”. In Thung Yai, Thailand, Sambar signs were twice as abundant in lowland forest as in montane forest, although this difference was not statistically significant (Steinmetz *et al*. 2008). Across seven sites in Thailand, places where sambar was detected had shallower slopes, more open habitat, were closer to streams, closer to roads and villages, and had lower rainfall (Lynam *et al.* 2012).In Southeast Asian regions of dense evergreen closed-canopy forest, Sambar is highly tolerant of forest degradation: indeed, much higher numbers are found in encroached stands than in pristine forests, if hunting is under control (Rijksen 1978, Heydon 1994, Stuebing 1995, Davies *et al*. 2001). In Sabah, Sambar was camera-trapped in both mature and young forest stands (Matsubayashi and Sukor

	2005). All the remaining Lao populations are centred around areas with extensive open, or at least broken, habitat amid forest (Duckworth *et al*. 1999), and the general paucity of records from the interiors of large blocks of closed-canopy evergreen and semi-evergreen forests, which generally support the least depleted large mammal populations, probably reflects natural patterns of habitat occupation (R.J. Timmins pers. comm. 2008). Similarly, in extensive tracts of deciduous dipterocarp forest the species occurs primarily around patches of denser habitats, and this seems to be a natural rather than hunting-led pattern (Timmins and Ou 2001). In this sense, in Indochina Northern Red Muntjac *Muntiacus vaginalis* is much more tolerant and versatile than is Sambar. In southern and central India where much of the forest is deciduous, Sambar is a true forest ungulate and conspicuously avoids disturbed and open forests, and is highly sensitive to any sort of forest resource extractive activities (N.S. Kumar pers. comm. 2008). Kushwaha *et al*. (2004) found that in Kumaon Himalaya (India), Sambar was primarily in areas of high tree and herb density with low shrub density. O'Brien *et al*. (2003) found no statistically significant difference in Sambar abundance between areas within 1 km inside the boundary of Bukit Barisan Selatan National Park, Sumatra, and those deep in the interior of the park. Caution is needed in inferring that there is truly no association of Sumatran Sambar with forest edges (which would be astonishing by comparison with its habitat use elsewhere) because the study does not specify whether this 'non-significant' result might simply reflect methodological factors rather than a genuine lack of biological effect (see, e.g., Johnson 1999). Despite the population rises that occur in post-logging forest, there is no evidence that Sambar can survive landscape-level conversion to exotic plantations or other non-forest land-uses, although many live-in coconut plantations (G. Semiadi pers. comm. 2008) and it is relatively common in immature *Acacia mangium* plantations within the matrix of plantation and natural forest of the Sarawak Planted Forests area, Bintulu (B. Giman pers. comm. 2008). Camera trapping in oil palm plantations adjacent to Danum Valley in Sabah suggest that the species does not utilize plantations (Yue and J. Brodie unpublished data). A study of coffee estates around Bhadra Wildlife Sanctuary, India, recorded Sambar only in those coffee areas within 1 km of the sanctuary's boundary (Bali *et al*. 2007). In forest, protected areas of Thailand such as Khao Yai National Park and Phu Khieo Wildlife Sanctuary, Sambar populations are often concentrated around anthropogenic grass and scrub (e.g. sites of former villages) rather than in the forest itself (Trisurat *et al*. 1996; Lynam *et al*. 2001) and this also seems to be true on remote parts of the Bolaven Plateau of south Lao PDR (Evans *et al*. 2000). In the Annamite mountains of Lao PDR and Viet Nam, Sambar seems often to be associated with degraded valley bottom areas, largely the result of long human influence: although the effects of a permanent water source and differences in terrain in determining distribution are difficult to disentangle (R.J. Timmins pers. comm. 2008). Sambar regularly visits salt licks (e.g. Matsubayashi *et al*. 2007), perhaps especially when growing new antlers. This predictability exposes it to high levels of hunting, where this is not effectively controlled. It seems that within an area, not all sort of licks are visited. At the Seima Biodivesity Conservation Area, Cambodia, Sambar photographs were initially very few at mineral lick camera-traps. But in 2007, cameras placed on trails and at some permanent water sources (especially in semi-evergreen forest) recorded Sambar much more often. Checking tracks at more than 40 licks indicated that some were used by Sambar and Red Muntjac, but not Gaur *Bos gaurus* or Asian Elephant *Elephas maximus*, while the big ones with many cattle and elephant prints had few Sambar prints (E. Pollard pers. comm. 2008).

	Sambar was considered to be mostly nocturnal by Kawanishi and Sunquist (2004), to show 'no pattern' (meaning unclear; perhaps intended to imply no significant variation through the 24-hour cycle, although this is itself a pattern) by O'Brien *et al*. (2003), and to be cathemeral by van Schaik and Griffiths (1996). In fact, its activity pattern may vary across sites, but in general it is mostly crepuscular, with significant nocturnal activity as well (Schaller 1967; J.W. Duckworth pers. comm. 2008). Sambar is essentially non-social, stable groups being at most family associations (Schaller 1967; Karanth and Sunquist 1992). However, it is often in groups, presumably temporary, of 12–30 in dry deciduous and semi-arid forests of India (e.g. Bandipur, Pench, Melghat and Ranthambore) (N.S. Kumar pers. comm. 2008), and the same is true around the secondary grasslands within Khao Yai National Park, Thailand (J.W. Duckworth pers. comm. 2008). During peak summer, such associations of up to 80–100 near large waterbodies are not uncommon in Pench in central India (N.S. Kumar pers. comm. 2008). A detailed review of information on grouping in Sambar is in Sankar and Acharya (2004). Results from many areas show a strong bias in sex ratio to females, perhaps reflecting selective predation; alternatively, stags may be more vulnerable to stress (Sankar and Acharya 2004). Breeding is rather seasonal in most areas where studied, for example Schaller (1967) reported that in Kanha the rut spreads over a period of at least seven months with a peak in November–December. Stags during the rut sometimes can cover large distances, up to 10–20 km in one night. Further information for India is reviewed in Sankar and Acharya (2004). The bucks of Formosan Sambar have a seasonal antler cycle, and the mating season is from June to January with a peak in September–October. Males wallow and mark with scent glands in this season. Fawns are born (usually singly) from March to August, with a peak in May and June (Lin, C.-Y. and Lee, L.-L. pers. comm. 2008). Predation appears to be the major cause of Sambar mortality. In Bandipur, Sambar is one of the most important prey in terms of the biomass taken by Tiger *Panthera tigris* (31%), Leopard *P. pardus* (8%) and Dhole *C. alpinus* (13%) (Andheria *et al*. 2007). In Bandipur Sambar remains were found in about 22.3% of Tiger faeces, 6.1% of Leopard faeces and 7.3% of Dhole faeces (Andheria *et al*. 2007). In adjoining Nagarahole, proportion of Sambar in Tiger's diet was about 25–29%, derived from faeces and kill data respectively (Karanth and Sunquist 1995). In Tadoba-Andhari, Sambar together with Gaur contributed to nearly 70% of the prey biomass consumed by Tiger, whereas in Pench-Maharashtra it was 80% (Karanth and Kumar 2005). Sambar occurred in 50% of Tiger scats in Pench-Maharashtra (Karanth and Kumar 2005). In well protected forest reserves where different body-sized ungulates are abundantly available, Sambar together with Gaur are selectively predated by Tiger.
Systems:	Terrestrial
Generation Length (years):	8-10

Threats

Major Threat(s):	Habitat encroachment and hunting are both widespread in the Sundaic region and in much of the rest of

Sambar's range. Indeed, these two threats are often associated and all Borneo's ungulates suffer from the increased hunting that often accompanies logging (Bennett and Dahaban 1995, Bennett and Gumal 2001), such that hunting to local extinction is the chief detrimental effect of logging on ungulates in Sarawak (Bennett and Gumal 2001). This conclusion probably is applicable across the range of Sambar, within which it is heavily hunted (e.g. Duckworth *et al*. 1999, Walston 2001, Tungittiplakorn and Dearden 2002, Linkie *et al*. 2003, Santiapillai and Wijeyamohan 2003, Tilson *et al*. 2004, Rao *et al*. 2005, Steinmetz *et al*. 2008, Saw Htun pers. comm. 2008). It is among the most sought-after wild meats in Indonesia (Semiadi 2005), Sarawak (Belden Giman pers. comm. 2008), and Viet Nam (B. Long pers. comm. 2008), and during 1988–1993 it was a common and preferred food in rural Lao PDR (Duckworth *et al*. 1999, Table 1), and is probably near the top of chosen wild meats throughout most of its range (GMA Indonesia workshop); however, it is less favoured in Taiwan compared with Formosan Serow *Capricornis crispus* and Reeves's Muntjac *Muntiacus reevesi* (Chang Shih-Wei pers. comm. 2008). However, it is now so rare in Nam Ha National Protected Area, Lao PDR, that a more recent hunting study found it to be eaten only rarely (Johnson *et al*. 2003). In Viet Nam, muntjac meat is now often served in wildlife restaurants as Sambar, because real Sambar meat is now so difficult to procure (B. Long pers. comm. 2008). These declines in consumption are probably representative of all Lao PDR and Viet Nam, and of increasing proportions of the rest its range, reflecting population losses (see Population).

There are major, ongoing, declines in at least Viet Nam, Lao PDR, Cambodia, Thailand, Malaysia, Myanmar, Bangladesh and Nepal, and probably Sri Lanka and Indonesia (see Populations) which can plausibly only be driven by hunting, because suitable habitat for Sambar is abundant in these countries but is almost or actually bereft of the species. Even in India, poaching has seriously depleted the abundance of large mammals in most areas; even in high-profile areas such a Corbett Tiger Reserve and Rajaji National Park there are still some instances of poaching (Johnsingh *et al*. 2004). An intensive study of hunting on mammals in two Hmong villages of northern Thailand classified quarry species into tiers representing the sequence of loss through overhunting; Sambar fell in the second tier (aside, e.g., big cats *Panthera*) in the extinction sequence (Tungittiplakorn and Dearden 2002). This study found that Sambar persisted anomalously long in one place under an "exceptional village wildlife hunting regulation promulgated by the village headman until 1994", but was generally extinct in the landscape. A study at Nagarahole National Park compared an area which was only moderately hunted with a heavily hunted site, but found no significant difference in Sambar densities between the two areas (Madhusudan and Karanth 2002). This was speculated to reflect the greater difficulty of hunting Sambar (highly dispersed and usually in rather thick vegetation), despite it being a prized species, than, particularly, Chital *Axis axis*, a herding species often out in the open, and the benefit to poachers of getting in, making a kill, and getting back out again as fast as possible to reduce detection chances; therefore, this pattern seems to have arisen through hunter choice. In the context of Indochina, even the heavily-hunted site would, however, rank as lightly hunted (J.W. Duckworth pers. comm. 2008, based on visit and discussion). For these two reasons, their finding, of an apparent high resilience of Sambar to hunting, is not applicable to the rest of the species' range (particularly outside well-secured protected areas). However, somewhat reflecting this, Sambar's status in non-Sundaic South-east Asia (still

widespread but in ongoing steep decline) relative to other large deer ecologically more similar to Chital (herding; often outside dense forest), Eld's Deer *Rucervus eldii* and Hog Deer *Axis porcinus* (extinct across most of their former range through former steep declines) does indeed suggest a broad applicability of a conclusion that Sambar is somewhat less rapidly reduced by hunting than are other sympatric deer, excepting muntjacs *Munitacus* spp.

Deer are hunted in India using snares, dogs, and guns (Jathanna *et al*. 2003; Kumara and Singh 2004) and these methods are general across their range. Some hunting is for village consumption of meat, but most (at least in South-east Asia) is probably sold commercially, to the affluent urban classes (e.g. Duckworth *et al*. 1999, Walston 2001, Kumara and Singh 2004), and to itinerant labourers, such as logging crews in at least Sarawak (Bennett and Gunal 2001) and gold-diggers and rattan-cutters in Myanmar (in Myanmar (A. Lynam pers. comm. 2014 based on observations in 2002, J.W. Duckworth pers. comm. 2008). Such commercially-driven hunting causes major declines (e.g. Steinmetz *et al*. 2008) because the market is limitless. Adult males suffer additionally because antlers are widely displayed as trophies and are used in traditional medicine (e.g. Martin 1992, Baird 1995). At least in Lao PDR, their market value means that, compared with muntjacs, a high proportion is sent to towns and traded internationally, and many are sold openly in tourist centres such as Louangphabang (Duckworth *et al*. 1999). In Taiwan, in the past live males were sought for farming velvet; this was far more valuable than the meat. Presently, velvet can be bought legally and cheaply from farms and hunting for velvet is now insignificant, as is, here, hunting for internal organs (Chang Shih-Wei pers. comm. 2008). Hunting pressures and patterns vary across Sambar's range: three areas (Indochina; Malaysian Borneo; Taiwan) are profiled below, and all are very different not just from each other, but from southern and central India, where (excepting Taiwan) the species has by far the healthiest conservation status. But even across India, hunting for Sambar meat is almost ubiquitous, even occurring within well-secured protected areas, and to greater extents in other protected areas and outside the protected area system (N.S. Kumar pers. comm. 2008).

Viet Nam, Lao PDR and to a lesser extent Cambodia and northern Thailand are apparently the areas of Sambar's range where generalised mammal hunting is heaviest. Sambar is hunted within a thriving hunting and wildlife trading culture in this area and in adjacent countries such as China and Thailand, involving many land vertebrate species, along with other forest products such as orchids and Aquilaria resin (e.g. Compton and Le Hai Quang 1998, Compton *et al*. 1999, Noreen and Claridge 2001, Smith and Xie Yan in press). Such hunting reaches all areas, although in large rugged mountain forest blocks trade-driven hunting of species valued only for their meat (rather than high-value, low-weight, generally medicinal products that can be carried out efficiently from even the remotest areas) is still limited by economics of accessibility. However, the ability of these areas to protect Sambar at the regional scale is questionable, because no areas of rugged evergreen forest are known with high Sambar densities: such habitat is rather marginal. The regional wild meat trade has little likelihood of abating as long as there are any of the most resilient species (pigs, muntjacs, and civets) to be hunted. The human population of Viet Nam is more than 84 million, that of China more than 1,000 million. Together, they comprise an enormous market for wildlife products. For example, tens of millions of

wild turtles are imported, legally and illegally, into China annually (van Dijk *et al*. 2000 and papers therein). There has been no comparable study of ungulate trade levels. Within the Northern and Central Annamites, every square kilometre of Viet Namese forest and of Lao forest that is within 5 km of the Viet Namese border probably has snares capable of capturing Sambar set in it every year (Timmins *et al*. 2007; R.J. Timmins pers. comm. 2008). Intensity in some areas probably reaches many thousands of snare-nights per km^2 per year (Timmins *et al*. 2007). Snaring is less intensive in Lao PDR at least away from the Vietnamese border, but is increasing dramatically (Timmins and Robichaud 2005; W.G. Robichaud pers. comm. 2007; R.J. Timmins pers. comm. 2008, 2014). Hunting intensity has in recent decades been generally lower in southern Viet Nam than in Lao PDR and northern Viet Nam, leaving many wildlife populations less depleted (e.g. Le Xuan Canh *et al*. 1997, Timmins and Duckworth 2000, Polet and Ling 2004), but the general increase in regional hunting intensity and economic wealth indicate that hunting intensity in this region must also be increasing, as suggested by a recent survey of forest in Dak Nong Province which detected Sambar only once and found many indications of extremely high hunting pressure (Timmins in press). Rapid economic development and expanding wealth, particularly Southeast Asia and China, are increasing the demand for wildlife meat and 'medicines' (e.g. TRAFFIC *et al*. 2008). Timmins *et al*. (2007) highlighted a common misconception, especially in documentation of development projects in the region, that poverty is a principal cause of biodiversity loss: as they pointed out for Saola *Pseudoryx nghetinhensis*, the main driver of threats to wild ungulates in Indochina, at least for the mid-term, is not rural poverty but increasing urban wealth in Indochina and China. In Viet Nam "the free market economy has resulted in feverish periods of trade in wild species nationwide, with negative impacts on biodiversity" (Government of the Socialist Republic of Viet Nam 2004). In Cambodia, the same factor has fostered a thriving bushmeat market and hunting of species for international wildlife trade (Timmins and Ou 2001, Timmins 2006, Maxwell *et al*. 2007), and the intensity of hunting there for some species (Sambar included) is likely to exceed even that in Viet Nam. This reflects the logistical ease of hunting and trading with few controls and the relative abundance of high-value quarry species (R.J. Timmins pers. comm. 2008). There is a rapid, ongoing, expansion of wealthy social strata in Lao PDR, Cambodia, and Viet Nam, directly accelerated by illegal trade in timber, wild meat, and other forest resources, and by the economics of large infrastructure projects (e.g. Nan Theun 2 hydro-electric power project), creating a significantly greater in-country demand for luxury meats such as venison (W.G. Robichaud pers. comm. 2007). Markets along major roads such as route 13 through Lao PDR (e.g. at Ban Namthon) have expanded, not contracted, in the last 15 years (up to 2008) and have a huge (albeit unquantified) turnover of wild meat; at this specific market, multiple stalls are selling dried deer meat daily. The effects of hunting in Lao PDR, Viet Nam, Cambodia and Thailand have been exacerbated during the last two decades by habitat loss and various socio-economic factors, of which the most biologically significant are discussed in the Red List account for Large-antlered Muntjac *M. vuquangensis* (Timmins *et al*. 2008). The most significant constraint to Indochina's Sambar populations is the long-term uncertainty of success in protected areas, even in those currently effective in conservation management. Even the most successful protected areas face an uncertain future with the possibility of degazettement of conservation status of parts of them, the lack of, or possible future loss of, adequate external funding necessary to maintain high standards of management, the lack of, or possible future loss of, political

	support necessary to uphold high protection standards and the uncertainties of maintaining a motivated and well-trained staff. On Borneo, Sambar is also widely and heavily hunted, largely for meat consumed in-country (Bennett *et al*. 2000, Mohd Azlan J. pers. comm. 2008, Belden Giman pers. comm. 2008, G.M. Fredriksson pers. comm. 2008, A.C. Sebastian pers. comm. 2008, Siew Te Wong pers. comm. 2008). Traditionally, hunters used traps, dogs and spears, and blowpipes. Hunters in remote parts of the interior still use these methods, but most animals now die by gunfire. Sarawak held 60,000 legally registered shotguns while Sabah held almost 13,000 in the mid 1990s (Bennett *et al*. 2000). Methods used in Indonesia include guns and spotlights along logging roads, snaring, and dogs (G.M. Fredriksson pers. comm. 2008, S. Hedges pers. comm. 2008). Snaring is still very heavy outside well-secured areas, but shotguns remain the even bigger problem (Bennett *et al*. 2000, Mohd Azlan J. pers. comm. 2008, A.C. Sebastian pers. comm. 2008, Siew Te Wong pers. comm. 2008). Over most of (at least) Malaysian Borneo, "in general, everyone will hunt and eat anything" (Bennett *et al*. 2000). Much hunting is for the market rather than local use, so there is a limitless demand. Bennett *et al*. (2000) and Bennett and Gumal (2001) profiled the hunting of ungulates in Sarawak in the mid 1990s thus: Sambar (along with Bearded Hog *Sus barbatus* and muntjacs *Muntiacus*) is heavily shot for wild meat trade across Sarawak, and these ungulates are the species most sought by the restaurants; Sambar in particular is an important source of meat for logging company employees in Sarawak. Wild meat is widely sold in towns, villages, restaurants and logging camps throughout Sarawak; 250 sales outlets were estimated across the state in 1996, with an annual trade worth 3.75 million USD. Along the Rejang river alone, in the mid 1980s, 1,500 Sambars were sold per year (Caldecott 1988). The market for meat is great and probably expanding. Bennett *et al*. (2000) considered the effects of this onslaught upon Sambar through a lengthy hunting study in February 1993 to June 1995, in both Bornean states of Malaysia (Sarawak and Sabah), each with eight study areas. Sambar constituted only 6.7% of animals killed in Sabah, but 35% by weight of wild meat; negligible numbers were taken in Sarawak, reflecting the major declines that had already reduced the species to rarity. Index counts of signs show an inverse relationship between sign index and hunting pressure so strong that the latter over-rode the effects of habitat variables in determining their densities. Hunting was so ubiquitous, even in protected areas, that in the two states, only one site (part of Danum Valley, Sabah) could be found as a control, where there was primary forest but negligible hunting levels. They concluded that "the only single factor offering any effective protection for [quarry species of] wildlife is difficulty of access"; whether animals are protected or non-protected species, inside or outside protected areas, had no significant restraint on hunting levels. There were, then, no official controls on commercial hunting of non-protected species. The Master Plan for Wildlife in Sarawak (Wildlife Conservation Society and Sarawak Forest Department 1996) introduced a strict ban on all wildlife trade, shotgun ownership and cartridge sales in the late 1990s (Bennett and Gumal 2001). Substantial numbers of Sambars are, nevertheless, still killed in the state, as they are elsewhere in Borneo. Although locally selective logging has probably benefited Sambar populations in some areas by creating more favourable habitats (e.g. Brodie in press b, c), and potentially increasing carrying capacity, the indirect effects of logging undoubtedly greatly outweighs any potential benefit (Bennett and Gumal 2001). Moreover, in the interim since the Master Plan, much forest has been completely lost and Sambar populations in the smaller and more isolated areas that

remain must now be even more vulnerable to local extinctions. For most Sambar populations inaccessibility is still essentially the only real protection for the species, and there are few inaccessible areas left (J. Brodie in litt 2014).

In a study area of almost half a million hectares in Sarawak Sambar detection probability declined by almost 40% between 2008-2014 (B. Giman pers. comm. 2014). This apparent decline coincided in part with harvesting of *Acacia mangium* although as of 2014 harvesting activity had only affected a few plantation compartments. The decline was also attributed to uncontrolled illegal hunting; prior to harvesting few people were involved in plantation activity, but for the period 2012-2014 many workers were brought in, and this resulted in many people hunting on a nightly basis. Additionally the harvesting activity destroyed an important mineral lick (B. Giman pers. comm. 2014).

Taiwan contrasts with the rest of Sambar range in that hunting has been so successfully reduced that populations are now increasing in large parts of the island. It was formerly a big problem, for venison and, for medicinal purposes, velvet and penis. The reduction during and since the 1990s reflects five factors. Hunting of Sambar was banned in 1989 through the Wildlife Conservation Act. Velvet prices fell steeply during 1985–1990 with deer TB in 1985, reducing returns from poaching absolutely an effect exacerbated by rapid economic development in 1980s leading to higher daily wages. Former logging road systems are deteriorating within protected areas, making removal of deer meat less attractive. The general awareness of ecological conservation has much enhanced. And eco-tourism through community forestry plans has given alternative employment to former hunters (all information: Lin, C.-Y. and Lee, L.-L. pers. comm. 2008).

Other sympatric ungulates are hunted broadly as avidly as Sambar, but there is suggestive evidence from two areas of Thailand (Kuiburi National Park and a 20 km² sector of Thung Yai Naresuan Wildlife Sanctuary) that when Sambar densities are very much reduced, recovery may be more difficult than with Gaur *Bos gaurus* and muntjacs. In both these areas the institution of effective protection fuelled a rise in sign density, and presumably animal populations, for Gaur and muntjacs, but not for Sambar (Steinmetz *et al*. 2007, R. Steinmetz pers. comm. 2008). A similar scenario may be ongoing in eastern Cambodia, where Sambar numbers are extremely low (Nuttall *et al.* 2014; O'Kelly *et al.*2012; Gray *et al.* 2013, 2011), presumably because of targeted hunting; yet despite the instigation of protection measures which up to at least 2008 appeared to have moderated hunting pressure there has been no visible sign of recovery (Nuttall *et al.* 2014). But currently significant levels of hunting still exist and have probably been increasing recently, due both to changes in the dynamics of poaching and to some extent protected area management (Nuttall *et al.* 2014, S. Brook pers. comm. 2014, T. Gray pers. comm. 2014, T. Lynam pers. comm. 2014), and perhaps this could be a significant factor in recovery (R.J. Timmins pers. comm. 2014). If these finding are widely applicable the implications for Sambar populations in Lao PDR, Viet Nam, northern Thailand, Peninsula Malaysia, Sarawak and other areas where populations are mostly down to scattered tiny numbers, may be profound.

Over many centuries, the loss of wilderness to human settlement, cultivation and industry has resulted

in massive loss of potential Sambar range, particularly in the densely-settled countries of India, China, Bangladesh, Thailand, and Viet Nam. Throughout the range of Sambar, natural and semi-natural habitats (forest, shrubland and grassland) continue to be converted to anthropogenic habitats, degraded (e.g. stands are being changed in character through logging) and fragmented (broken into smaller blocks). The relative proportions of these activities vary across the range as does the percentage of former forest land so affected. The role of these habitat changes as a direct stimulant of the major declines in progress is unclear. Sambar is highly tolerant of forest degradation: indeed, much higher numbers are found in encroached stands than in pristine closed-canopy forests, if hunting is under control (Rijksen 1978; Heydon 1994; Stuebing 1995; Davies *et al*. 2001, Brodie *et al.* in press b, c). Degradation *per se* is unlikely to be a significant threat. Many Indian forest areas are severely encroached by exotics such as *Lantana camara*, *Parthenium* spp. and *Chromolaena odorata*, and these are suspected to effect major changes to forest structure (Hiremath and Sundaram 2005): but their effects on Sambar populations warrant further study. There is no evidence that Sambar can survive complete conversion of landscapes to non-forest uses such as rice paddies, and its ability to use tree plantations in the absence of natural forest is unclear. Probably, like most deer, provided strips of semi-natural vegetation survive (e.g. along streams and on steep slopes) are present, it can use them to some degree. In most of its range (parts of India excepted) it is unlikely that habitat extent is the determining factor of current Sambar numbers, because large tracts of apparently suitable habitat now support no or only tiny numbers of Sambar. By far the most serious effect of current habitat trends is that fragmentation opens up wilderness areas to people, making it easier to hunt throughout them and cheaper to remove bulk wildlife products such as Sambar meat. In both Malaysian Borneo and Lao PDR the 'natural protection' afforded to an area through difficulty of access has been considered to be the chief factor allowing populations of large, hunted, mammals to survive (Timmins and Duckworth 1999, Bennett *et al*. 2000), and this is probably widely true for Sambar outside India, Nepal and the few other areas where active protective measures are effective. Although Sambar has a wide tolerance of habitat types, numerous observations and studies have indicated that highest densities and presumably habitat preferences of the species correlate with factors such as relatively gentle terrain, river plains, stream and other wetland vicinities, habitat ecotones, and secondary formations originating from closed canopy forests (Simcharoen *et al.*2014; Lynam *et al.* 2012, Brodie *et al.* in press b, c), all factors which correlate positively with ongoing anthropogenic pressures and thus suggest that optimal habitats (and thus potentially a significant proportion of the global Sambar population) are correlated in one way or another with high threat levels for the species. In sum, the proximate cause of the major ongoing Sambar declines in most of its range is hunting, for which habitat conversion and fragmentation exacerbate the effects; and these processes are resulting in an ever-smaller maximum possible population, were the hunting issues to be successfully addressed.

Threats other than hunting and, locally, habitat loss, seem to be insignificant at the species level. Hybridization with Javan Rusa *Rusa timorensis* has been documented (Van Mourik and Schurig 1985), and is apparently a localized threat, where the latter has been introduced into Sambar range, in Pewajam District, East Kalimantan (G. Semiadi pers. comm. 2006) and potentially more widely (Corlett 2010). Hybridization has also been suspected in Sumatra, with the introduced Chital *Axis axis* (G. Semiadi pers. comm. 2006). However, Sambar and Chital co-occur extensively in India

	without hybridizing. Sambar is an occasional crop pest in mainland China, notably around the Ailoshan range (J. Fellowes pers. comm. 2008), India (N.S. Kumar pers. comm. 2008), Lao PDR (Duckworth *et al*. 1999), Myanmar (J.W. Duckworth pers. comm. 2008), Sumatra (D. Martyr pers. comm. 2008), and probably throughout its range. There is no evidence that Sambar is a serious crop pest away from the fields directly abutting forests. Nonetheless, crop damage is often stated by affected farmers to lead to a requirement for lethal control. However, the ready market for meat means that this is most probably an excuse for killing that would enthusiastically be undertaken anyway (N.S. Kumar and J.W. Duckworth pers. comm. 2008): it is therefore unlikely that control of crop-degrading animals is a significant cause of the species' decline anywhere in Sambar's range. Grazing competition with domestic stock seems to be much less of a threat to Sambar than to sympatric Gaur and Chital: in fact the key study quantifying just how serious a threat such competition is in Indian protected areas (Madhusudan 2004) found that it had negligible effects on Sambar densities, presumably because Sambar is an efficient browser. Threats to southern India's forest ungulates by competition with domestic stock grazing within protected areas are exacerbated where dung is collected for export to adjacent coffee areas. Fuel wood removal may also be at levels sufficient to disrupt nutrient cycles of the habitat (Madhusudan 2005). In the Indian Terai Arc Landscape, lopping of tree branches for cattle fodder is a threat to Sambar as it effectively removes most browsable vegetation from the landscape (B. Long pers. comm. 2008). These are probably more serious concerns for Sambar than is grazing by domestic stock.

Conservation Actions

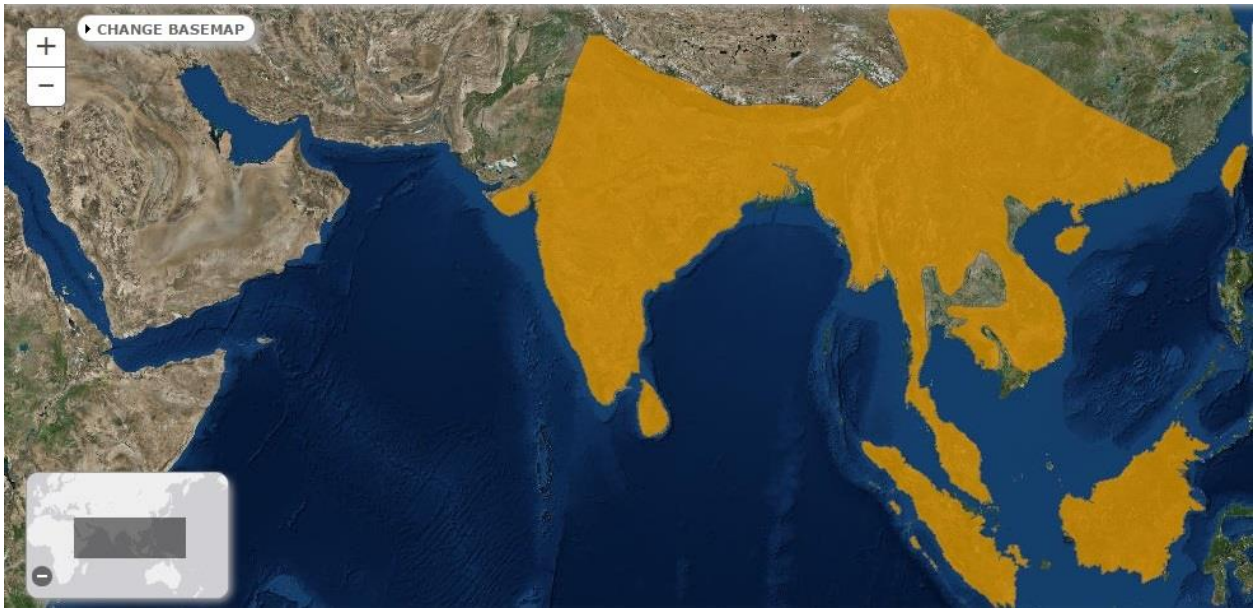
Conservation Actions:	The Sambar is found in many protected areas throughout its range, although in most of these areas this legal status has not stemmed declines and local extinctions from hunting. Similarly, although it is protected from hunting by legislation, even outside protected areas, in most or all range states, these laws are challenging to enforce, given the trade demand for meat and antlers (GMA Indonesia Workshop). In Sarawak, Borneo, unfortunately, Sambar is not on the protected list of Sarawak Wildlife Protection Ordinance, 1998 (a, b) (B. Giman pers. comm. 2014). Currently the law has a strong protective effect in Taiwan (Lin, C.-Y. and Lee, L.-L. pers. comm. 2008) and in various protected areas of India (N.S. Kumar pers. comm. 2008). In Southeast Asia, Sambar declines have lagged behind those of other sympatric deer (excepting muntjacs). There is no doubt that within a decade or two Sambar will be, like Hog Deer and Eld's Deer are already, almost absent from South-east Asia unless effective protection from trade-driven hunting is instituted. In India, the species's status is less grim, and this is dependent upon continuation of the current protected areas system, and the expansion of effective threat reduction into a greater proportion of protected areas: in many Indian protected areas, poaching is rampant and in such vulnerable areas Sambar numbers are still declining. Given the major challenges combating hunting of such a desired animal, long-term survival is most realistic in large protected areas (exceeding 1,000 km^2 where possible), lacking people living within them, with an adequate number of motivated and capable staff (Anak Patannavibool pers. comm. 2008, A.J. Lynam pers. comm. 2008). The precise ways for protected areas to function effectively in the conservation of large mammals depend upon their own specific

circumstances, but field presence of staff, dispersed across the area, is likely to be important in almost every area. For example, Lynam *et al*. (2006) found in Khao Yai National Park, Thailand, that encounter rates of tracks and signs of Sambar (and other large mammals) decreased with distance from ranger substations. Deep inside the forest to the south and east, far away from ranger substations, Sambar was locally extinct. Similar patterns are shown by current Sambar distributions in other Thai protected areas such as Khao Sok, Phu Khieo and Kaeng Krachan (A.J. Lynam pers. comm. 2008). In some protected areas (recent examples being Bhadra and Kudremukh in Karnataka), formerly forest-dwelling human communities have resettled closer to markets, clinics, school and other services (Karanth and Karanth 2007). This expands habitat available to Sambar (that which was formerly fields and houses) but more significant is the removal of a source of hunters and the cessation of grazing competition with domestic stock (see Karanth *et al*. 2006). Such conservation interventions have helped recovery of Sambar populations in this region. Increasing development aspirations mean that outmigration is likely from further areas, e.g. Mudumalai. Most of the remaining forest within its Chinese range are already established as nature reserves (M.W.N. Lau pers. comm. 2008).

As the majority of the Sambar population is in South Asia, conservation activities are important there. It is also important that populations are maintained at least in several areas in Southeast Asia, to maintain Sambar presence through its historical range, to preserve Sambar genetic diversity and through its importance to the ecosystems within which it lives. Given the regional pattern of threats and current successes to date, implementing effective conservation interventions is considerably more challenging, and therefore a higher priority in the Southeast Asian region.
The most important conservation measure for Sambar in Cambodia is the continued strengthening and support of conservation efforts in Seima Protected Forest, Phnom Prich Wildlife Sanctuary and Mondulkiri Protected Forest and to a lesser extent support of protected area conservation management in the northern plains and central Cardamoms. Likewise, in Viet Nam, the most important conservation measure is the continued support of protection efforts within Cat Tien National Park, and in Thailand it is to to expand government-funded park protection and ranger training programmes outside of the few parks which are currently well supported in the Western Forest Complex. In Myanmar, the Hukaung Valley is an exceptional area of lowland plains forest, grassland, and wetlands. Through its size and mostly little-encroached condition, this is the most outstanding remaining landscape-level floodplains habitat for very large mammals remaining in tropical Asia, and although wildlife populations are highly depleted, warrants the strongest effort to conserve it. It faces a number of daunting challenges (J.W. Duckworth pers. comm. 2008). In Lao PDR, any of a large number of areas could become key Sambar conservation sites, but there is as yet no precedent in the country for effective conservation of high-trade-value large mammals. Xe Pian, Nam Et–Phou Louey, and Nakai–Nam Theun NPAs could all be highly significant areas for the species, but so could almost any other NPA; the reality is that the most success with Sambar conservation is likely to come through identifying areas with positive underlying situations to achieve conservation, rather than identifying the area with the most intrinsic importance for Sambar as the focus for efforts.

Captive breeding is being developed in East Kalimantan (G. Semiadi pers. comm. 2008). A captive

	herd of 223 heads in 10 ha enclosure was established in 1998 in Penajam District, as a pilot project. Several private herds exist in the province, such as at Bearau and at Nunukan, both with more than 20 heads (G. Semiadi pers. comm. 2008). Captive Sambar herds are also widespread in mainland Asia.



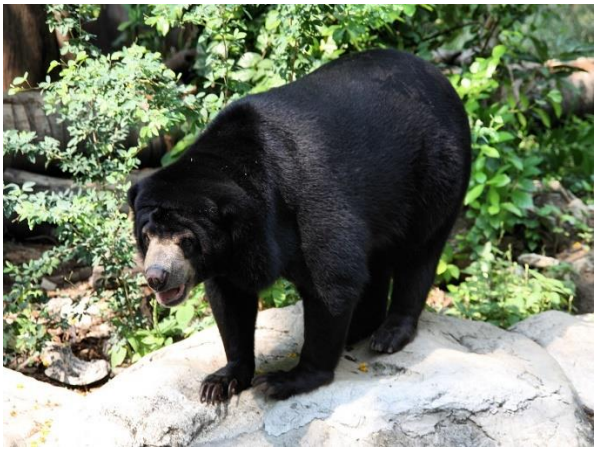
Range map for *Rusa unicolor* (Sambar)

Source: IUCN.org

Sunda Pangolin *(Manis javanica)*

Dhole (*Cuon alpinus*)

Chinese Pangolin (*Manis pentadactyla*)



Sun Bear *(Helarctos malayanus)*

Eastern Hoolock Gibbon *(Hoolock leuconedys)*

Sambar *(Rusa unicolor)*

Himalayan Black Bear *(Ursus thibetanus)*

Yellow-throated Marten *(Martes flavigula)*

Common Palm Civet *(Paradoxurus hermaphrodites)* **Black Giant Squirrel *(Ratufa bicolor)***

Fig 23: Some photo of recorded mammals in survey area

Reptile and amphibian

A total of 8 species were recorded during the period at chibwe nge dam site and power house area. Seven reptile species and one amphibian species were observed during the survey area. Among these recorded species Chinese Cobra Naja atra and King Cobra Ophiophagus Hannah are Vulnerable species as listed in IUCN Red List of Appendix II. Forest crasted lizard Calotes emma and Spotted forest skink Sphenomorphus maculates were found as common reptile species distributing in all habitats of the studied area. Common toad Bufo melanostatus was observed particularly in human habitation area.

Table 14: List of reptile and amphibian species recorded around the power house

Sr. No.	Scientific Name	Common Name	Family	IUCN Status	CITIES Status
1	*Ptyas sp.*	Rat Snake	Colubridae	LC	none
2	*Sphenomorphus maculatus*	Spotted forest skink	Scincidae	LC	none
3	*Bufo melanostatus*	Common toad	Bufonidae	LC	none

Table 15: List of reptile and amphibian species recorded around the dam site

Sr. No.	Scientific Name	Common Name	Family	IUCN Status	CITIES Status
1	*Ahaetulla nasuta*	Long-nosed whip snake	Colubridae	LC	none
2	*Ophiophagus Hannah*	King Cobra	Elapidae	VU	Appendix II

3	*Naja atra*	Chinese Cobra	Elapidae	VU	none
4	*Mabuya sp.*	Common Skink	Scincidae	LC	none
5	*Calotes emma*	Forest crasted lizard	Agamidae	LC	none

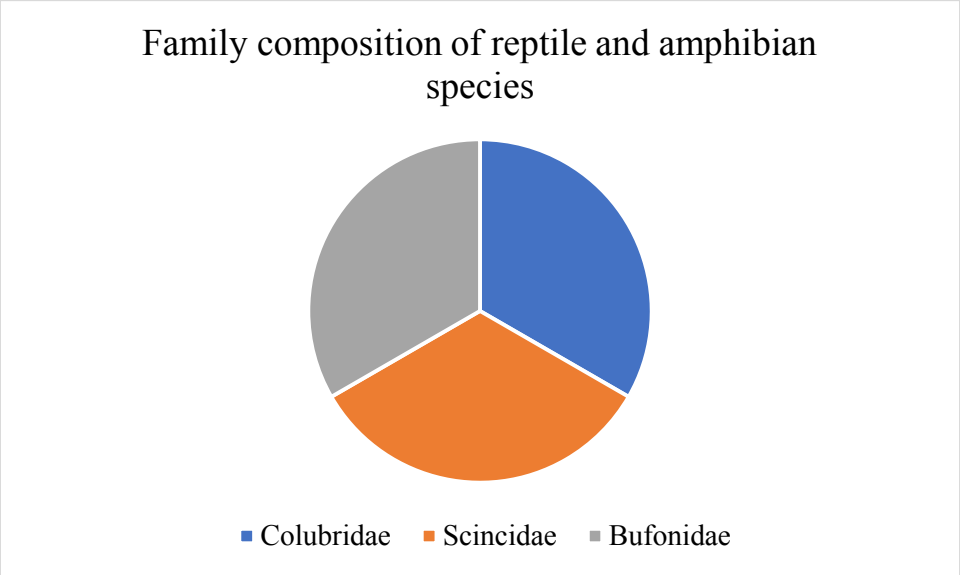


Fig 24: Family composition of reptile and amphibian species recorded around the power house area

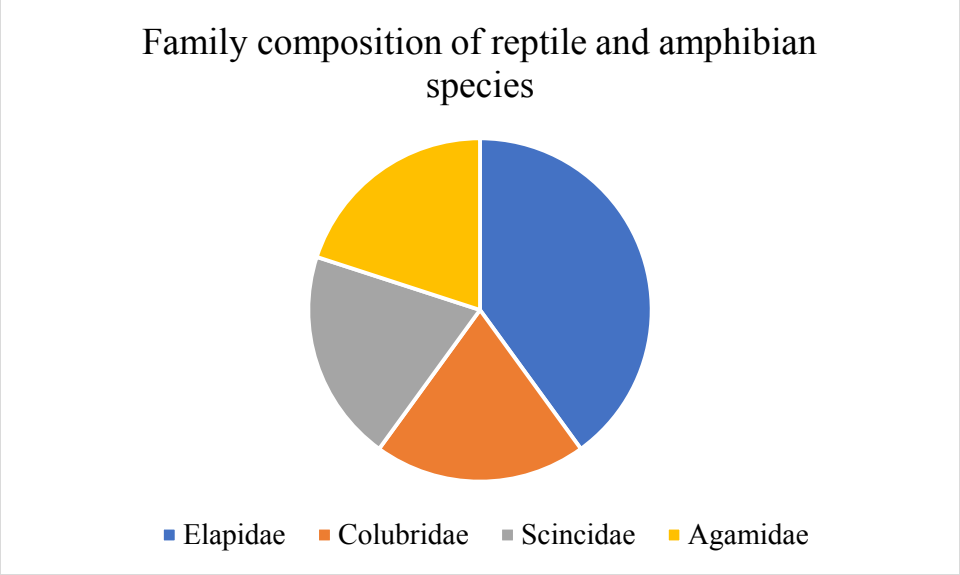


Fig 25: Family composition of reptile and amphibian species recorded around the dam site

Long-nosed whip snake ***(Ahaetulla nasuta)***

King Cobra ***(Ophiophagus Hannah)***

Chinese Cobra ***(Naja atra)***

Spotted forest skink ***(Sphenomorphus maculates)***

Common toad ***(Bufo melanostatus)***

Fig. 26: Photo of Reptile and Amphibian species recorded in survey area

Aquatic Fauna

(i) Fish

A total of 13 fish species at upstream and 15 species at downstream were recorded during the survey period

(Table 9 and 10), where members of Family Cyprinidae dominate the fish fauna. It was reportedly recorded that the fishes were in small population size. Commercial fishery activities were not observed in the area. The recorded fish species were not listed under IUCN Red List. The recorded fish species are not listed under long-distance longitudinal migratory species. According to the interview result, the fishes were not main sources for the consumption of the local people.

Table 16: Lists of fish species recorded at upstream site

Sr. No.	Scientific Name	Common Name	Family	IUCN Status	Remark
1	*Puntius chola*	Barb	Cyprinidae	LR	Interview
2	*Labeo calbasu*	Carp	Cyprinidae	LR	Interview
3	*Labeo boga*	Carp	Cyprinidae	LR	Interview
4	*Cirrhinus mrigala*	Carp	Cyprinidae	LR	Interview
5	*Osteobrama belangeri*	Carp	Cyprinidae	LR	Interview
6	*Garra lamta*	Carp	Cyprinidae	LR	Interview
7	*Tor brevifilis*	Carp	Cyprinidae	LR	Interview
8	*Heteropneustes fossilis*	Stinging catfish	Heteropneustidae	LR	Interview
9	*Mystus montanus*	Striped dwarf catfish	Bagridae	LR	Interview
10	*Mystus vittatus*	Catfish	Bagridae	LR	Interview
11	*Pseudecheneis sulcatus*	Silurus	Siluridae	LR	Observed
12	*Neolissocheilus hexastichus*	Copper mahseer	Cyprinidae	LR	Observed
13	*Channa striatus*	Striped snake head	Channidae	LR	Interview

LR = Least Risk

Table 17: Fish species recorded at downstream site

Sr. No.	Scientific Name	Common Name	Family	IUCN Status	Remark
1	*Puntius chola*	Barb	Cyprinidae	LR	Interview
2	*Labeo calbasu*	Carp	Cyprinidae	LR	Interview
3	*Labeo angra*	Carp	Cyprinidae	LR	Observded
4	*Cirrhinus mrigala*	Carp	Cyprinidae	LR	Interview
5	*Osteobrama belangeri*	Carp	Cyprinidae	LR	Interview
6	*Garra lamta*	Carp	Cyprinidae	LR	Interview
7	*Tor brevifilis*	Carp	Cyprinidae	LR	Interview
8	*Heteropneustes fossilis*	Stinging catfish	Heteropneustidae	LR	Interview
9	*Mystus vittatus*	Catfish	Bagridae	LR	Interview
10	*Mystus bleekeri*	Catfish	Bagridae	LR	Observed
11	*Pseudecheneis sulcatus*	Silurus	Siluridae	LR	Observed
12	*Neolissocheilus hexastichus*	Copper mahseer	Cyprinidae	LR	Observed
13	*Channa orientalis*	Brown snakehead	Channidae	LR	Interview

14	*Glyptothorax dorsalis*	Catfish	Sisoridae	LR	Interview
15	*Glyptothorax cavia*	Catfish	Sisoridae	LR	Interview

LR = Lower Risk

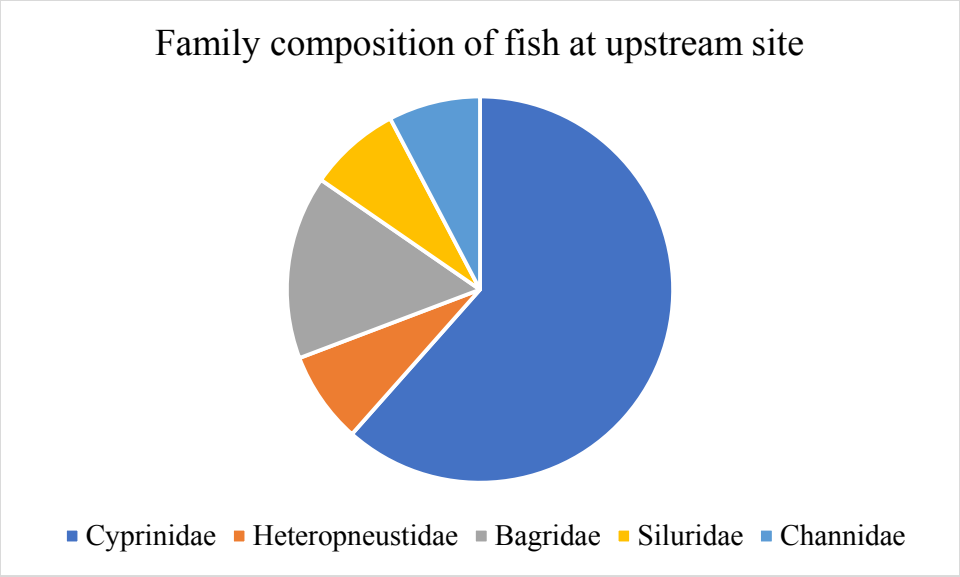


Fig 27: Family composition of fish recorded at the dam upstream site

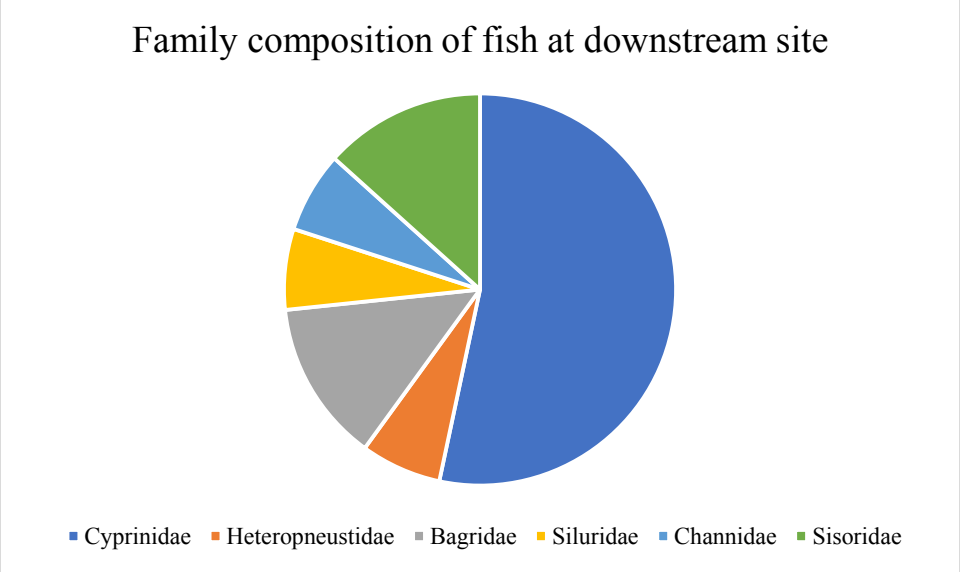
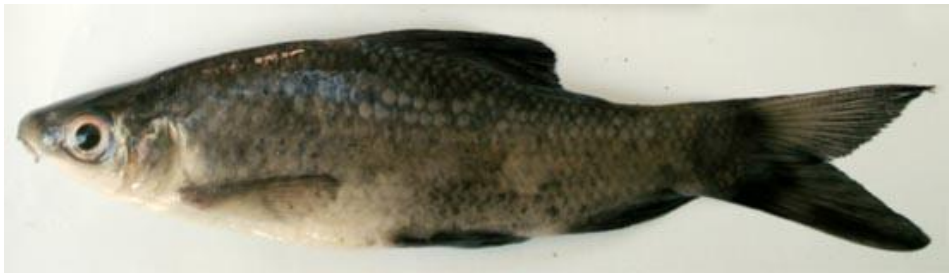


Fig 28: Family composition of fish recorded at dam downstream site

Puntius chola **(Barb)**



Labeo calbasu **(Carp)**

Heteropneustes fossilis **(Stinging catfish)**

Pseudecheneis sulcatus **(Silurus)**

Labeo angra **(Carp)**

Mystus vittatus **(Catfish)**

Neolissocheilus hexastichus **(Copper mahseer)**

Channa orientalis **(Brown snakehead)**

Fig 29: Photo of fish species recorded in survey area

(ii) Benthos

Benthos species were rare in both upstream and upstream sites. Four species at upstream site and three species at downstream site were recorded. Two mollusc species were found during the survey periood. The earthworm species Notoscolex striatus was observed both in upstream and downstream sites (Table 11 and 12). The larvae of Trithemis kirbyi kirbyi dragon fly species were found as benthos species.

Table 18: Benthos species recorded at upstream site

Sr. No.	Species	Family	Group	Remark
1	*Pila polita*	Ampullariidae	Mollusk	uncommon
2	*Pheretima andersoni*	Megascolecidae	Earthworm	uncommon
3	*Notoscolex striatus*	Megascolecidae	Earthworm	uncommon
4	*Trithemis kirbyi kirbyi*	Libellulidae	Larvae of dragon fly	uncommon

Table 19: Benthos species recorded at downstream site

Sr. No.	Species	Family	Group	Remark
1	*Clea helena*	Buccinidae	Mollusk	uncommon
2	*Notoscolex striatus*	Megascolecidae	Earthworm	uncommon
3	*Trithemis kirbyi kirbyi*	Libellulidae	Larvae of dragon fly	uncommon

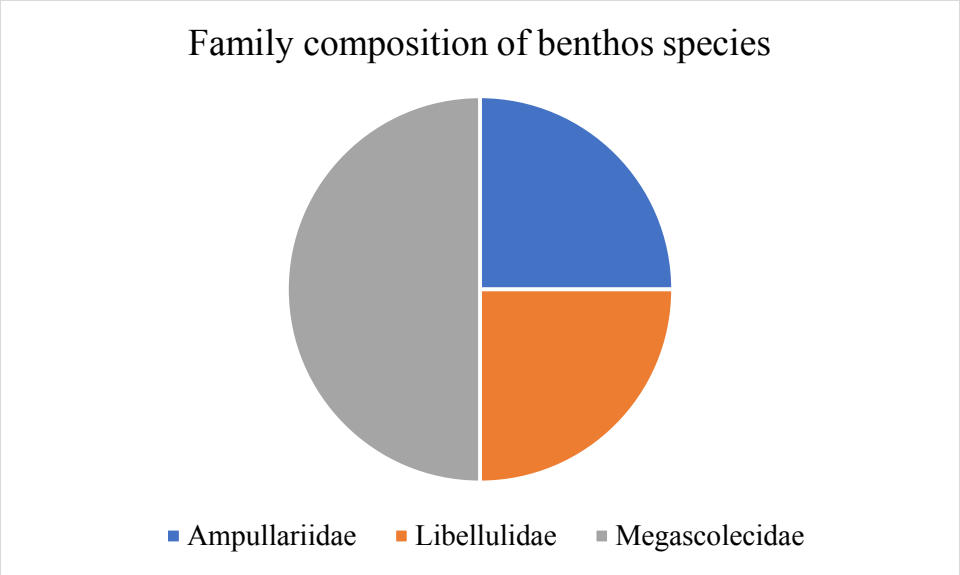


Fig 30: Family composition of Benthos species recorded at upstream site

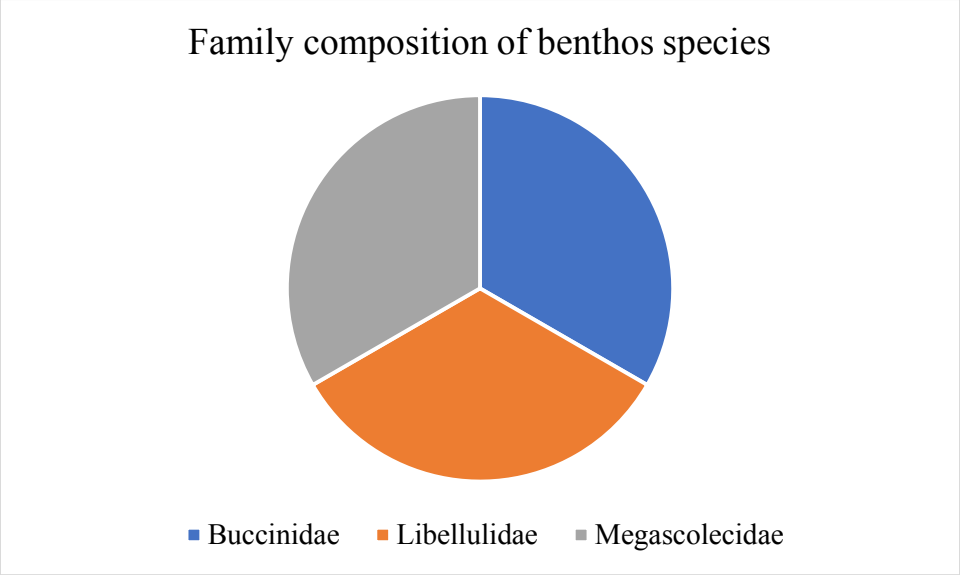


Fig 31: Family composition of benthos species recorded at downstream site

(iii) Plankton

A total of 9 plankton species were recorded at upstream site, where 5 species were observed as zooplankton species and the next 4 species as phytoplankton species. Among the recorded species, Closterium archerianum was found as common species. Seven plankton species were found from the samples collected from downstream site. Among these recorded plankton species, three species were found as zoolplankton species and two species as phytoplankton species.

Table 20: Plankton species recorded at upstream site

Sr. No.	Species	Group	Family	Remark
1	*Diffugia lebes*	Zoolplankton	Diffugiidae	Uncommon
2	*Spathidium spathula*	Zoolplankton	Didiniidae	Uncommon
3	*Notholca acuminate*	Zoolplankton	Brachiondae	Uncommon
4	*Brachionus falcatus*	Zoolplankton	Brachiondae	Uncommon
5	*Bosmina sp*	Zoolplankton	Bosminidae	Uncommon
6	*Closterium archerianum*	*Phytoplankton*	Desmidiaceae	Uncommon
7	*Spirogyra protecta*	*Phytoplankton*	Zygnemataceae	Uncommon
8	*Oscillatoria subbrevis*	*Phytoplankton*	Oscillatoriaceae	Uncommon
9	*Tabellariae sp*	*Phytoplankton*	Fragilariaceae	Uncommon

Table 21: Plankton species recorded at downstream site

Sr. No.	Species	Group	Family	Remark
1	*Diffugia lebes*	Zoolplankton	Diffugiidae	Uncommon
2	*Spathidium spathula*	Zoolplankton	Didiniidae	Uncommon
3	*Brachionus falcatus*	Zoolplankton	Brachiondae	Uncommon
4	*Closterium archerianum*	*Phytoplankton*	Desmidiaceae	Uncommon
5	*Spirogyra protecta*	*Phytoplankton*	Zygnemataceae	Uncommon
6	*Lyngbya contorta*	*Phytoplankton*	Oscillatoriaceae	Uncommon
7	*Tabellariae sp*	*Phytoplankton*	Fragilariaceae	Uncommon

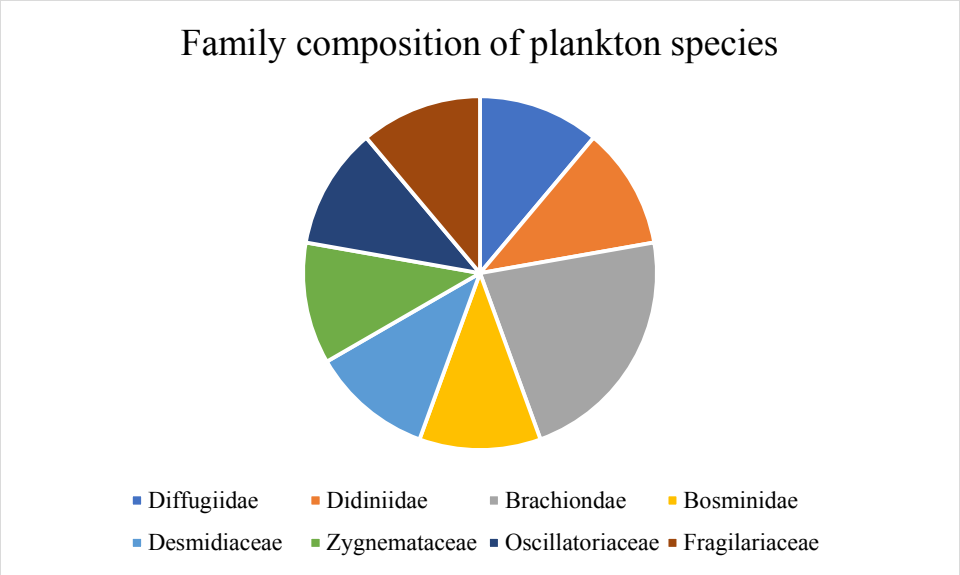


Fig 32: Family composition of plankton species recorded at dam upstream site

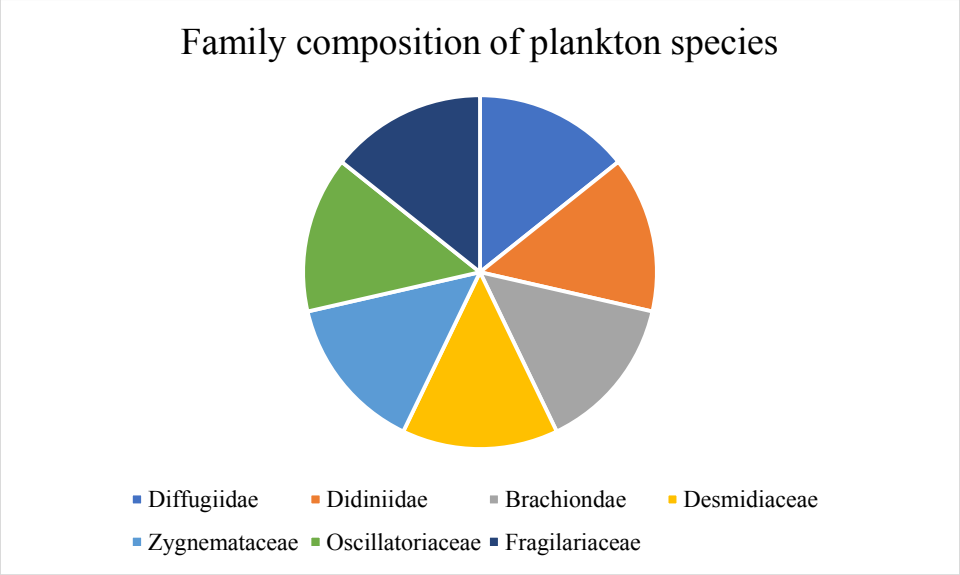


Fig 33: Family composition of plankton species recorded at dam downstream site

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Appendix III

Social and Health Impact Assessment

For

Chipwi Nge Hydropower Project

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Chapter I

Introduction

1. Project Background

1.1 Location

The Project site is situated in Chipwi Township, Myinkyina District, eastern part of Kachin State, Northern Myanmar. Chipwi Township lies between North Latitude between 25˚00´ and 26˚ 00´ and East Longitude between 97˚00´ and 98˚ 45´. The dam of Chipwi Nge Hydropower Station is located on Chipwi River, a tributary on the left bank of Nmaihka River, in the straight river valley about 1.5km～2.0km at the upstream of Labang Bridge, about 15km away from Chipwi Town; the plant is on the left bank of Nmaihka River, about 9km away from the upstream Chipwi Town, about 62km away from the downstream Myistone Hydropower Station, and about 20km away from the upstream Chipwi Hydropower Station. At present, the purpose of the project is to supply power to Chipwi Town and Myitkyina City, Kachin State and Mawluu, Sagaing Division. (Map 1.1)

Nmaihka River originates from the southwest foot hill of Boshula Mountains in the boundary of Zayu County, Tibet, China, and flows into Myanmar from Maku of Gongshan County, Yunnan Province, and converges with Malikha River at Myitsone which is about 45km north of Kachin Myitkyina. And then, it is formed as Ayeyawady River. Nmaihka River is 353km in length and 24,200km^2 (including 4,200km^2 in the Chinese boundary) in drainage area.

Chipwi River is a tributary on the left bank of Nmaihka River, and the geographical coordinate is East Longitude 98°8′～98°28′ and North latitude 25°30′～25°52′. It originates from Gaoligong Mountain at the boundary of China and Myanmar, flows from southeast to northwest, and converges with Nmaihka River close to Chipwi Town. Chipwi River is 743.6km^2 in drainage area, 58.0km in length, and 52% in gradient. Average annual discharge is 54.0m^3/s.

The dam of Chipwi Nge Hydropower Station is planned to be located about 15km away from the river mouth. Riverbed elevation there is about 710m, control catchment above the is 552.3km^2, river length is 42.1km, and gradient is 54‰.

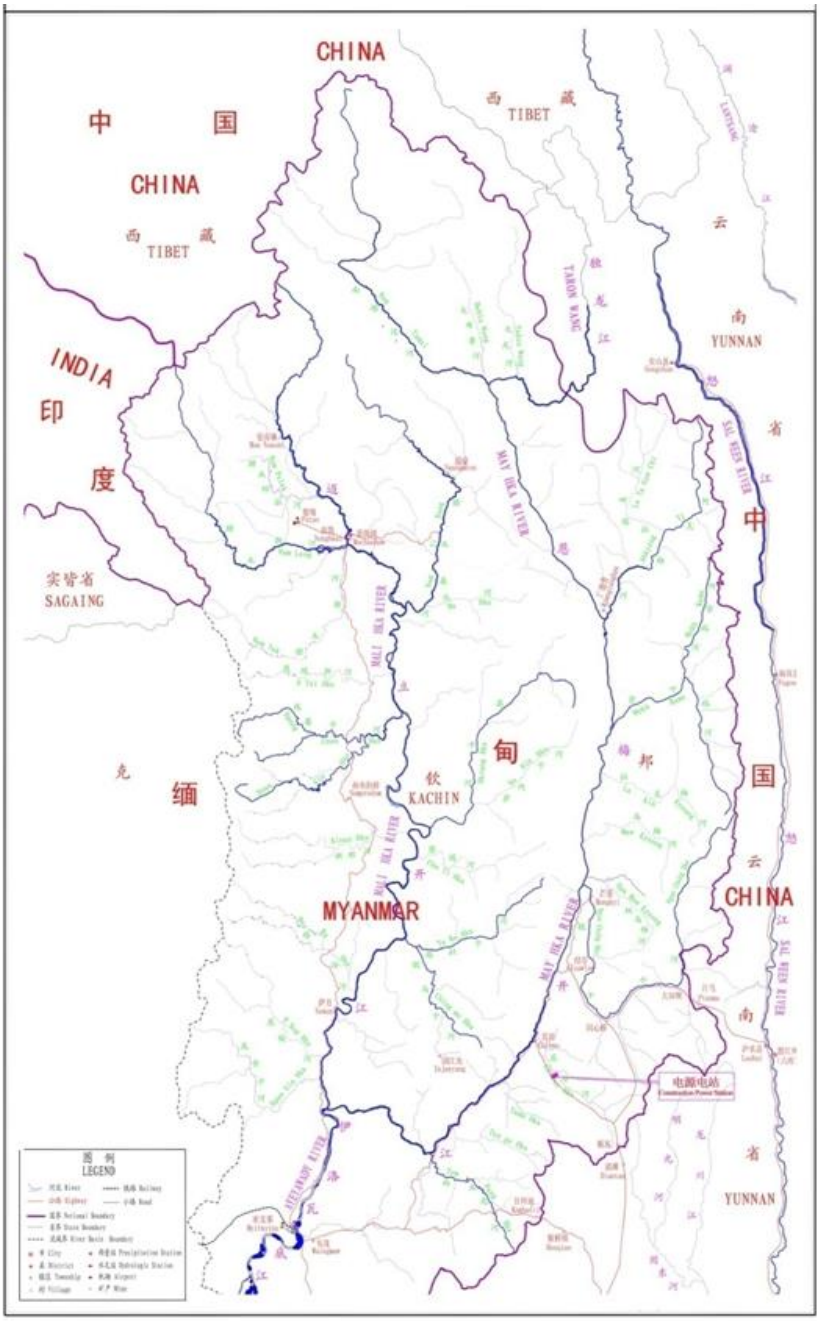


Figure 1.1 Location Map of Chipwi Township

1.2 Hydropower planning in the drainage basin

Ayeyawady River basin above Myitkyina owes abundant water resources, which has relatively valuable development. In recent years, with the demand of social and economic development, Myanmar government lists hydropower development as the national priority, and at the same time, transforms its advantage of resources into economic advantage. According to the geological location and the condition of hydropower resources, Myanmar government plans to focus on developing hydropower resources in Ayeyawady River basin above Myitkyina.

In December 2006, Ministry of Electric Power No. 1, Myanmar (MOEP 1) and China Power Investment Corporation (CPI) signed the *Memorandum of Understanding on Hydropower Projects in Nmaihka River, Malikha River and Chipwi Nge of Ayeyawady River, Myanmar*. Entrusted by CPI, CDC formulated the *Planning Report of Hydropower Development in Nmaihka River, Malihka River and Chipwi Nge Hydropower Station of Ayeyawady River, Myanmar* in December 2007. In October 2009, CDC formulated *Feasibility Study Report of Chipwi Nge Hydropower Station in Upper Reaches of Ayeyawady River*.

According to the characteristics of Ayeyawady River basin above Myitkyina and the requirement of the national economy of Myanmar on river development, the mission of the planned drainage basin development is power generation while controlling flood and improving shipping along the lower reaches and irrigation conditions. The plan recommends scheme 1 for the Cascade Development of Ayeyawady River basin above Myitkyina after analyzing and comparing the comprehensive utilization profits, engineering technical condition and engineering economic indexes, namely:

Enmaynua River, Ayeyawady River: Yenan(1010m)—Kaunglanhpur(875m)—Pisa(665m)—Wutsok(525m)—Chipwi(400m)—Myitsone(245m) and Malinka River: Laza (370m).

The recommended scheme for the cascade development of Ayeyawady River basin above Myitkyina is of 184,00MW total installed capacity and 99.11 billion kW-h annual energy output.

According to MOA agreement, Myanmar, it is planned to spend 15 years on developing this valley cascade power station. According to the development condition, pre-phase work foundation and the cascade power station profit, the power stations of Myistone and Chipwi are listed as recent projects to be developed, Wutsok, Pisa, Kaunglanhpur and Laza power stations, which have relatively good development condition and economic indexes, are listed as the second batch of projects to be development, and Yenan power station the third batch.

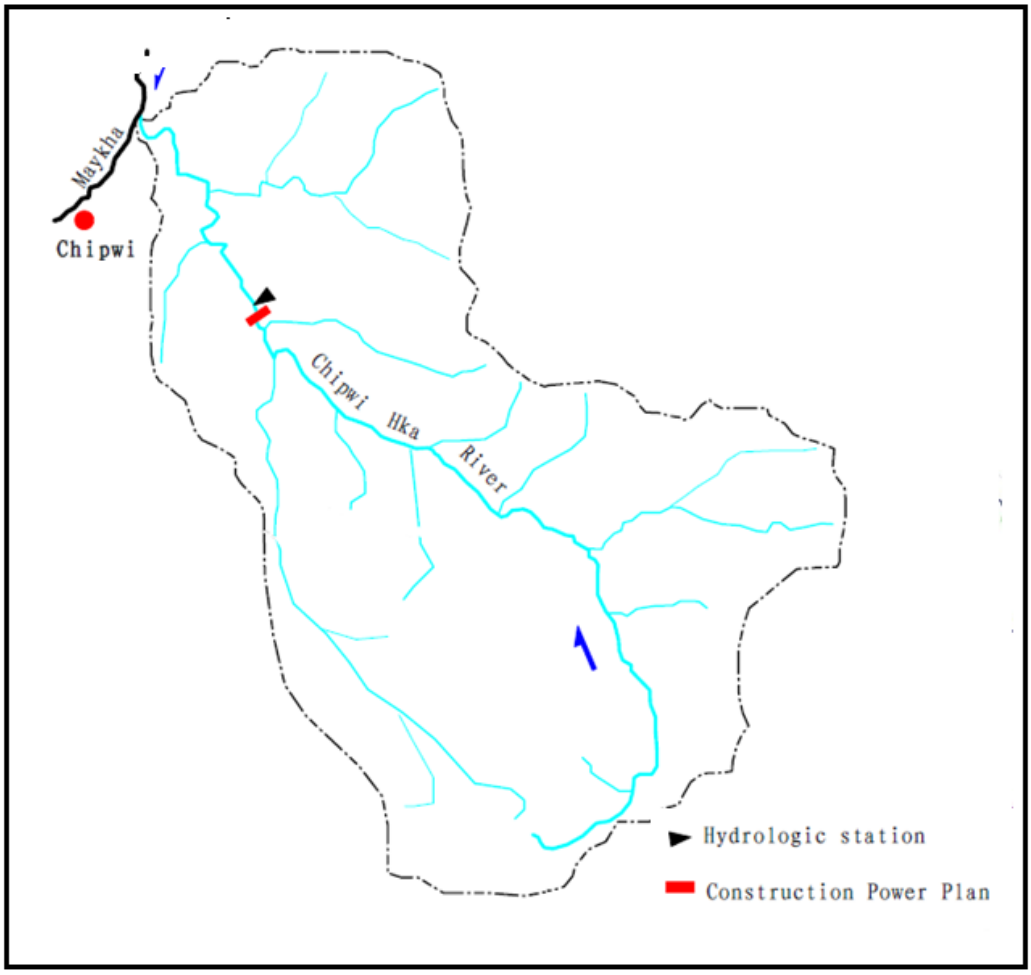


Figure 1.2 Chipwi Hydropower Station and Power Plant

1.3 Social and Helath Impact Assessment Team

Team comprises of 6 professional experts including two doctors surveyed the project area and its environs, held public meetings and analyzed the potential impacts by using the collected data.

Table 1.1 Social Impact Assessment Team

No	Name	Gender	Duty	Responsibility
1	Ms. Khin Ohnmar Htwe	FM	Principal Consultant	Social Impact
2	Ms. Phyu Phyu Shein	FM	Principal Consultant	Social Impact
3	Ms. Nan Thazin Oo	FM	Senior Consultant	Social Impact
4	Ms. Mya Mya Khine	FM	Consultant	Social Impact
5	Dr. Ye Naing	M	Consultant	Health Impact
6	Dr. Hein Htet Soe	M	Consultant	Health Impact

1.4 Legal and Institutional Framework of Myanmar

Introduction

Myanmar has already had some legislation and regulation relating to natural environmental aspects since before its independence. The Forest Act and the Burma Wildlife Protection Act, for example, have been enacted respectively in 1902 and 1936 for the sustainability of the forest produces. Amended versions of such earlier acts and newly promulgated ones are herein briefly outlined to give a perspective on the existing legal and administrative framework concerning the environmental affairs in Myanmar.

Key Agencies

In Myanmar, ministries get involved sector in legislation and administration of environment-related laws and acts depending on the technical nature of respective ministry and relevant environmental aspects. The principal ministries implementing and administering such enacted laws and regulations on behalf of the government are, namely, Ministry of Environmental Conservation and Forest, Ministry of Mines, Ministry of Culture, Ministry of Agriculture and Irrigation, Ministry of Health, Ministry of Hotel and Tourism, and Ministry of Livestock and Fisheries. They issued orders, directives and notifications as may be necessary. On the other hand, the National Commission for Environmental Affairs (NCEA), formed under the Ministry of Foreign Affairs in 1990, has played a role as a central/focal coordinating body for environmental matters, particularly adopting national policies on environment until 2011. After the elected government of 2010, the Ministry of Forestry has been reformed into Ministry of Environmental Conservation and Forestry and an Environmental Conservation Law (2012) has been approved recently by Myanmar Government.

There are also some NGOs cooperating in the environmental activities of Myanmar. Some of these are, Red Cross, NIL, Fire Volunteer Service, Forest Resources and Environment Development Association (FREDA), Wildlife Conservation Society (WCS), California Academy of Science, International Center for Integrated Mountain Development, Botanic Gardens Conservation International, Conservation on Biodiversity, Smithsonian Institution, Wild Birds Society of Japan, and Asian Elephant Specialist Group. Also, there are academic and research organizations like Myanmar Environment Institute (MEI) and Economic and Environmental Research Institute (EERI).

Legislation and Guidelines

In the state constitution, "environment" means "natural environment". It states that "The state shall protect the natural environment".

The National Environmental Policy in 1994 was adopted to ensure the incorporation of environmental concerns in planning for economic development. The NEP emphasizes "the responsibility of the State and every citizen to preserve its natural resources in the interest of present and future generations".

There formulated Myanmar Agenda 21, in 1997 in response to the call of the Earth Summit to develop national strategies to implement the Global Agenda 21. This document served as a framework for

integrating environmental considerations in future national development plans as well as sectoral and regional development plans in Myanmar until 2012. In 2012 March, Environmental Conservation Law was approved by the Government and it has become the most supreme legislation for environmental aspects in Myanmar.

Besides the above-stated documents, there are several laws and regulations relating to the environmental matters administered by various relevant ministries in Myanmar.

The laws related to the present Hydropower Project are described in Table 1-2 and the project owner will comply these laws and regulation during construction, operation and decommisionning phase of the present hydropower project.

Table 1-2 Legal Framework related to the present project.

Title	Brief Description
National Environmental Policy (1994)	To establish sound environmental policies in utilization of water, land, forest, mineral resources, and other natural resources in order to conserve the environment and to preserve it degradation. It is the responsibility of every citizen to preserve its natural resources in the interests of present and future generations. Environmental protection should always be the primary objective in seeking development.
Myanmar Agenda (1997)	Agenda encourages on mobilization and focus national efforts to achieve sustainable development and facilitation the incorporation of environmental considerations in the development process of the economic and social sectors
The 2008 Constitution	Governments' commitment to protect and preserve natural environment
Environmental Conservation Law, 2012 (Section 7- o, 14, 15,24, 29)	Provision of basic guidance to integrate environmental conservation in sustainable development, ministry's responsibility to develop relevant guideline and regulation, setting up monitoring system, waste management, conservation of natural resource and cultural heritage.
Environmental Conservation Rules, 2014 (Rule 69)	The principle of this rule is to support the execution conducted by ministry as required by environmental conservation law.
EIA Procedures, 2015 (Article 102 – 110, 113, 115, 117)	Description of categories of project to conduct EIA and IEE requirement, content of EIA, submission and approval principle, environmental certificates, responsibilities of ministry and project proponent
National Environmental Quality (Emission) Guidelines, 2015	MOECAF formulated the National Environmental Quality (Emission) Guidelines (NEQG) in coordination with ADB in December 2015. The NEQG determines the guideline values for general emission such as air emissions, wastewater, noise levels, odor, and those for sector-specific emission such as emission from forestry, agribusiness/food production, chemicals, oil and gas, infrastructure, general manufacturing, mining, and power.
The Forest Law, 2018 (40 section 3,4) (41-A,B), (42-A), (43-A,B,C)	To implement forest policy and environmental conservation policy, to promote the sector of public cooperation in implementing these policies, to develop the economy of the State, to prevent destruction of forest and biodiversity, to carry out simultaneously conservation of natural forests and establishment of forest plantations and to contribute to the fuel requirements of the country.

Title	Brief Description
The protection of Biodiversity and Protected Area Law, 2018	To protect wildlife, wild plants and conserve natural areas, to contribute towards works of natural scientific research, and to establish zoological gardens and botanical gardens. Law describe (a) to implement the policy and strategy of protecting biodiversity of the Government,(b)To implement the policy of conserving the natural areas of the Government,(c) To carry out in accordance with International Conventions adopted by the State in respect of the preservation of wild life and wild plants, living and non-living organisms and migratory birds (d) To protect wild life and wild plants liable to the danger of extinction and the habitats thereof(e)To contribute towards works of natural scientific research. The project company commit to comply section 39, 40 and 41.
The protection and preservation of Cultural Heritage Region Law, 2019	Obligation not to carry out any of the following in the cultural heritage region (a) Destroying an ancient monument; (b) Willfully altering the original ancient form and structure or original ancient workmanship of an ancient of an monument; (c) Excavating to search for antiques; (d) Exploring for petroleum, natural gas, precious stones or minerals.
Land Acquisition Act (1894)	Enacted in 1894 during British Colony time, this act highlights the process and duty of government to acquire the land for sake of country with notification to owners, compensation for land and damage to land
Farmland Law and Rule 2012	The law provides the rights of farmers to a certain extent than the similar laws in the last 50 years. There is significant improvement in this law with regard to the right of farmers such as right to sell the land and ownership. Any form of acquiring farm land to convert to investment project for sake of country shall be strictly followed in accordance with these law and rule
The Myanmar Citizen Investment Law (2013)	The New Citizens Investment Law was enacted in 2013, repealing the Myanmar Citizens Investment Law of 1994. This law is to promote the inducement of domestic investment so as to lead to promotion of production and exports by the private sector.
The Electricity Law (2015)	Generally, set forth the principle of permission required by relevant authorities to installation, generation, transmission, distribution and inspection tasks. Permission might be withdrawn under the circumstance that licensed organization infringe the requirements stipulated in agreement. Projects are divided into three categories as small, medium and large.
The Conservation of Water Resources and River Law (2006)	This law aims at protection of water resources and river, avoidance of environmental impact, enhancement in navigation and safe water way and contribution to State economy
The Conservation of Cultural Heritage Objects Law (2015)	Generally, set for steps to adhere in the event of discovering objects which are judged as culturally valuable. Types of cultural heritage objects and reporting process are also listed.
Protection and prevention of ancient buildings (2015)	This law aims at conservation of historically valuable buildings deemed under the law.
The Prevention of Hazard from Chemical and Related	The Prevention of Hazard from Chemical and Related Substances Law, the central law of chemicals management in Myanmar enacted in 2013, stipulates that when chemicals and related substances is to be transferred, stored, used, or disposed, operating approval

Title	Brief Description
Substances Law (2013)	certificate should be obtained in accordance with the regulations based on the international treaties.
Social Security Law (2012)	The Social Security Law, enacted in 1012, was amended the Social Security Act in 1954. It stipulates the formation and implementation of social security system.
Workmen's Compensation Act (1923)	It stipulates that employer is required to make payments to employees who become injured or who die in any accidents arising during and in consequence of their employment. Such compensation also must be made for disease which arise as a direct consequence of employment, such as carpal tunnel syndrome.
The Minimum Wage Law (2013)	The law was replaced the 1949 Minimum Wage Act. The Law provides a framework for minimum wage determination, the presidential office establishing a tripartite minimum wage committee shall decide minimum wage with industrial variation base on a survey on living costs of workers possibly every two years. This also stipulates equal payment.
Employment and Skill Development Law (2013)	The law aims to facilitate employment which is appropriate to the age and ability of the job seeker and to help workers obtain employment and to provide stability of employment and skills development for employees ant also too help employers obtain appropriate employees.
The Leave and Holiday Act (1951)	This act has been used as the basic framework for leaves and holidays for workers with minor amendment in 2006 and 2014. This defines the public holidays that every employee shall be granted with full payment. It also defines the rules of leaves for workers including medical leave, earned leave and maternity leave.
The Labour Organization Law (2011)	The Labour Organization Law replaced the Trade Union Act enacted in 1927 for protecting the rights of the workers, having good relations among the workers or between the employer and the worker, and for forming and carrying out the labour organizations systematically and independently. Under the law, the labour organization has the right to carry out freely in drawing up their constitution and rules. It has the right to negotiate and settle with the employer if the workers are unable to obtain the right of the workers contained in the labor laws. On the other hand, the employer shall recognize the labour organizations and assist as much as possible if the labour organizations request for help for the interest of his workers.
The Labour Dispute Settlement Law (2012)	This law was enacted for safeguarding the right of workers or having good relationship between employer and workers and making peaceful workplace or obtaining the rights fairly, rightfully and quickly by settling the dispute of employer and worker justly. It stipulates that employer in which more than 30 workers are employed shall form the workplace coordinating committee consisting of the representatives of workers and the representatives of employer.
The Protection and Preservation of Antique Objects Law (2015)	It aims to implement the policy of protection and preservation of the perpetuation of antique objects and to protect and preserve antique objects so as not to deteriorate due to natural disaster or man-made destruction.
Motor Vehicles Law (2015)	It aims to drive safely motor vehicles in public area through registration according to official rules and regulations, to provide driving license, to protect the road users from the road risks and vehicles perils, to avoid traffic congestion and to use high technology transportation systems.
Export and Import Law (2015)	It aims to implement the economic principles of the State successfully, to lay down the policies to export and import that support the development of the State, and that are to be in conformity with the international trade standards.

Title	Brief Description
The Explosive Substances Act (1908)	The Explosive Substance Act stipulates the prohibitions on production, possession and use of explosives without permission
The Myanmar Citizen Investment Law (2013)	The New Citizens Investment Law was enacted in 2013, repealing the Myanmar Citizens Investment Law of 1994. This law is to promote the inducement of domestic investment so as to lead to promotion of production and exports by the private sector.
Kachin State Municipal Act (Kachin State Parliament Law No. 10/2013)	This municipal act aim to protect the environment and supervise the discharge of solid waste and municipal waste.

Myanmar as one of the parties signed more than 30 international and regional conventions and protocols. Refer to Table 1-3 for details.

Table 1.3 Myanmar's Commitment to International Agreements on Environmental Issues

No.	*International Environmental Conventions/ Protocols/ Agreements*
1	Plant Protection Agreement for the South-East Asia and the Pacific Region, Rome, 1956
2	Treaty Banning Nuclear Weapons Test in the Atmosphere in Outer Space and Under Water, Moscow, 1963
3	Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Sea-Bed and Ocean Floor and in the Subsoil there of, London, Moscow, Washington, 1971
4	Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons, and on their Destruction, London, Moscow, Washington, 1972
5	International Convention for the Prevention of Pollution from Ships, London, 1973
6	Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, London, 1973
7	United Nations Convention on the Law of the Sea, Montego Bay, 1982
8	United Nations Framework Convention on Climate Change, New York, 1992 (UNFCCC)
9	Convention on Biological Diversity, Rio de Janeiro, 1992
10	Treaty on the Non-Proliferation of Nuclear Weapons, London, Moscow, Washington, 1968
11	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and their Destruction, Paris, 1993
12	International Tropical Timber Agreement (ITTA), Geneva, 1994
13	Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985
14	Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1987

15	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990
16	The Convention for the Protection of the World Culture and Natural Heritage, Paris, 1972
17	ICAO ANNEX 16 Annex to the Convention on International Civil Aviation Environmental Protection Vol. 1 Aircraft Noise
18	ICAO ANNEX 16 Annex to the Convention on International Civil Aviation Environmental Protection Vol. II Aircraft Engine Emission
19	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space Including the Moon and Other Celestial Bodies (Outer Space Treaty), London, Moscow, Washington, 1967
20	Agreement on the Networks of Aquaculture Centres in Asia and the Pacific, Bangkok, 1988
21	South East Asia Nuclear Weapon Free Zone Treaty, Bangkok, 1995
22	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and / or Desertification, Particularly in Africa, Paris, 1994 (UNCCD)
23	Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, D.C., 1973; and this convention as amended in Bonn, Germany,1979 (CITES)
24	Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, New York, 1994
25	Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, Rome, 1973
26	ASEAN Agreement on the Conservation of Nature and Nature Resources, Kuala Lumpur, 1985
27	Catagena Protocol on Biosafety, Cartagena, 2000
28	ASEAN Agreement on Transboundary Haze Pollution
29	International Treaty on Plant Genetic Resources for Food and Agriculture, 2001
30	Kyoto Protocol to the Convention on Climate Change, Kyoto, 1997
31	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001

Laws related to Land Issue

As the present project comprises land acquisition and resettlement, present study also emphasize significant laws which have govern the issues related to land, land administration and land ownership in Myanmar since in the British Colonial time to the present day.

1. Farmland Law, 2012
2. Farmland Rules, 2012
3. Fellow, Vacant and Virgin Lands Management Law, 2012
4. Fellow, Vacant and Virgin Lands Management Rules, 2012

5. The Foreign Investment Law, 2012
6. The Foreign Investment Rules, 2013
7. Myanmar Special Economic Zone Law, 2011
8. Constitution of the Republic of the Union of Myanmar, 2008
9. The Development Committee Law, 1993
10. The Forest Law, 1992
11. Duties and Rights of the Central Committee for the Management of Culturable Land, Fallow Land and Waste Land, 1991
12. Transfer of Immovable Property Restriction Law, 1987
13. The Lower Burma Town and Village Land Manual, 1899
14. The Land Acquisition Act, 1894
15. The Lower Burma Land Revenue Manual, 1876

Table 1.5 List of laws and regulations related to land tenure and land use, the brief summary, current status and responsible ministry/department

Law/Regulation		Date and Year		Brief Summary	Current Status	Responsible ministry/ department
Name	Number	Promulgation	Enforcement			
Union Level						
Farmland Law	11/2012	30 Mar, 2012	31 Aug, 2012	The law introduces right to use the land to farmers through land use certificate and acquiring the farmland for other purpose	Newly enacted and currently applied	MOAI/SLRD
Farmland Rules	62/2012	31 Aug, 2012	31 Aug, 2012	This rules detailed the eligibility of farmer or organization for the process of acquiring land use certificate , the role and responsibility of farm land committee in various level and the application process of land use certificate	Newly enacted and currently applied	MOAI/SLRD
Vacant, Fallow & Virgin Lands Management Law	10/2012	30 Mar, 2012	31 Aug, 2012	Stipulation of claiming unused land to usable in form of agriculture , livestock, mining & government allowable other purpose	Newly enacted and currently applied	MOAI
Vacant , Fallow & Virgin Lands Management Rules	1/2012	31 Aug, 2012	31 Aug, 2012	Process of application and approval of the unused land for various purposes.	Newly enacted and currently applied	MOAI
The Forest Law	8/92	3 Nov, 1992	1992	Classification of type of land belongs to Forestry Department. The law supports conservation, sustainable forestry and socio-economic benefits. In addition, the law decentralizes forest management to some degree and encourages the private sector and community participation in forest management.	Existing and currently applied	MONREC
Union Government Notification	No. 39	2011	2011	Application of right to use land owned by government , government departments, organization, citizens	Existing and currently applied	

Table 1.6 List of laws and regulations related to compensation of assets and losses, the brief summary, current status and responsible ministry/department

Law/Regulation		Date and Year		Brief Summary	Current Status	Responsible ministry/ department
Name	Number	Promulgation	Enforcement			
Union Level						
Land Acquisition Act	Act no. 1	1 March, 1894	1894	Consideration for calculating a suitable amount of compensation is to be made as quick as possible for affected person when the land is acquired by the government. Government has authority to acquire the land under this Act not only for public purpose but also for business reasons for the companies at that time.	Existing and partially applied	MOHA
Myanmar Special Economic Zone Law		27 Jan, 2011	2011	The developer shall bear the expenses of transferring and compensation of houses, buildings, farms and gardens, orchards/ fields, plantation on land permitted by the Central Body if these are required to be transferred.		MONPAED/ MIC
Farmland Rules	62/2012	31 Aug, 2012	31 Aug, 2012	The requirement of indemnity and compensation to the affected person when it comes to the case of confiscating farms in the interests of nation.	Newly enacted and currently applied	MOAI

Institutional Arrangement

Although Myanmar has a number of environmental laws and regulations, the appropriate institutional framework to carry out 'protection and conservation of the environment' so as to achieve sustainable development by implementing these laws has been still establishing. The Ministry of Environmental Conservation and Forestry did its best in addressing environmental issues through engagement, coordination and cooperation both at sectoral and national levels. Myanmar Investment Commission (MIC) asked all the development projects passing through to conduct proper EIA from middle half of 2012.

National Coordination Framework/Mechanism

The Environmental Conservation Committee (ECC) of the House (*PyidaungsuHluttaw*, in Myanmar Words similar to the Sum of Congress and Senate) is the policy maker and Ministry of Environmental Conservation and Forestry (MOECAF) act as National Coordinating Body. In fact, MOECAF was established to advise the Government on environmental policies, to act as a focal point and as a coordinating body for environmental affairs; and to promote environmentally sound and sustainable development in Myanmar.

The Ministry is to be assisted by a staff bureau namely Department of Environmental Conservation recently being organized in September 2012. Before the full service and control by this department, environmental affairs in the MOECAF are being handled by the Department of Planning and Account. Because of the very recent establishment of Law of Environmental Conservation signed by the President on 30th March 2011, detail duty and coordination framework and mechanism has not been thoroughly settled yet. The ministry (MOECAF) recommends the environmental service companies to follow the world known environmental standards e.g. the Asia Development Bank (ADB) and International Finance Corporation (IFC) (Resource & Environment Myanmar, per. Com. 2012).

Sectoral Framework/Mechanism

Different ministries involved in dealing with environmental issues also have their own policies, capacities, processes, legislations, and budgets for the environmental issues they have. For example, the Ministry of Environmental Conservation and Forestry has its own budget for the reforestation component of the Land Degradation Programme. However, given close cooperation between different ministries, information regarding budgets as on other matters is shared between one another. Capacity and institution building in the short and medium term is being carried out by each ministry separately on their own budgets.

International Best Practices

In developing countries, it has frequently observed that laws and standards pertinent to social aspects are not sufficient enough to refer in setting up the project oriented regulatory frameworks. Consequently, many organizations operating in these countries have to adopt guidelines and standards of well-known financial

institutions such as equator principle, ADB and, IFC/ World Bank as best practices in their industries. Similarly, in Myanmar as being a developing country, these guidelines are also widely considered as most appropriate tools for organization's social & environmental management, continual improvement and sustainable development during the absence of country's regulations.

These Principles are used as industry tools for identifying, assessing and managing potential environmental and social impacts expected from the proposed project activities.

Equator principles are developed based on the IFC and World Bank's standards and cover the following subjects.

Principle 1: Review and Categorization

This principle states the risk categorization of a proposed project to determine the magnitude of potential social and environmental impact

Principle 2: Social and Environmental Assessment

This clarifies the project categorized as A for conducting mandatory social and environmental impact assessment study.

Principle 3: Applicable Social and Environmental Standards

This indicates to adopt IFC performance standards and international guidelines for the assessment activity.

Principle 4: Action Plan and Management System

Environmental and social management plan is to be developed based on the facts discovered in assessment studies. The action plant must address and cover all findings and draw the conclusion for assessment report.

Principle 5: Consultation and Disclosure

The reports are to be disclosed to public for their review and recognize their contributions toward sustainable development.

Principle 6: Grievance Mechanism

In order to maintain the system of consultation, disclosure and public engagement throughout the project life, the Grievance Mechanism is to be established.

Principle 7: Independent Review

EIA report and plan are suggested to be reviewed by independent thirty party consultants.

Principle 8: Covenants

This indicates to comply with relevant host country regulations and contents of action plan and to prepare periodic reports

Principle 9: Independent Monitoring and Reporting

Independent experts are required to conduct monitoring and reporting.

Principle 10: Reporting

Reporting is to be published at least annually about the performance and achievement of monitoring and management.

IFC 's Guidance Notes: Performance Standards on Environmental and Social Sustainability (2007)

International Finance Corporation's Performance Standards outline as follows in managing environmental and social risks and enhancement of the performance of the organization's activities.

Performance Standard 1.Social and Environmental Assessment and Management System

This standard underscores the importance of managing social and environmental performance throughout the life of a project. In the annex A of the standard, it states the contents of a typical social and environmental assessment report such as

- Non-technical executive summary,
- Policy, legal, and administrative framework
- Project Description
- Baseline data
- Social and environmental impact
- Analysis of alternative
- Management program

Performance Standard 2.Labour and Working Conditions

Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be balanced with protection for basic rights of workers. Actually, the requirement set out in this standard have been in part guided by a number of international conventions negotiated through the International Labor Organization (ILO) and the United Nations (UN). It mentions the requirement of Human Right Policy of an organization and contents are suggested in the appendix.

Performance Standard 3. Pollution Prevention and Abatement

This performance standard requires the consideration of pollution prevention and control technologies during the life cycle of project so as to reduce the adverse impact on human health and the environment through the project withtechnically and finically feasible way.

Performance Standard 4. Community Health, Safety and Security

The objectives of this performance standard are to minimize the risks to and impacts on the affected community by setting up the safe guarding system of personnel and property.

Performance Standard 5. Land Acquisition and Involuntary Resettlement

This performance standard demands the project proponent to practice proper resettlement planning and implementation process. It also encourages project proponent to acquire land right through negotiated resettlement to avoid long term hardship and impoverishment for affected persons and communities.

Performance Standard 6. Biodiversity Conservation and Sustainable Natural Resource Management

Project proponent has the responsibility to assess the significance of project impacts on all levels of biodiversity as an integral part of social and environmental assessment process.

Performance Standard 7. Indigenous Peoples

The development of project must foster full respect for the dignity, human rights, aspirations, cultures and natural resources –based livelihoods of the Indigenous People.

The project is required to preserve the culture, knowledge and practices of Indigenous People.

Performance Standard 8. Cultural Heritage

The objectives of this standard highlight the importance of preserving and protecting cultural heritage by avoiding, minimizing, or mitigating the adverse impacts that projects might cause to cultural heritage.

In view of industry best practiced by financial institutions, specific consideration should be made for the following areas in preparation of a SIA study in developing country.

- Protection of cultural heritage
- Labor issue and community health and safety consideration
- Land acquisition and involuntary resettlement
- Affected communities and vulnerable people
- Indigenous people, the value of their unique living styles and relevant cultural value
- Socioeconomic impacts
- Cumulative impact of existing projects, the proposed project and the future projects

နောက်ဆက်တွဲ - (က)

Title	Brief Description
The Leave and Holiday Act (1951)	This act has been used as the basic framework for leaves and holidays for workers with minor amendment in 2006 and 2014. This defines the public holidays that every employee shall be granted with full payment. It also defines the rules of leaves for workers including medical leave, earned leave and maternity leave.
The Labour Organization Law (2011)	The Labour Organization Law replaced the Trade Union Act enacted in 1927 for protecting the rights of the workers, having good relations among the workers or between the employer and the worker, and for forming and carrying out the labour organizations systematically and independently. Under the law, the labour organization has the right to carry out freely in drawing up their constitution and rules. It has the right to negotiate and settle with the employer if the workers are unable to obtain the right of the workers contained in the labor laws. On the other hand, the employer shall recognize the labour organizations and assist as much as possible if the labour organizations request for help for the interest of his workers.
The Labour Dispute Settlement Law (2012)	This law was enacted for safeguarding the right of workers or having good relationship between employer and workers and making peaceful workplace or obtaining the rights fairly, rightfully and quickly by settling the dispute of employer and worker justly. It stipulates that employer in which more than 30 workers are employed shall form the workplace coordinating committee consisting of the representatives of workers and the representatives of employer.
The Protection and Preservation of Antique Objects Law (2015)	It aims to implement the policy of protection and preservation of the perpetuation of antique objects and to protect and preserve antique objects so as not to deteriorate due to natural disaster or man-made destruction.
Automobile Safety and Automobile Management Act (2020)	To ensure that vehicles are legally checked and registered;(b) Check whether those who drive in accordance with the type of automobile are qualified to obtain a driver's license;(c) To alleviate the atmosphere, water, soil pollution, and noise caused by automobiles;(d) To reduce accidents caused by automobiles, we need to manage them in an orderly fashion;(e) To monitor and supervise traffic safety in accordance with the criteria;(f) To reduce traffic congestion and to use high-tech transportation efficiently in traffic safety;(g) To reduce people's lives and socio-economic losses and injuries due to the risk of an accident, and to facilitate road users' travel;(h) to transport hazardous goods safely.
Export and Import Law (2015)	It aims to implement the economic principles of the State successfully, to lay down the policies to export and import that support the development of the State, and that are to be in conformity with the international trade standards.
The Explosive Substances Act (1908)	The Explosive Substance Act stipulates the prohibitions on production, possession and use of explosives without permission
The Myanmar Citizen Investment Law and Rules of Law (2016 and 2017)	The New Citizens Investment Law was enacted in 2016 and 2017, repealing the Myanmar Citizens Investment Law of 1994. This law is to promote the inducement of domestic investment so as to lead to promotion of production and exports by the private sector.
Kachin State Municipal Act (Kachin State Parliament Law No. 10/2013)	This municipal act aim to protect the environment and supervise the discharge of solid waste and municipal waste.
Myanmar Insurance Law (1993)	15. Owners of motor vehicles shall affect compulsory Third Party Liability Insurance with the Myanmar Insurance. 16. An entrepreneur or an organization operating an enterprise which may cause loss to State-owned property or which may cause damage to the life and property of the public or which may cause pollution to the environment shall effect compulsory General Liability Insurance with the Myanmar Insurance

Chapter II

Existing Socio-economic Environment

2.1 Socio-economic Profile of Chipwi Township

2.1.1 Location of the Project Area

The project area is located in Chipwi Township, eastern part of Kachin State, Northern Myanmar. Chipwi Township lies between North Latitude between 25˚00´ and 26˚ 00´ and East Longitude between 97˚00´ and 98˚ 45´. It adjoins HsawLaw Township on the north, N'Jang Yang Township (Triangle area) on the west, Wai Maw Township on the south and common border with China to the eastern and northeastern part and has an area of 3,429.4 square Kilometers (1324.09 square miles). About ¾ of the study area is on the eastern side of N'Mai Hka River and remainder (a narrow area) being on the western part of triangle catchment area. It comprises of 4 Wards and 33 Village Tracts. (Figure 2.1)

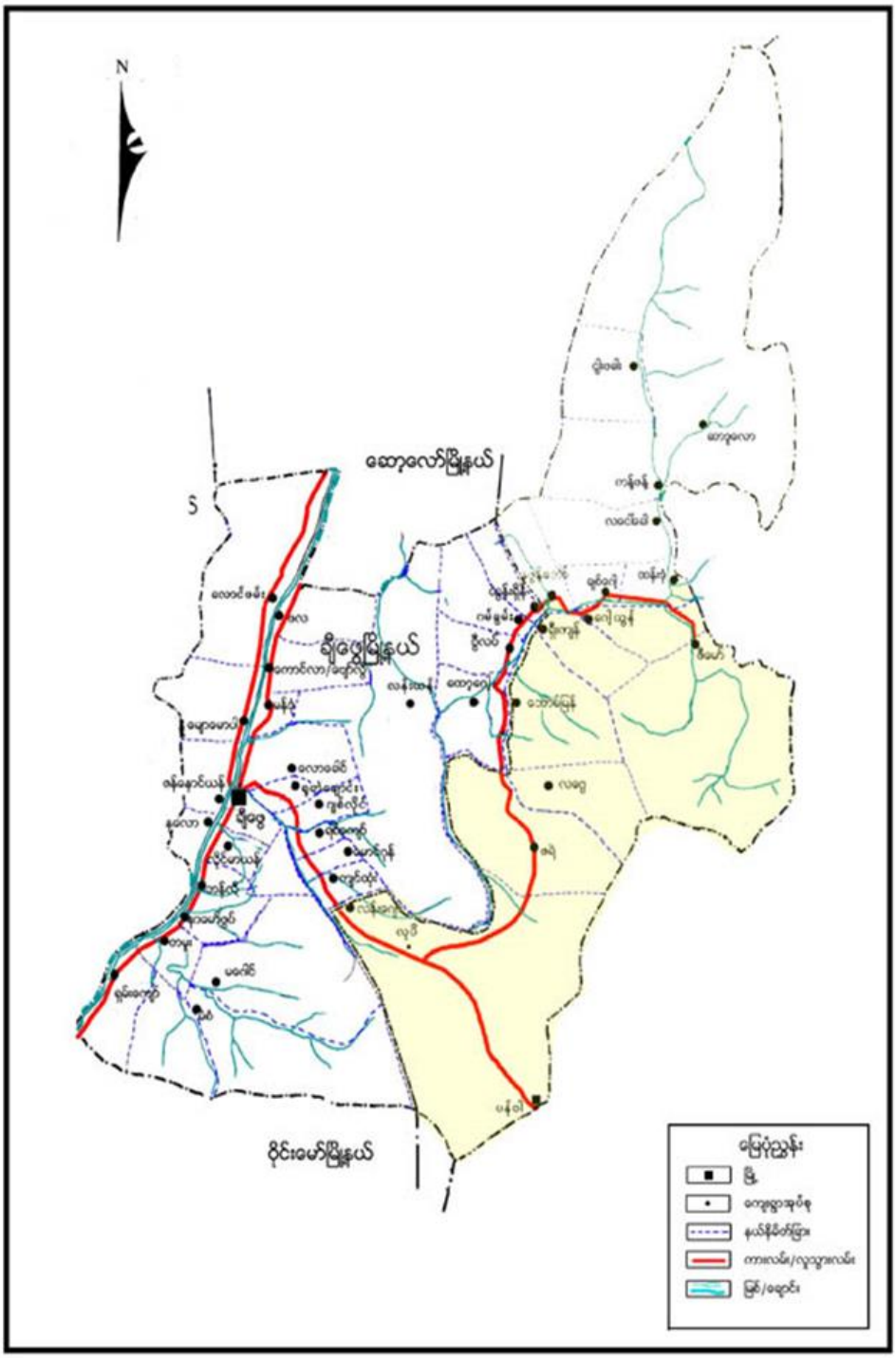


Figure 2.1 Location of the Project Area

2.1.2 Population in Chipwi Township

Population is one of the important socio-economic conditions of a township. In 2016, the total population of Chipwi Township was 29,514 persons. (Table 2.1) Among the villages of Chipwi

Township, the highest number of population is found in Chipwi Town (14,858 persons) and the lowest population is found in Byawloi Village (only 56 persons). Population density of Chipwi Township is

22 persons per square miles. In Chipwi Township, the major ethnic group in 4 wards and 33 Village Tracts is Kachin (Ngaw Chang and La Chait). Most of them are Christians.

Table 2.1 Total Population of Chipwi Township (2016)

Sr.	Wards/ Village Tracts	House	House hold	Male	Female	Total Population
1	**Chipwi Town**	**1774**	**1763**	**5750**	**5571**	**14,858**
2	Yitlaw	135	135	359	344	973
3	Oakkekut	97	97	289	319	802
4	Barle	41	41	109	105	296
5	Kanpaingyan	34	34	77	62	207
6	Laingmaryan	16	16	32	51	115
7	Zannaungyan	73	73	198	186	530
8	Nalaw	17	17	38	34	106
9	Myawmawpar	15	15	50	52	132
10	Laungpand	30	30	141	170	371
11	Mansan	17	17	65	56	155
12	Shankyaw	25	25	60	63	173
13	Magaung	99	99	352	350	900
14	Bantli	46	46	147	155	394
15	Narmawsaup	17	17	49	67	150
16	Tamue	15	15	28	42	100
17	Pala	27	27	75	77	206
18	Byawloi	10	10	24	32	56
19	Mandon	25	25	68	60	178
20	Lawkaung	46	46	131	110	333
21	Yaukchaung	8	8	25	26	67
22	Gitlaing	52	52	174	183	461
23	Yitkyaw	8	8	28	29	73
24	Maunggon	35	35	124	105	299
25	Gintone	30	30	94	97	251
26	Tortkork	22	22	66	64	174
27	LanYan	118	118	344	312	892
28	Velup	43	43	167	137	390
29	Gankon	49	49	175	162	435
30	Tunshein	75	75	283	225	658
31	NuzonBaung	41	41	130	128	340
32	Chitkort	89	89	306	297	781
33	Tandon	69	69	259	232	629
34	Langawkaw	73	73	334	291	771
35	Sardulaw	81	81	263	229	654
36	Ngwarpakar	80	80	254	226	640
37	Kantpant	90	90	400	364	944
	Total	**3522**	**3511**	**11468**	**11013**	**29514**

Source: General Administrative Department, Chipwi Township

2.1.3 Economic Conditions of Chipwi Township

Landuse of Chipwi Township includes cultivated land, virgin land and non-cultivated land. In 2013, there were 1,651 hectares (4,078 acres) of cultivated land and 228,387 hectares (564,117 acres) of non-cultivated land. Cultivated land included *Le* (paddy field) (161.5 hectares or 399 acres), Ya (496.8 hectares or 1,227 acres), Garden (621.2 hectares or 1,535 acres) and *Taungyar* (373 hectares or 922 acres). The main crops are paddy, corn, walnut and vegetables. Cows and buffalos are mainly used in agricultural works. Chicken, pig and duck are important livestock for home consumption. Walnut is the main income source of their livelihood.

2.1.4 Transportation of Chipwi Township

Road transportation was constructed in 1911 by the British government. Paths for mules of about 300 miles were started in 1923 and the road from Myitkyina to Chipwi was constructed before World War II. Old motor road from Chipwi to Law Hkaung is now useless, because local people used this road as a shortcut instead of the previous footpath. Formerly, Law Hkaung was the administrative center of eastern mountain region of China-Myanmar border area. From Chipwi to Hpimaw a mule path was opened in 1913. Lagwi, Hpare, and Hpimaw Passes were opened in 1914 connecting Chipwi with China. Pang Wa Pass was opened in 1916, Cinimali Pass in 1917, Fenshuling in 1918. In 1993 local ethnic leaders started to construct motor roads encompassing the whole region. The local people use footpaths and roads to go from one place to another within Chipwi Township. Landslides often occur during the rainy season which is a hindrance. Chiphwi is suffering from poor and irregular system of transportation. The road passes through Bala Min Htin Bridge across the Ayeyarwady River and from Wai Maw to Chiphwi is 140 kilometers (87 miles), landslides often is experienced along the N'Mai Hka. From Chiphwi to Pang Wa is a 67.6 kilometers (42 miles) all season hard surface road. A motor road from Pang Wa to Hpimaw through Hpare-Nazumbaw-Chichyang –Jigyaw, Gam Hkun 117 kilometers (110 miles) was opened since 2002, but it can be used only during the open season. There is also a road between Pang Wa to Ngawchang Hka Bridge a junction to Hsaw Law and Hpimaw. Nowadays, local ethnic leaders upgraded many of the foot path system to hard surface road system. Sometimes cars used on these roads encounter landslides in rainy season due to steep slopes. A bridge across the N'Mai Hka was constructed in 2003-2004 connecting Zanaung Yang and Chiphwi. Before the construction of a new concrete bridge, a suspension bridge of cane was used instead. Chiphwi- Pang Wa, Chiphwi-Hsaw Law, Chiphwi- N'Jang Yang, Chiphwi-Hpimaw hard surface motor roads are used during the open season. Road transportation in Chiphwi is mostly footpath system. Local people use this footpath system of mountain transportation and they also have a custom to meet their relatives yearly. The tradition of Kachin people is to invite all relatives from every village in the region, when cultural, traditional and religious ceremonies take place. For example, after harvesting they have harvest

thanking ceremony (N'lung n'nan sha poi) in every village with the Manaudance. All relatives are invited to celebrate that thank harvesting festival. They always travel to the villages on foot path system.

2.1.5 Education Status in Chipwi Township

The development of a region can be evaluated, by the standard of education. There are schools in all village-tracts in Chipwi Township is inconvenient communication and transportation.

According to 2016 data, Chipwi Township had two Basic Education High Schools, four Basic Education Middle Schools (Affiliated) and 53 Basic Primary Schools. The teachers and the students' ratios were 1:22 for High School level, 1:18 for Middle School level, and 1:19 for Primary School Level. Therefore, the ratios of teachers and students are acceptable, especially for High School level.

2.1.6 Public Health

There are one (25) bedded hospital, one (16) bedded hospitals and four rural health care centers in Chipwi Township.

2.1.7 Cultural & Archaeological Heritage

Lawkhaung, one of the principal settlement areas of Laho Vo is onc e the headquarters of the secretary for Hill tract Administration. In this area are included Maykha valley with Chiphwekha valley (SE – 0299) and Taunkha valley (SD – 9791), the later two emptying into the former, Lawkhwang area is bounded in the north by the jurisdiction in the south by the jurisdictions of Sawlaw and Htawgaw hill tract chiefs and in the west by Triangle region. InHtawlaw area, Laho Vo people mostly live in the Maykha valley, Makkharami valley (NU – 2428), Armak valley (NU – 3343) and Lakinchaung valley (NU – 1302). According to the 1955 data, there were ninety-eight villages, 575 households with 5692 people. The administration of Htawlan was divided into thirty-one units. Under the hill tract chief were five hill tract heads, and a total of 122 Duwas and headmen.

Among the Lhao Vo settlements, the most outstanding are those of ancient sites, known as Labyu cave and the Bat cave. Labyu cave is located on the Shanban Mountain, four miles in the northeast of Chiphwe town. Lhao Vo people also call Layu cave as Layu corner (gyaung), in that Layu means the origins of ancient man and corner (gyaung) stand for cave. The cave is also known as Wamhte cave, after the fact that, the area was administered by the Lhao Vo nationality Wamhtezok Khao Leim". Facing to the north, the entrance of Labyu cave has measurement of six feet into four feet. Just after the entrance, there is a large chamber measuring about thirty feet in breadth. On the wall of it is what the blurred wall paintings seemed. From this chamber, one can precede to the interior throng the three openings, each measuring about nine x nine feet leading to north, east and south directions. By the condition of cave structure, it can be assumed that, it is a Neolithic site. Local Lhao Vo also thought that the cave is their forefathers growing ground. All these facts show that the distribution pattern of Lhao Vo settlement depends upon the geographical distribution mountains, plains and valleys. As Lhao

Vo people settled at the places mostly in the plains and valleys, villages and town emerged and developed there. On the mountainous area, as the people settled temporarily, no big settlements of towns and large village, but small villages only can be found. Therefore, some small settlements had already been disappeared.

2.2 Socio-economic Profile of Respondents in the Project Area

2.2.1 Location of the Project Area

The project area is located in Chipwi Township, Kachin State. The project site is situated near the China border area. It lies between North Latitude 25° 43' and 26° 30' and between East Longitude 98° 13’ and 98° 46'. Detailed location of wards in the project area is shown in Map 2.2 and Table 2.2.

Table 2.2 Location of study wards and Power plant in the Project Area

Sr.	Name	Latitude	Longitude	Elevation
1	Barle Ward	25˚ 53' 03.17"	98˚ 07' 50.59"	293 m
2	Kanpaingyan Ward	25˚ 53' 23.04"	98˚ 07' 53.61"	258 m
3	Oakekat Ward	25˚ 53' 10.63"	98˚ 07' 45.72"	259 m
4	Yitlaw Ward	25˚ 53' 17.68"	98˚ 07' 53.39"	261 m
5	Power plant	25˚ 50' 20.00"	98˚ 04' 56.36"	273 m

Figure 2.2 Project Area showing Wards

2.2.2 Methodology

The aim of the socio-economic survey was to collect information on the existing socio-economic condition of the study area to establish the baseline condition against which the impacts of the project could be assessed and mitigation measures could be formulated. The survey was conducted during August 2016 and including Stakeholders Meetings, Semi-structured Interviews and Questionnaire Distribution were done with respondents' coverage for the Head of Wards such as Barle, Yitlaw, Oakekat and Kanpaingyan and Chipwi Nge Power Plant. There are 163 respondents in the survey, and the survey focused to measure on potential impacts of the project to surrounding residential area.

2.2.3 Population in Affected Villages

The dam of Chipwi Nge Hydropower Station is planned to be located about 15km away from the river mouth. Riverbed elevation there is about 710m, control catchment above the dam 552.3km^2, river length 42.1km, and gradient 54‰. The affected wards are Barle, Yitlaw, Oakekut and Kapaingyan Wards.

Among these wards, Yitlaw is the biggest ward with 135 houses and 135 households followed by Oakekut Ward with 97 houses and 97 households. Barle is the third biggest village with 41 houses and 41 households. Potential social impact of the project is relatively high due to their wide social network.

There are 703 persons in Yitlaw, 608 persons in Oakekut Ward, 214 persons in Barle Ward, 139 persons in Kanpaingyan Ward and 76 persons in Power Plant. Among them, 163 respondents are selected as sample population for the study. Among the total number households of (334) from four wards and power plant' workers, 163 households are selected as samples. Therefore, the sample population is about 49 percent of the total number households in study area. (Table 2.3, Figure 2.1 and Figure 2.3)

Table 2.3 Population and Samples of the study area (2016)

Study Area	Household	Male	Female	Total	No. of Sample
Barle	41	109	105	214	23
Kan Paing Yan	34	77	62	139	22
Oake kut	97	289	319	608	39
Yitlaw	135	359	344	703	62
Power plant	27	42	34	76	17
Total	334	876	864	1740	163

(Source: Field Survey, August 2016)

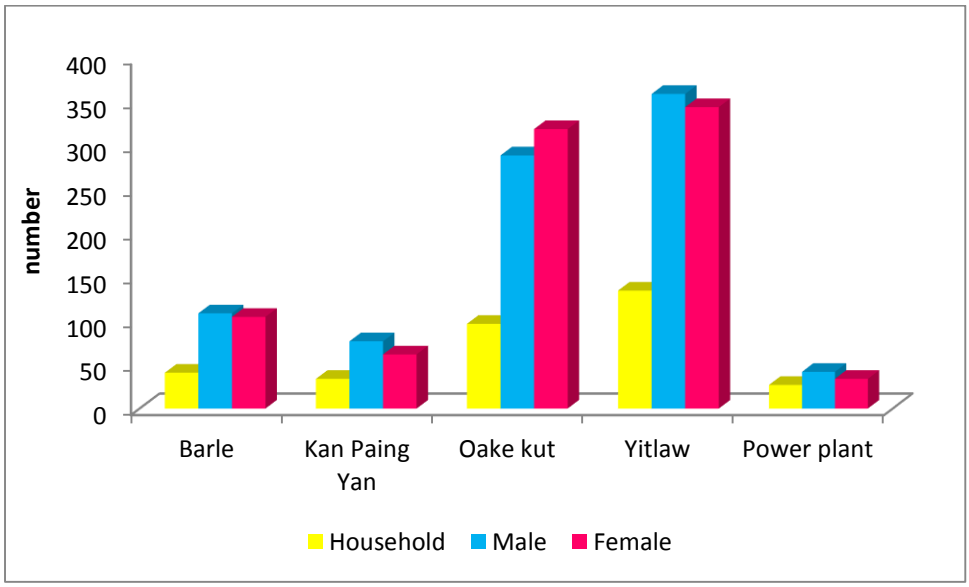


Figure 2.3 Population and Samples of the study area (2016)

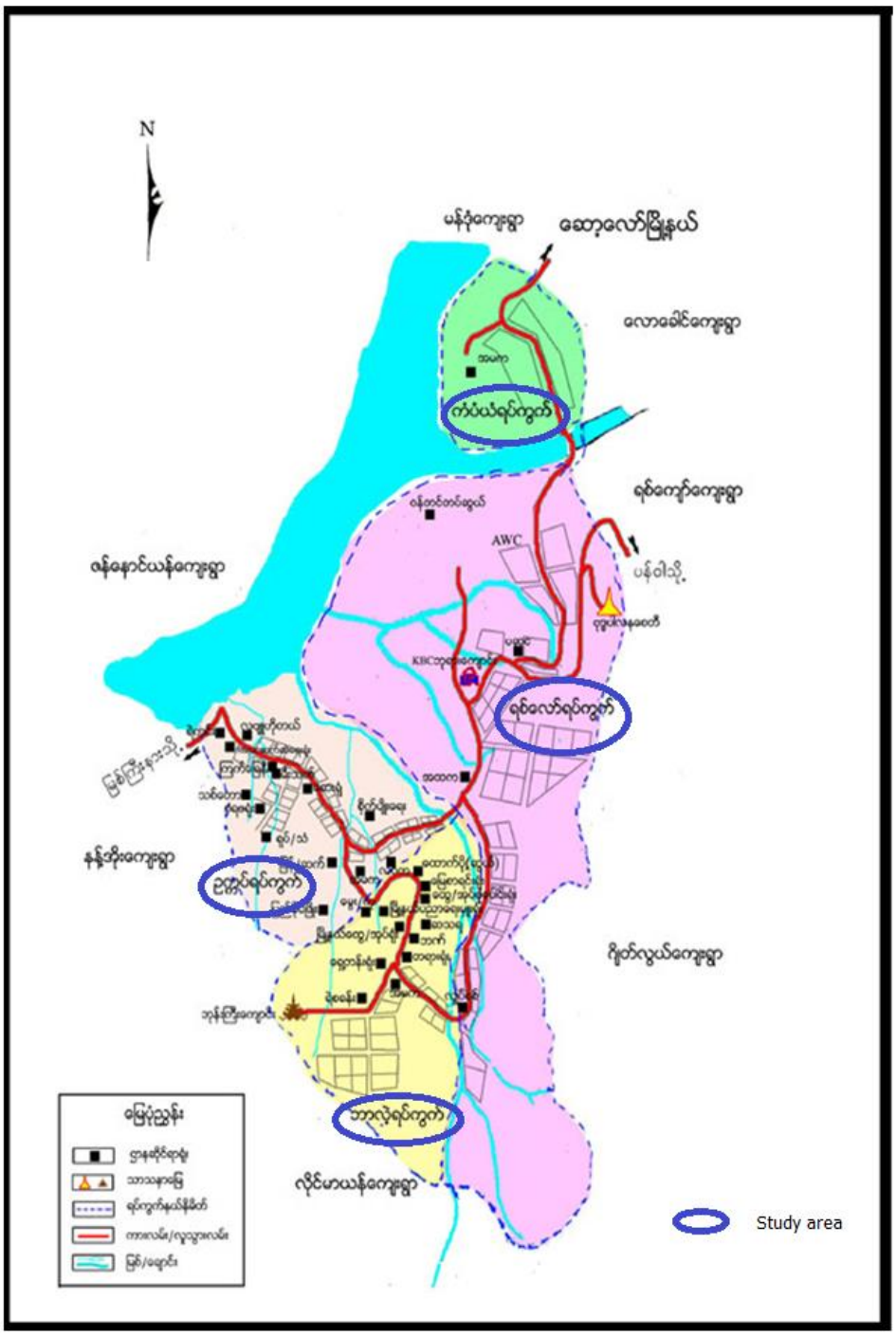


Figure 2.4 Study Wards in Chipwi Township

It is Socio-economic base line data of study wards in Chipwi Township. (Table 2.4 to 2.7)

Table 2.4 Community Questionnaire by Socio-economic Survey, Barle Ward

Name: အမည်	**La GanDaingZel**		
Date: (DD/MM/YY) နေ့စွဲ	**10-8-2016**		
Location Details			
Village:ကျေးရွာအမည်	**Barle Ward**	Township:မြို့နယ်	**Chipwi**
Village Tractကျေးရွာအုပ်စု	-	District:ခရိုင်	**Chipwi**
State/Region ပြည်နယ် ၊ တိုင်း	**Kachin State**		

Village Level Primary Information							
	Population လူဦးရေ	**Total စုစုပေါင်း**		**Male ကျား**		**Female မ**	
		214		**109**		**105**	
	Number of households အိမ်ထောင်စုဦးရေ	**41**		Disabled population မသန်းမစွမ်းလူဦးရေ		**1**	
	Women headed HHs အမျိုးသမီးဦးဆောင်သော အိမ်ထောင်စု	**7**		Poor HHs ဆင်းရဲသောအိမ်ထောင်စု		**40**	
	Ethnicity လူမျိုး		**Ethnicity လူမျိုး**	**No. of HHs အိမ်ထောင်စုဦးရေ**		**Ethnicityလူမျိုး**	**No. of HHs အိမ်ထောင်စုဦးရေ**
			Bamarဗမာ	**2**		Rakhineရခိုင်	-
			Kachin ကချင်	**39**		Shan ရှမ်း	-
			Kayahကယား	-		Indian	-
			Kayinကရင်	-		Chinese	-
			Mon မွန်	-		Other (……)	-
	When was the village founded? ရွာကိုမည်သည် အချိန်တွင် တည်ထောင်သနည်း			**Over 100 years**			
	How far is the nearest river? ရွာနှင့် မြစ် အကွာအဝေး Or how close is the community to other (သို့) ရေအရင်းအမြစ် နှင့် လူနေထိုင်ရာအကွာအဝေး ကိုဖော်ပြပါ။ water body?			**0.5mile**			

Land				
9.	ရွာတွင်စိုက်ပျိုးရေးလုပ်ငန်းလုပ်ပါသလား	Yes လုပ်သည်။ ☑ 2) No မလုပ်ပါ။		
10.	လုပ်သည်ဆိုပါကအိမ်ထောင်စုမည်မျှလုပ်သနည်း။	**10**		
11.	Is farming the main economic activity in this settlement? As major form of subsistence or primarily for selling purposes or for both? လယ်ယာလုပ်ငန်းသည်ဤဒေသတွင်အဓိကစီး ပွားရေးလုပ်ငန်းဖြစ်ပါသလား။ တစ်နိုင်စားသောက်ရန် သို့ အဓိကစီးပွားရေးအဖြစ် သို့ နှစ်ခုစလုံးရောင်းချခြင်းဖြစ်ပါသလား။	For subsistence (မိသားစုစားသုံးရန်) ☑ primarily for selling purposes (ထွက်ကုန်ရောင်းချခြင်းဖြင့်မိသားစုအပိုဝင်ငွေရရန်)		
12.	Provide the approximate proportion of land under each category ခေါင်းစဉ်တစ်ခုစီတွင်ခန့်မှန်းမြေအတိုင်းအတာဖြည့်သွင်းပါ။	**Type of land**	**Proportion**	**Utilisation**
		LE (wet)လယ်၊စိုစွတ်	-	-
		Ya (dry) ယာ၊ ခြောက်သွေ့	-	-
		Kaing (cultivable waste land, island etc.)စိုက်ပျိုးဖြစ်ထွန်းနိုင်သောဖုန်းဆိုးမြေ။ ကျွန်းစသည်ဖြင့်	-	-
		Reserved forest ဘေးမဲ့တော	-	-
		Current fallowလက်ရှိမြေလွတ်မြေရိုင်း	-	-
		Gardenဥယျာဉ်ခြံမြေ	-	-
		Dani (swamp lands) ရွှံမြေ	-	-
		Taungya (shifting cultivation) ရွှေပြောင်းတောင်ယာ	-	-
		Other (specify)အခြား	-	-
13.	What is the number of households having the following proportion of irrigated land (in dry season) ခြောက်သွေ့သောရာသီတွင်ဆည်ရေသောက်ဒေသအတွင်းရှိသောအိမ်ထောင်စုအရေအတွက်	**Proportion of Irrigation**	**Number of HHs**	**Proportion of HHs**
		0% irrigated land	**10**	**100%**
		0-10% irrigated land		
		10-25% irrigated land		
		25-50% irrigated land		

		50-75% irrigated land		
		75-100% irrigated land		
Crops				
14.	Crops grown in the village (specify is repeated cultivation of the same crop) ကျေးရွာအတွင်းစိုက်ပျိုးသည့်သီးနှံ			
	Type of Crop	**Dry Season/ Wet Season နွေရာသီ၊ မိုးရာသီ**	**Type of Crop**	**Dry Season/ Wet Season**
	Monsoon Paddy မိုးစပါး	**Wet Season**	Turmeric နနွင်း	-
	Summer Paddy နွေစပါး	-	Chilicရုတ်သီး	-
	Oil Seedsဆီထွက်သီးနှံ	-	Fruitsအသီးအနှံ	-
	Peasစားတော်ပဲ	-	Vegetables	-
	Pulsesပဲအမျိုးမျိုး	-	Sugar cane ကြံ	-
	Maizeပြောင်း	-	Nippa Palm ထန်း	-
	Wheatဂျုံ	-	Coconutအုန်း	-
	Potatoesအာလူး	-	Betel nut/ leafကွမ်းသီး။ရွက်	-
	Sweet Potatoကန်စွန်းဥ	-	Toddy ဓနိ	-
	Onion ကြက်သွန်နီ	-	Other (Specify)အခြား	-
Livestock				
15.	Number of people rearing these livestock (tick the appropriate option) အောက်ပါမွေးမြူရေးလုပ်ငန်းများကို လုပ်ကိုင်သူအရေအတွက်	**Type**	**Number of Households having the livestock holdings**	**Main Use**
		Buffalo ကျွဲ	**7**	**For sale**
		Goats/Sheep ဆိတ်။သိုး	**-**	
		Horse	**-**	
		Cattle နွား	**15**	**Forsale**
		Ducks ဘဲ		
		Chickens ကြက်	**41**	**For subsistence**
		Pigs ဝက်	**34**	**For sale**
	Income/ Expenditure			
16.	How many households fall into these Annual Income Levels? အောက်ပါဝင်ငွေအဆင့်တွင်ရှိသောအိမ်ထောင်စုအရေအတွက်	**Level of monthly income နှစ်စဉ်ဝင်ငွေ**	**Number of HH falling under the categories** သတ်မှတ်ထားသည့် အုပ်စုများတွင် ပါဝင်သည့်အိမ်အရေအတွက်	
		Less than 25,000Kyats	10	

		25,000-50,000 Kyats	-
		50,000-100,000 Kyats	**31**
		100,000-200,000Kyats	**30**
		200,000-300,000Kyats	-
		More than 300,000 Kyats	-

Availability, access and proximity to the education services		**Facility**	**Distance (km or time)**	**Quality (Good/bad/no comments)**
17.	**Operational Education System**	a. Nursery မူကြို		
		b. Primary မူလတန်း	**Inside ward(about 10mins)**	**No comments**
		c. Middle အလယ်တန်း		
		d. Secondary အထက်တန်း	**30mins**	**Good**
		e. University တက္ကသိုလ်		
		Vocational training institute အသက်မွေးမှုဆိုင်ရာ လေ့ကျင့်ရေးတက္ကသိုလ်		
		Buddhist Religious School ဘုန်းတော်ကြီးသင်ပညာရေးကျောင်း		
18.	**Market စျေး**	Every day market နေ့စဉ်စျေး	**30mins**	**No comments**
		Weekly market (for basic provisions)ခုနှစ်ရက်စျေး		
		Monthly market (for trade)လစဉ်စျေး(ကုန်သွယ်မှု)		
		Occasional market အခါအားလျော်စွာဖွင့်လှစ်သည့်စျေး		
19.	**Operational Health System လက်ရှိကျန်းမာရေးစနစ်**	Town council မြို့နယ်ကောင်စီ		
		Maternity and child health and school မိခင်နှင့်ကလေးစောင့်ရှောက်မှုနှင့်ကျောင်း		
		Station hospital တိုက်နယ်ဆေးရုံ	**15mins (Township Hospital)**	**Good**
		Rural health center ကျေးလက်ကျန်းမာရေးဌာန		
		Rural health Sub-center ကျေးလက်ကျန်းမာရေးဌာနခွဲ		
		Village health committee ကျေရွာကျန်းမာရေးကော်မတီ		

20.	**Credit Facility**				
A	Credit Sources in the village ရွာရှိချေးငွေရရှိနိုင်သောနေရာများ	1. Family 2. In laws ဆွေမျိုးများ3. Friends/ Neighbours သူငယ်ချင်း။အိမ်နီးချင်းများ☑ 4. Store keeperစတိုးအကြီးအကဲ 5. Bank ဘဏ် 6. SUSU Groups 7. Informal credit 8. Self Help groups ကိုယ်ပိုင်အစုအဖွဲ့များ☑ 9. Other (specify):			
B	What is the interest rate? အတိုးနှုန်းမည်မျှနည်း	☐**5% per Month** (period : year, month) ☐ No interestအတိုးမဲ့			
C	Why people borrow money? ငွေချေးရသည့်အကြောင်းရင်း	1. Buying seeds မျိုးစေ့ဝယ်ရန်2. Buying food အစားအစာဝယ်ရန် ☑ 3. For Field preparation စိုက်ပျိုးရေးအတွက်ပြင်ဆင်ရန် 4. Medical facilities 5. For Marriageအိမ်ထောင်ပြုရန် 6. For house constructionအိမ်ဆောက်ရန် 7. For Businessလုပ်ငန်းလုပ်ရန် 8. Othersအခြား**For Education and Health**			
21.	Identify the five main diseases in the village according to the following အဓိကရင်ဆိုင်ရသောကျန်းမာရေးပြဿနာငါးမျိုးကိုဖော်ပြပေးပါ။	**General**		**Especially among women**	**Especially among children**
		A**Malaria**		A**Hypertension**	A**Malaria**
		B		B	B
		C		C	C
		D		D	D
		E		E	E
22.	Access to Electricity လျှပ်စစ်မီးရရှိမှု	**Type of electricity supply**		**No. of HHs utilizing**	**Frequency of power cuts**
		Government Electricity အစိုးရလျှပ်စစ်မီး			
		Electricity organised by the Village ကျေးရွာကိုယ်ထူကိုယ်ထလျှပ်စစ်မီး			
		Electricity by private/ commercial generator		**5**	**24hrs**
		Solar			
		No electricity			

Water Services					
23.	**Water source**	**Proportion of HHs dependent**	**Distance from the village**	**Availability of water (In months)**	**Quality (Good/ Average/ Bad)**
	River မြစ်				
	Creekချောင်း				
	Pondကန်				
	Brick Well အုတ်ရေတွင်း				

	Hand –Dug Well လက်ရက်တွင်း				
	Tube Well (Motor Pump)အဝီစိတွင်း				
	Tube Well (Hand Pump) လက်နှိပ်တွင်း				
	Spring Water (natural) စမ်းရေ	**41**	**10mins**	**12months**	**Good**
	Spring Water (stored) စမ်းရေ(သိုလှောင်)				
	Public Water Supply ရေပေးဝေရေးစနစ်				
	Damဆည်ရေ				
	Rain Water Storage Tank မိုးရေလှောင်ကန်				
	Other (Specify)အခြား**(Mountain torrent)**	**34HHs**	**5mins to 30mins**	**12 months**	**Good**

Livelihood **အသက်မွေးဝမ်းကျောင်း**				
24.	Number of people engaged in these sources of livelihood အောက်ပါအသက်မွေးဝမ်းကြောင်းများလုပ်ကိုင်သူအရေအတွက်	**Source of livelihood** **အသက်မွေးဝမ်းကျောင်းများ**	**Number of HHs engaged** **အိမ်အရေအတွက်**	**Dominance of Men/Women** **အမျိုးသားသာ၊ အမျိုးသမီးသာ**
		Cultivatorတောင်သူ	**10**	**Both**
		Agricultural labourer စိုက်ပျိုးရေးလုပ်သား		
		Fishingငါးဖမ်းလုပ်ငန်း		
		Business (SME, shop, trading etc.) ကိုယ်ပိုင်စီးပွားရေးလုပ်ငန်း (အသေးစား၊အလတ်စား၊ဆိုင်၊ ကုန်သွယ်ရေး)		
		Forest userတောတက်သူ		
		Livestock rearing မွေးမြူရေး		
		Casual Labourကျဘန်း		
		Other (specify) အခြား**(Office staff)**	**31**	**Both**

25.	Distance to the following facilities (in time or kms) အောက်ပါ အရပ်ဒေသသို့ အကွာအဝေး ကိုကြာချိန်(သို့) ကီလိုမီတာ ဖြင့်ပြပါ။				
	Infrastructure အခြေခံအဆောက်အအုံ	**Distance in Wet Season (in Minutes) မိုးရာသီ ကြာချိန်**	**Distance in Dry Season (in Minutes) ပွင့်လင်းရာသီ ကြာချိန်**	**Preferred mode of Transport အဓိကသယ်ယူပို့ဆောင်ရေးနည်းလမ်း**	**Mode of Transport သယ်ယူပို့ဆောင်ရေးနည်းလမ်းများ**
	Health Center ကျန်းမာရေးဌာန	**15mins**	**20mins**	**Motor-Cycle**	*Walking, Bicycle, Motor-Cycle, Car, Boat etc.*
	Seed/grain bank စပါးကျီ				
	Cyclone shelter မုန်တိုင်းဒဏ်ခံနိုင်သောအဆောက်အဦး				
	Hand pumps တုံကင်				
	Grocery shops ကုန်စုံဆိုင်	**30mins**	**30mins**	**Motor-Cycle**	
	Chemist ဆေးဆိုင်	**30mins**	**30mins**	**Motor-Cycle**	
	Post office စာတိုက်	**10mins**	**10mins**	**Motor-Cycle**	
	Nearest Township အနီးဆုံးမြို့နယ်	**6hrs**	**8hrs**	**Motor-Cycle**	
	Bankဘဏ်	**30mins**	**30mins**	**Motor-Cycle**	
	Other (specify).....				
26.	Access to Road Facilities in the village (tick the appropriate) လမ်းပန်းဆက်သွယ်ရေးအနေအထား	No Road (reaching all the way to the village);လမ်းမပေါက်သေးပါ Rough Track (Bullock Cart or Walking only); လမ်းကြမ်း (နွားလှည်း(သို့) ခြေလျင်ခရီး Accessible by trawlargee but not cars/trucks;ထော်လာဂျီ ဖြင့် သွားနိုင်သည် (ကားထရပ်မပါ) Accessible by car/ truck in dry weather only; ပွင့် လင်းရာသီတွင် ကားထရပ်များသွားလာနိုင်သည်။ Accessible by car/truck in all weatherရာသီမရွေးကားထရပ်များသွားလာနိုင်သည်။☑			

Table 2.5 Community Questionnaire by Socio-economic Survey, Oakekut Ward

Name: အမည်	**Za Khon Tain Khaw**		
Date: (DD/MM/YY) နေ့စွဲ	**10-8-2016**		
Location Details			
Village: ကျေးရွာ အမည်	**Oakekut Ward**	Township:မြို့နယ်	**Chipwi**
Village Tract ကျေးရွာ အုပ်စု	-	District: ခရိုင်	**Chipwi**
State/Region ပြည်နယ် ၊ တိုင်း	**Kachin State**		

Village Level Primary Information						
Population လူဦးရေ	**Total စုစုပေါင်း**		**Male ကျား**		**Female မ**	
	608		**289**		**319**	
Number of households အိမ်ထောင်စုဦးရေ	**97**		Disabled population မသန်းမစွမ်း လူဦးရေ		-	
Women headed HHs အမျိုးသမီး ဦးဆောင်သော အိမ်ထောင်စု	-		Poor HHs ဆင်းရဲသော အိမ်ထောင်စု		**70**	
Ethnicity လူမျိုး		**Ethnicity လူမျိုး**	**No. of HHs အိမ်ထောင်စု ဦးရေ**		**Ethnicity လူမျိုး**	**No. of HHs အိမ်ထောင်စု ဦးရေ**
		Bamar ဗမာ	-		Rakhine ရခိုင်	-
		Kachin ကချင်	**97**		Shan ရှမ်း	-
		Kayah ကယား	-		Indian	-
		Kayin ကရင်	-		Chinese	-
		Mon မွန်	-		Other (……)	-
When was the village founded? ရွာကို မည်သည် အချိန်တွင် တည်ထောင်သနည်း။						
How far is the nearest river? ရွာနှင့် မြစ် အကွာအဝေး Or how close is the community to other water body? (သို့) ရေ အရင်းအမြစ် နှင့် လူနေထိုင်ရာအကွာအဝေး ကိုဖော်ပြပါ။	**Beside of river, about 15minutes**					

ရွာတွင်စိုက်ပျိုးရေးလုပ်ငန်းလုပ်ပါသလား	Yes လုပ်သည်။ ✓ 2) No မလုပ်ပါ။		
လုပ်သည်ဆိုပါကအိမ်ထောင်စုမည်မျှလုပ်သနည်း။	**40**		
Is farming the main economic activity in this settlement? As major form of subsistence or primarily for selling purposes or for both? လယ်ယာလုပ်ငန်းသည်ကျေးဒေသတွင်အဓိကစီးပွားရေးလုပ်ငန်းဖြစ်ပါသလား။ တစ်နိုင်စား သောက်ရန်သို့ အဓိကစီးပွားရေးအဖြစ် သို့နှစ်ခုစလုံးရောင်းချခြင်းဖြစ်ပါသလား။	For subsistence (မိသားစုစားသုံးရန်) ✓ primarily for selling purposes (ထွက်ကုန်ရောင်းချခြင်းဖြင့်မိသားစုအပိုဝင်ငွေရရန်)		
Provide the approximate proportion of land under each category ခေါင်းစဉ်တစ်ခုစီတွင်ခန့်မှန်းမြေအတိုင်းအတာဖြည့်သွင်းပါ။	**Type of land**	**Proportion**	**Utilisation**
	LE (wet) လယ်၊စိုစွတ်	-	-
	Ya (dry) ယာ၊ခြောက်သွေ့	-	-
	Kaing (cultivable waste land, island etc.)စိုက်ပျိုးဖြစ်ထွန်းနိုင်သောဖုန်းဆိုးမြေ။ ကျွန်းစသည်ဖြင့်	-	-
	Reserved forest ဘေးမဲ့တော	-	-
	Current fallowလက်ရှိမြေလွတ်မြေရိုင်း	-	-
	Gardenဥယျာဉ်ခြံငြေ့မ	-	-
	Dani (swamp lands) ရွှံမြေ	-	-
	Taungya (shifting cultivation) ရွှေပြောင်းတောင်ယာ	-	-
	Other (specify)အခြား	-	-
What is the number of households having the following proportion of irrigated land (in dry season)	**Proportion of Irrigation**	**Number of HHs**	**Proportion of HHs**
	0% irrigated land	**40**	**100%**

ခြောက်သွေ့သောရာသီတွင်ဆည်ရေသောက်ဒေသအတွင်းရှိသောအိမ်ထောင်စုအရေအတွက်	0-10% irrigated land		
	10-25% irrigated land		
	25-50% irrigated land		
	50-75% irrigated land		
	75-100% irrigated land		
Crops			
Crops grown in the village (specify is repeated cultivation of the same crop) ကျေးရွာအတွင်းစိုက်ပျိုးသည့်သီးနှံ			
Type of Crop	**Dry Season/ Wet Season** **နွေရာသီ၊ မိုးရာသီ**	**Type of Crop**	**Dry Season/ Wet Season**
Monsoon Paddy မိုးစပါး	**Wet Season**	Turmeric နနွင်း	-
Summer Paddy နွေစပါး	-	Chili ငရုတ်သီး	-
Oil Seeds ဆီထွက်သီးနှံ	-	Fruits အသီးအနှံ	-
Peas စားတော်ပဲ	-	Vegetables	-
Pulses ပဲအမျိုးမျိုး	-	Sugar cane ကြံ	-
Maize ပြောင်း	**Wet Season**	Nippa Palm ထန်း	-
Wheat ဂျုံ	-	Coconut အုန်း	-
Potatoes အာလူး	-	Betel nut/ leaf ကွမ်းသီး။ရွက်	-
Sweet Potato ကန်စွန်းဥ	-	Toddy ဓနိ	-
Onion ကြက်သွန်နီ	-	Other (Specify) အခြား**Taro**	**Wet Season**
Livestock			
Number of people rearing these livestock (tick the appropriate option) အောက်ပါမွေးမြူရေးလုပ်ငန်းများကိုလုပ်ကိုင်သူအရေအတွက်	**Type**	**Number of Households having the livestock holdings**	**Main Use**
	Buffalo ကျွဲ	**10**	**Use for traditional Festival**
	Goats/Sheep ဆိတ်။သိုး	-	
	Horse	-	

	Cattle နွား	**20**	**Use for traditional Festival and for meat**
	Ducks ဘဲ	**4**	**For subsistence**
	Chickens ကြက်		
	Pigs ဝက်		
Income/ Expenditure			
How many households fall into these Annual Income Levels? အောက်ပါဝင်ငွေအဆင့်တွင်ရှိသောအိမ်ထောင်စုအရေအတွက်	**Level of monthly income** **နှစ်စဉ်ဝင်ငွေ**	**Number of HH falling under the categories** သတ်မှတ်ထားသည့်အုပ်စုများတွင်ပါဝင်သည့်အိမ်အရေအတွက်	
	Less than 25,000Kyats	-	
	25,000-50,000 Kyats	**30**	
	50,000-100,000 Kyats	**50**	
	100,000-200,000Kyats	**17**	
	200,000-300,000Kyats	-	
	More than 300,000 Kyats	-	

Availability, access and proximity to the education services	**Facility**	**Distance (km or time)**	**Quality (Good/bad/no comments)**
Operational Education System	a. Nursery မူကြို		
	b. Primary မူလတန်း		
	c. Middle အလယ်တန်း		
	d. Secondary အထက်တန်း	**30mins**	**Good**
	e. University တက္ကသိုလ်		
	Vocational training institute အသက်မွေးမှုဆိုင်ရာလေ့ကျင့်ရေးတက္ကသိုလ်		
	Buddhist Religious School ဘုန်းတော်ကြီးသင်ပညာရေးကျောင်း		
Market ဈေး	Every day market နေ့စဉ်ဈေး	**30mins**	**No comments**

		Weekly market (for basic provisions) ခုနစ်ရက်စျေး		
		Monthly market (for trade) လစဉ်စျေး(ကုန်သွယ်မှု)		
		Occasional market အခါအားလျော်စွာဖွင့်လှစ်သည့်စျေး		
Operational Health System လက်ရှိကျန်းမာရေးစနစ်		Town council မြို့နယ်ကောင်စီ		
		Maternity and child health and school မိခင်နှင့်ကလေးစောင့်ရှောက်မှုနှင့်ကျောင်း		
		Station hospital တိုက်နယ်ဆေးရုံ	**10mins (Township Hospital)**	**Good**
		Rural health center ကျေးလက်ကျန်းမာရေးဌာန		
		Rural health Sub-center ကျေးလက်ကျန်းမာရေးဌာနခွဲ		
		Village health committee ကျေရွာကျန်းမာရေးကော်မတီ		

	Credit Facility			
A	Credit Sources in the village ရွာရှိချေးငွေရရှိနိုင်သောနေရာများ	1. Family 2. In laws ဆွေမျိုးများ 3. Friends/ Neighbours သူငယ်ချင်း။အိမ်နီးချင်းများ 4. Store keeper စတိုအကြီးအကဲ 5. Bank ဘဏ် 6. SUSU Groups 7. Informal credit 8. Self Help groups ကိုယ်ပိုင်အစုအဖွဲ့များ☑ 9. Other (specify):		
B	What is the interest rate? အတိုးနှုန်းမည်မျှနည်း	☐ **2% Month** (period : year, month) ☐ No interest အတိုးမဲ့		
C	Why people borrow money? ငွေချေးရသည့်အကြောင်းရင်း	1. Buying seeds မျိုးစေ့ဝယ်ရန် 2. Buying food အစားအစာဝယ်ရန် 3. For Field preparation စိုက်ပျိုးရေးအတွက်ပြင်ဆင်ရန် 4. Medical facilities 5. For Marriage အိမ်ထောင်ပြုရန် 6. For house constructionအိမ်ဆောက်ရန် 7. For Business လုပ်ငန်းလုပ်ရန် 8. Others အခြား**For Education**		
	Identify the five main diseases in the village according to the following အဓိကရင်ဆိုင်ရသော ကျန်းမာရေးပြ	**General**	**Especially among women**	**Especially among children**
		A**Hypertension**	A**Hypertension**	A**Flu**
		B**Stroke**	B**Diabetes**	B
		C**Malaria**	C**Stroke**	C
		D**Diabetes**	D	D
		E**Flu**	E	E

	သနာငါးမျိုးကိုဖော်ပြပေးပါ။			
	Access to Electricity လျှပ်စစ်မီးရရှိမှု	**Type of electricity supply**	**No. of HHs utilizing**	**Frequency of power cuts**
		Government Electricity အစိုးရလျှပ်စစ်မီး		
		Electricity organised by the Village ကျေးရွာကိုယ်ထူကိုယ်ထလျှပ်စစ်မီး		
		Electricity by private/ commercial generator	**100**	**24hrs**
		Solar		
		No electricity		

Water Services

	Water source	**Proportion of HHs dependent**	**Distance from the village**	**Availability of water (In months)**	**Quality (Good/ Average / Bad)**
	River မြစ်				
	Creek ချောင်း				
	Pond ကန်				
	Brick Well အုတ်ရေတွင်း				
	Hand –Dug Well လက်ရက်တွင်း				
	Tube Well (Motor Pump) အဝိစိတွင်း				
	Tube Well (Hand Pump) လက်နှိပ်တွင်း				
	Spring Water (natural) စမ်းရေ				
	Spring Water (stored) စမ်းရေ(သိုလှောင်)	**97**	**15mins**	**12months**	**Good**
	Public Water Supply ရေပေးဝေရေးစနစ်				
	Dam ဆည်ရေ				
	Rain Water Storage Tank မိုးရေ လှောင်ကန်				

	Other (Specify) အခြား**(Mountain torrent)**	**34HHs**	**5mins to 30mins**	**12 months**	**Good**

Livelihood
အသက်မွေးဝမ်းကျောင်း

	Number of people engaged in these sources of livelihood အောက်ပါအသက်မွေးဝမ်းကြောင်းများလုပ်ကိုင်သူအရေအတွက်	**Source of livelihood အသက်မွေးဝမ်းကျောင်းများ**	**Number of HHs engaged အိမ်အရေအတွက်**	**Dominance of Men/Women အမျိုးသားသာ၊ အမျိုးသမီးသာ**
		Cultivator တောင်သူ	40	Both
		Agricultural labourer စိုက်ပျိုးရေးလုပ်သား		
		Fishing ငါးဖမ်းလုပ်ငန်း		
		Business (SME, shop, trading etc.) ကိုယ်ပိုင်စီးပွားရေးလုပ်ငန်း (အသေးစား၊အလတ်စား၊ဆိုင်၊ ကုန်သွယ်ရေး)		
		Forest user တောတက်သူ		
		Livestock rearing မွေးမြူရေး		
		Casual Labour ကျဘန်း	**10**	**Both**
		Other (specify) အခြား	**50**	**Both**

Village Infrastructure

Distance to the following facilities (in time or kms) အောက်ပါ အရပ်ဒေသသို့ အကွာအဝေး ကိုကြာချိန်(သို့) ကီလိုမီတာ ဖြင့်ပြပါ။

Infrastructure အခြေခံ အဆောက်အအုံ	**Distance in Wet Season (in Minutes) မိုးရာသီ ကြာချိန်**	**Distance in Dry Season (in Minutes) ပွင့်လင်းရာသီ ကြာချိန်**	**Preferred mode of Transport အဓိကသယ်ယူပို့ဆောင်ရေး နည်းလမ်း**	**Mode of Transport သယ်ယူပို့ဆောင်ရေး နည်းလမ်းများ**
Health Center ကျန်းမာရေးဌာန	**15mins**	**15mins**	**Walking**	*Walking, Bicycle, Motor-Cycle, Car, Boat etc.*
Seed/grain bank စပါးကျီ				
Cyclone shelter မုန်တိုင်းဒဏ်ခံနိုင်သော အဆောက်အဦး				

	Hand pumps တုံကင်				
	Grocery shops ကုန်စုံဆိုင်	**15mins**	**15mins**	**Walking**	
	Chemist ဆေးဆိုင်	**15mins**	**15mins**	**Walking**	
	Post office စာတိုက်	**15mins**	**15mins**	**Walking**	
	Nearest Township အနီးဆုံးမြို့နယ်	**4hrs**	**4hrs**	**Motor-Cycle**	
	Bank ဘဏ်	**30mins**	**30mins**	**Walking**	
	Other (specify).....				
	Access to Road Facilities in the village (tick the appropriate) လမ်းပန်းဆက်သွယ်ရေး အနေ အထား	No Road (reaching all the way to the village); လမ်းမပေါက်သေးပါ Rough Track (Bullock Cart or Walking only); လမ်းကြမ်း (နွားလှည်း(သို့) ခြေလျှင် ခရီး Accessible by trawlargee but not cars/trucks; ထော်လာဂျီ ဖြင့် သွားနိုင်သည် (ကားထရပ်မပါ) Accessible by car/ truck in dry weather only; ပွင့် လင်းရာသီတွင် ကားထရပ်များ သွားလာနိုင်သည်။ Accessible by car/truck in all weather ရာသီ မရွေး ကားထရပ်များ သွားလာနိုင်သည်။☑			

Table 2.6 Community Questionnaire by Socio-economic Survey, Kanpaingyan Ward

Name: အမည်	**Za KhonKhaung Zel**		
Date: (DD/MM/YY) နေ့စွဲ	**10-8-2016**		
Location Details			
Village: ကျေးရွာ အမည်	**Kan Paing Yan Ward**	Township:မြို့နယ်	**Chipwi**
Village Tract ကျေးရွာ အုပ်စု	-	District: ခရိုင်	**Chipwi**
State/Region ပြည်နယ် ၊ တိုင်း	**Kachin State**		

Village Level Primary Information						
Population လူဦးရေ	**Total စုစုပေါင်း**		**Male ကျား**		**Female မ**	
	139		**77**		**62**	
Number of households အိမ်ထောင်စုဦးရေ	**34**		Disabled population မသန်းမစွမ်း လူဦးရေ		**1**	
Women headed HHs အမျိုးသမီး ဦးဆောင်သော အိမ်ထောင်စု	**8**		Poor HHs ဆင်းရဲသော အိမ်ထောင်စု		**8**	
		Ethnicity လူမျိုး	**No. of HHs**		**Ethnicity လူမျိုး**	**No. of HHs**

Ethnicity လူမျိုး			အိမ်ထောင်စုဦးရေ			အိမ်ထောင်စုဦးရေ
		Bamar ဗမာ	2		Rakhine ရခိုင်	-
		Kachin ကချင်	30		Shan ရှမ်း	1
		Kayah ကယား	-		Indian	-
		Kayin ကရင်	-		Chinese	-
		Mon မွန်	-		Other (.....)	-
When was the village founded? ရွာကို မည်သည် အချိန်တွင် တည်ထောင်သနည်း			Over 100 years			
How far is the nearest river? ရွာနှင့် မြစ် အကွာအဝေး Or how close is the community to other (သို့) ရေ အရင်းအမြစ် နှင့် လူနေထိုင်ရာအကွာအဝေး ကိုဖော်ပြပါ။ water body?			Beside of river, about 10minutes			
Land						
ရွာတွင်စိုက်ပျိုးရေးလုပ်ငန်းလုပ်ပါသလား			Yes လုပ်သည်။☑2) No မလုပ်ပါ။			
လုပ်သည်ဆိုပါကအိမ်ထောင်စုမည်မျှလုပ်သနည်း။			5			
Is farming the main economic activity in this settlement? As major form of subsistence or primarily for selling purposes or for both? လယ်ယာလုပ်ငန်းသည်ဤဒေသတွင်အဓိကစီးပွားရေးလုပ်ငန်းဖြစ်ပါသလား။ တစ်နိုင်စားသောက်ရန် သို့ အဓိကစီးပွားရေးအဖြစ် သို့ နှစ်ခုစလုံးရောင်းချခြင်းဖြစ်ပါသလား။			For subsistence (မိသားစုစားသုံးရန်) ☑ primarily for selling purposes (ထွက်ကုန်ရောင်းချခြင်းဖြင့်မိသားစုအပိုဝင်ငွေရရန်)			
Provide the approximate proportion of land under each category ခေါင်းစဉ်တစ်ခုစီတွင်ခန့်မှန်းမြေအတိုင်းအတာဖြည့်သွင်းပါ။		**Type of land**		**Proportion**		**Utilisation**
		LE (wet) လယ်၊စိုစွတ်		-		-
		Ya (dry) ယာ၊ ခြောက်သွေ့		-		-
		Kaing (cultivable waste land, island		-		-

	etc.)စိုက်ပျိုးဖြစ်ထွန်းနိုင်သောဖုန်းဆိုး မြေ။ ကျွန်းစသည်ဖြင့်		
	Reserved forest ဘေးမဲ့တော	-	-
	Current fallowလက်ရှိမြေလွတ်မြေရိုင်း	-	-
	Gardenဥယျာဉ်ခြံမြေ	-	-
	Dani (swamp lands) ရွှံမြေ	-	-
	Taungya (shifting cultivation) ရွှေပြောင်းတောင်ယာ	-	-
	Other (specify)အခြား	-	-
What is the number of households having the following proportion of irrigated land (in dry season) ခြောက်သွေ့သောရာသီတွင်ဆည်ရေသောက်ဒေသအတွင်းရှိသောအိမ်ထောင်စုအရေအတွက်	**Proportion of Irrigation**	**Number of HHs**	**Proportion of HHs**
	0% irrigated land	**5**	**100%**
	0-10% irrigated land		
	10-25% irrigated land		
	25-50% irrigated land		
	50-75% irrigated land		
	75-100% irrigated land		

Crops			
Crops grown in the village (specify is repeated cultivation of the same crop) ကျေးရွာအတွင်းစိုက်ပျိုးသည့်သီးနှံ			
Type of Crop	**Dry Season/ Wet Season နွေရာသီ၊ မိုးရာသီ**	**Type of Crop**	**Dry Season/ Wet Season**
Monsoon Paddy မိုးစပါး	**Wet Season**	Turmeric နနွင်း	-
Summer Paddy နွေစပါး	-	Chili ငရုတ်သီး	**Both**
Oil Seeds ဆီထွက်သီးနှံ	-	Fruits အသီးအနှံ	**Both**
Peas စားတော်ပဲ	-	Vegetables	**Both**
Pulses ပဲအမျိုးမျိုး	-	Sugar cane ကြံ	-
Maize ပြောင်း	**Wet Season**	Nippa Palm ထန်း	-
Wheat ဂျုံ	-	Coconut အုန်း	-
Potatoes အာလူး	-	Betel nut/ leaf ကွမ်းသီး။ရွက်	-
Sweet Potato ကန်စွန်းဥ	-	Toddy ဓနိ	-
Onion ကြက်သွန်နီ	-	Other (Specify) အခြား	**Wet Season (Taro)**

Livestock			
Number of people rearing these livestock (tick the appropriate option) အောက်ပါမွေးမြူရေးလုပ်ငန်းများကိုလုပ်ကိုင်သူ အရေအတွက်	**Type**	**Number of Households having the livestock holdings**	**Main Use**
	Buffalo ကျွဲ	**9**	**Put to work**
	Goats/Sheep ဆိတ်။သိုး	**-**	
	Horse	**-**	
	Cattle နွား	**6**	**Put to work and for meat**
	Ducks ဘဲ	**-**	
	Chickens ကြက်	**30**	**For subsistence**
	Pigs ဝက်	**34**	**For meat**
Income/ Expenditure			
How many households fall into these Annual Income Levels? အောက်ပါဝင်ငွေအဆင့်တွင်ရှိသောအိမ်ထောင်စု အရေအတွက်	**Level of monthly income နှစ်စဉ်ဝင်ငွေ**	**Number of HH falling under the categories** သတ်မှတ်ထားသည့် အုပ်စုများတွင် ပါဝင်သည့်အိမ်အရေအတွက်	
	Less than 25,000Kyats	-	
	25,000-50,000 Kyats	-	
	50,000-100,000 Kyats	**32**	
	100,000-200,000Kyats	**2**	
	200,000-300,000Kyats	-	
	More than 300,000 Kyats	-	

Availability, access and proximity to the education services	**Facility**	**Distance (km or time)**	
Operational Education System	a. Nursery မူကြို		
	b. Primary မူလတန်း	**Inside ward(about 15mins)**	**No comments**
	c. Middle အလယ်တန်း		
	d. Secondary အထက်တန်း	**30mins**	**Good**
	e. University တက္ကသိုလ်		
	Vocational training institute အသက်မွေးမှုဆိုင်ရာ လေ့ကျင့်ရေးတက္ကသိုလ်		
	Buddhist Religious School ဘုန်းတော်ကြီးသင်ပညာရေးကျောင်း		
Market ဈေး	Every day market နေ့စဉ်ဈေး	**30mins**	**No comments**

	Weekly market (for basic provisions) ခုနစ်ရက်စျေး		
	Monthly market (for trade) လစဉ်စျေး(ကုန်သွယ်မှု)		
	Occasional market အခါအားလျော်စွာဖွင့်လှစ်သည့်စျေး		
Operational Health System လက်ရှိကျန်းမာရေးစနစ်	Town council မြို့နယ်ကောင်စီ		
	Maternity and child health and school မိခင်နှင့်ကလေးစောင့်ရှောက်မှုနှင့်ကျောင်း		
	Station hospital တိုက်နယ်ဆေးရုံ	**1Mile (Township Hospital)**	**Good**
	Rural health center ကျေးလက်ကျန်းမာရေးဌာန		
	Rural health Sub-center ကျေးလက်ကျန်းမာရေးဌာနခွဲ		
	Village health committee ကျေရွာကျန်းမာရေးကော်မတီ		

	Credit Facility			
A	Credit Sources in the village ရွာရှိချေးငွေရရှိနိုင်သောနေရာများ	1. Family 2. In laws ဆွေမျိုးများ 3. Friends/ Neighbours သူငယ်ချင်း။အိမ်နီးချင်းများ 4. Store keeper စတိုအကြီးအကဲ 5. Bank ဘဏ် 6. SUSU Groups 7. Informal credit 8. Self Help groups ကိုယ်ပိုင်အစုအဖွဲ့များ 9. Other (specify):☑		
B	What is the interest rate? အတိုးနှုန်းမည်မျှနည်း	☐ **2% to 5% per Month** (period : year, month) ☐ No interest အတိုးမဲ့		
C	Why people borrow money? ငွေချေးရသည့်အကြောင်းရင်း	1. Buying seeds မျိုးစေ့ဝယ်ရန် 2. Buying food အစားအစာဝယ်ရန် 3. For Field preparation စိုက်ပျိုးရေးအတွက်ပြင်ဆင်ရန် 4. Medical facilities 5. For Marriage အိမ်ထောင်ပြုရန် 6. For house constructionအိမ်ဆောက်ရန် 7. For Business လုပ်ငန်းလုပ်ရန် 8. Others အခြား**For Education and Health**		
	Identify the five main diseases in the village according to the following အဓိကရင်ဆိုင်ရသောကျန်းမာရေးပြဿနာငါးမျိုးကိုဖော်ပြပေးပါ။	**General**	**Especially among women**	**Especially among children**
		A**Malaria**	A**Hypertension**	A**Dengue**
		B**Gastric**	B**Diabetes**	B
		C	C	C
		D	D	D
		E	E	E

	Access to Electricity လျှပ်စစ်မီးရရှိမှု	**Type of electricity supply**	**No. of HHs utilizing**	**Frequency of power cuts**
		Government Electricity အစိုးရလျှပ်စစ်မီး	**34**	**24hrs**
		Electricity organised by the Village ကျေးရွာကိုယ်ထူကိုယ်ထလျှပ်စစ်မီး		
		Electricity by private/ commercial generator		
		Solar		
		No electricity		

Water Services

	Water source	**Proportion of HHs dependent**	**Distance from the village**	**Availability of water (In months)**	**Quality (Good/ Average/ Bad)**
	River မြစ်				
	Creek ချောင်း				
	Pond ကန်				
	Brick Well အုတ်ရေတွင်း				
	Hand –Dug Well လက်ရက်တွင်း				
	Tube Well (Motor Pump) အဝီစိတွင်း				
	Tube Well (Hand Pump) လက်နှိပ်တွင်း				
	Spring Water (natural) စမ်းရေ				
	Spring Water (stored) စမ်းရေ(သိုလှောင်)				
	h. Public Water Supply ရေပေးဝေရေးစနစ်				
	Dam ဆည်ရေ				
	Rain Water Storage Tank မိုးရေ လှောင်ကန်				
	Other (Specify) အခြား**(Mountain torrent)**	**34HHs**	**5mins to 30mins**	**12 months**	**Good**

Livelihood
အသက်မွေးဝမ်းကျောင်း

	Number of people engaged in these sources of livelihood အောက်ပါအသက်မွေးဝမ်းကြောင်းများလုပ်ကိုင်သူအရေအတွက်	**Source of livelihood အသက်မွေးဝမ်းကျောင်းများ**	**Number of HHs engaged အိမ်အရေအတွက်**	**Dominance of Men/Women အမျိုးသားသာ၊ အမျိုးသမီးသာ**
		Cultivator တောင်သူ		
		Agricultural labourer စိုက်ပျိုးရေးလုပ်သား		
		Fishing ငါးဖမ်းလုပ်ငန်း		
		Business (SME, shop, trading etc.) ကိုယ်ပိုင်စီးပွားရေးလုပ်ငန်း (အသေးစား၊အလတ်စား၊ဆိုင်၊ ကုန်သွယ်ရေး)		
		Forest user တောတက်သူ		
		Livestock rearing မွေးမြူရေး		
		Casual Labour ကျဘန်း	**32**	**Both**
		Other (specify) အခြား	**12**	**Both**

Village Infrastructure

Distance to the following facilities (in time or kms) အောက်ပါ အရပ်ဒေသသို့ အကွာအဝေး ကိုကြာချိန် (သို့) ကီလိုမီတာ ဖြင့်ပြပါ။

Infrastructure အခြေခံ အဆောက်အအုံ	**Distance in Wet Season (in Minutes) မိုးရာသီ ကြာချိန်**	**Distance in Dry Season (in Minutes) ပွင့်လင်းရာသီ ကြာချိန်**	**Preferred mode of Transport အဓိကသယ်ယူပို့ဆောင်ရေး နည်းလမ်း**	**Mode of Transport သယ်ယူပို့ဆောင်ရေး နည်းလမ်းများ**
Health Center ကျန်းမာရေးဌာန	**30mins**	**30mins**	**Walking**	*Walking, Bicycle, Motor-Cycle, Car, Boat etc.*
Seed/grain bank စပါးကျီ				
Cyclone shelter မုန်တိုင်းဒဏ်ခံနိုင်သော အဆောက်အဦး				
Hand pumps တုံကင်				
Grocery shops ကုန်စုံဆိုင်	**30mins**	**30mins**	**Walking**	
Chemist ဆေးဆိုင်	**30mins**	**30mins**	**Walking**	
Post office စာတိုက်	**30mins**	**30mins**	**Walking**	
Nearest Township အနီးဆုံးမြို့နယ်	**7hrs**	**8hrs**	**Motor-Cycle**	
Bank ဘဏ်	**30mins**	**30mins**	**Walking**	

	Other (specify).....				
	Access to Road Facilities in the village (tick the appropriate) လမ်းပန်းဆက်သွယ်ရေး အနေ အထား	No Road (reaching all the way to the village); လမ်းမပေါက်သေးပါ Rough Track (Bullock Cart or Walking only); လမ်းကြမ်း (နွားလှည်း(သို့) ခြေလျှင် ခရီး Accessible by trawlargee but not cars/trucks; ထော်လာဂျီ ဖြင့် သွားနိုင်သည် (ကားထရပ်မပါ) Accessible by car/ truck in dry weather only; ပွင့် လင်းရာသီတွင် ကားထရပ် များ သွားလာနိုင်သည်။ Accessible by car/truck in all weather ရာသီ မရွေး ကားထရပ်များ သွားလာနိုင်သည်။☑				

Table 2.7 Community Questionnaire by Socio-economic Survey, Yinlaw Ward

Name: အမည်	**La GanKhaungZel**		
Date: (DD/MM/YY) နေ့စွဲ	**10-8-2016**		
Location Details			
Village:ကျေးရွာအမည်	**Yit Law Ward**	Township:မြို့နယ်	**Chipwi**
Village Tractကျေးရွာအုပ်စု	-	District:ခရိုင်	**Chipwi**
State/Region ပြည်နယ် ၊ တိုင်း	**Kachin State**		

Village Level Primary Information							
	Population လူဦးရေ	j. **Total စုစုပေါင်း**		k. **Male ကျား**		l. **Female မ**	
		703		**359**		**344**	
	Number of households အိမ်ထောင်စုဦးရေ	**135**		Disabled population မသန်းမစွမ်းလူဦးရေ		**1**	
	Women headed HHs အမျိုးသမီးဦးဆောင်သော အိမ်ထောင်စု	-		Poor HHs ဆင်းရဲသော အိမ်ထောင်စု		**70**	
	Ethnicity လူမျိုး		**Ethnicity လူမျိုး**	**No. of HHs အိမ်ထောင်စုဦးရေ**		**Ethnicityလူမျိုး**	**No. of HHs အိမ်ထောင်စုဦးရေ**
		kk.	Bamarဗမာ	**3**	ll.	Rakhineရခိုင်	-
		mm.	Kachin ကချင်	**132 (လချိတ် ၈၀, လဝေါ် ၅၂)**	nn.	Shan ရှမ်း	-
		oo.	Kayahကယား	-	pp.	Indian	-
		qq.	Kayinကရင်	-	rr.	Chinese	-
		ss.	Mon မွန်	-	tt.	Other (.....)	-
	When was the village founded? ရွာကိုမည်သည် အချိန်တွင် တည်ထောင်သနည်း	**About 200years**					u

	How far is the nearest river? ရွာနှင့် မြစ် အကွာအဝေး Or how close is the community to other (သို့) ရေအရင်းအမြစ် နှင့် လူနေထိုင်ရာအကွာအဝေး ကိုဖော်ပြပါ။ water body?	**Beside of river, about 15minutes**
Land		
	ရွာတွင်စိုက်ပျိုးရေးလုပ်ငန်းလုပ်ပါသလား	4) Yes လုပ်သည်။ √ 2) No မလုပ်ပါ။
	လုပ်သည်ဆိုပါကအိမ်ထောင်စုမည်မျှလုပ်သနည်း။	**50**
	Is farming the main economic activity in this settlement? As major form of subsistence or primarily for selling purposes or for both? လယ်ယာလုပ်ငန်းသည်ဤဒေသတွင်အဓိကစီး ပွားရေးလုပ်ငန်းဖြစ်ပါသလား။ တစ်နိုင်စားသောက်ရန် သို့ အဓိကစီးပွားရေးအဖြစ် သို့ နှစ်ခုစလုံးရောင်းချခြင်းဖြစ်ပါသလား။	**7.** For subsistence (မိသားစုစားသုံးရန်) √ 8. primarily for selling purposes (ထွက်ကုန်ရောင်းချခြင်းဖြင့်မိသားစုအပိုဝင်ငွေရရန်)

		x. Type of land	xi. Proportion	xii. Utilisation
	Provide the approximate proportion of land under each category ခေါင်းစဉ်တစ်ခုစီတွင်ခန့်မှန်းမြေအတိုင်းအတာဖြည့်သွင်းပါ။	bb. LE (wet)လယ်၊စိုစွတ်	-	-
		cc. Ya (dry) ယာ၊ခြောက်သွေ့	-	-
		dd. Kaing (cultivable waste land, island etc.)စိုက်ပျိုးဖြစ်ထွန်းနိုင်သောဖုန်းဆိုးမြေ။ ကျွန်းစသည်ဖြင့်	-	-
		ee. Reserved forest ဘေးမဲ့တော	-	-
		ff. Current fallowလက်ရှိမြေလွတ်ငြေမရိုင်း	-	-
		gg. Gardenဥယျာဉ်ခြံမြေ	-	-
		hh. Dani (swamp lands) ရွှံမြေ	-	-
		ii. Taungya (shifting cultivation) ရွှေပြောင်းတောင်ယာ	-	-
		jj. Other (specify)အခြား	-	-

	What is the number of households having the following proportion of irrigated land (in dry season) ခြောက်သွေ့သောရာသီတွင်ဆည်ရေသောက်ဒေသအတွင်းရှိသောအိမ်ထောင်စုအရေအတွက်	**x. Proportion of Irrigation**	**xi. Number of HHs**	**xii. Proportion of HHs**
		0% irrigated land	**50**	**100%**
		0-10% irrigated land		
		10-25% irrigated land		
		25-50% irrigated land		
		50-75% irrigated land		
		75-100% irrigated land		
Crops				
	Crops grown in the village (specify is repeated cultivation of the same crop) ကျေးရွာအတွင်းစိုက်ပျိုးသည့်သီးနှံ			
	Type of Crop	**Dry Season/ Wet Season နွေရာသီ၊ မိုးရာသီ**	**Type of Crop**	**Dry Season/ Wet Season**
	Monsoon Paddy မိုးစပါး	**Wet Season**	Turmeric နနွင်း	-
	Summer Paddy နွေစပါး	-	Chilicရုတ်သီး	**Wet Season**
	Oil Seedsဆီထွက်သီးနှံ	-	Fruitsအသီးအနှံ	**Both**
	Peasစားတော်ပဲ	-	Vegetables	**Dry Season**
	Pulsesပဲအမျိုးမျိုး	-	Sugar cane ကြံ	-
	Maizeပြောင်း	**Wet Season**	Nippa Palm ထန်း	-
	Wheatဂျုံ	-	Coconutအုန်း	-
	Potatoesအာလူး	-	Betel nut/ leafကွမ်းသီး။ရွက်	-
	Sweet Potatoကန်စွန်းဥ	-	Toddy ဓနိ	-
	Onion ကြက်သွန်နီ	**Dry Season**	Other (Specify)အခြား	-
Livestock				
	Number of people rearing these livestock (tick the appropriate option) အောက်ပါမွေးမြူရေးလုပ်ငန်းများကိုလုပ်ကိုင်သူ အရေအတွက်	**Type**	**Number of Households having the livestock holdings**	**Main Use**
		Buffalo ကျွဲ	**30**	**Use for traditional Festival**
		Goats/Sheep ဆိတ်။သိုး	-	
		Horse	-	

		Cattle နွား	**35**	**Use for traditional Festival and for meat**
		Ducks ဘဲ	**4**	**For subsistence**
		Chickens ကြက်	**100**	**For subsistence**
		Pigs ဝက်	**34**	**For meat**
Income/ Expenditure				
	How many households fall into these Annual Income Levels? အောက်ပါဝင်ငွေအဆင့်တွင်ရှိသောအိမ်ထောင်စုအရေအတွက်	**Level of monthly income နှစ်စဉ်ဝင်ငွေ**	**Number of HH falling under the categories** သတ်မှတ်ထားသည့်အုပ်စုများတွင် ပါဝင်သည့်အိမ်အရေအတွက်	
		y. Less than 25,000Kyats	-	
		z. 25,000-50,000 Kyats	-	
		aa. 50,000-100,000 Kyats	**45**	
		bb. 100,000-200,000Kyats	**30**	
		cc. 200,000-300,000Kyats	35	
		dd. More than 300,000 Kyats	30	

Availability, access and proximity to the education services		**vii. Facility**	**viii. Distance (km or time)**	**ix. Quality (Good/bad/no comments)**
	Operational Education System	a. Nursery မူကြို		
		b. Primary မူလတန်း	**Inside ward(about 15mins)**	**Good**
		c. Middle အလယ်တန်း		
		d. Secondary အထက်တန်း	**30mins**	**Good**
		e. University တက္ကသိုလ်		
		ee. Vocational training institute အသက်မွေးမှုဆိုင်ရာလေ့ကျင့်ရေးတက္ကသိုလ်		
		ff. Buddhist Religious School ဘုန်းတော်ကြီးသင်ပညာရေးကျောင်း		
	Market ဈေး	m. Every day market နေ့စဉ်ဈေး	**10mins**	**Good**
		n. Weekly market (for basic		

		provisions)ခုနှစ်ရက်စေ့		
		o. Monthly market (for trade)လစဉ်စေ့(ကုန်သွယ်မှု)		
		p. Occasional market အခါအားလျော်စွာဖွင့်လှစ်သည့်စု		
	Operational Health System လက်ရှိကျန်းမာရေးစနစ်	s. Town council မြို့နယ်ကောင်စီ		
		t. Maternity and child health and school မိခင်နှင့်ကလေးစောင့်ရှောက်မှုနှင့်ကျောင်း	**15mins**	**Good**
		u. Station hospital တိုက်နယ်ဆေးရုံ	**15mins (Township Hospital)**	**Good**
		v. Rural health center ကျေးလက်ကျန်းမာရေးဌာန		
		w. Rural health Sub-center ကျေးလက်ကျန်းမာရေးဌာနခွဲ		
		x. Village health committee ကျေရွာကျန်းမာရေးကော်မတီ		
	Credit Facility			
A	Credit Sources in the village ရွာရှိချေးငွေရရှိနိုင်သောနေရာများ	1. Family√2. In laws ဆွေမျိုးများ√ 3. Friends/ Neighbours သူငယ်ချင်း။အိမ်နီးချင်းများ√ 4. Store keeperစတိုအကြီးအကဲ 5. Bank ဘဏ် 6. SUSU Groups 7. Informal credit 8. Self Help groups ကိုယ်ပိုင်အစုအဖွဲ့များ 9. Other (specify):		
B	What is the interest rate? အတိုးနှုန်းမည်မျှနည်း	☐ **5% per Month** (period : year, month) ☐ No interestအတိုးမဲ့		
C	Why people borrow money? ငွေချေးရသည့်အကြောင်းရင်း	1. Buying seeds မျိုးစေ့ဝယ်ရန် 2. Buying food အစားအစာဝယ်ရန် 3. For Field preparation စိုက်ပျိုးရေးအတွက်ပြင်ဆင်ရန် 4. Medical facilities √5. For Marriageအိမ်ထောင်ပြုရန် 6. For house constructionအိမ်ဆောက်ရန် 7. For Businessလုပ်ငန်းလုပ်ရန် 8. Othersအခြား**For Education**		

	Identify the five main diseases in the village according to the following အဓိကရင်ဆိုင်ရသောကျန်းမာရေးပြဿနာငါးမျိုးကိုဖော်ပြပေးပါ။	**j. General**	**k. Especially among women**	**l. Especially among children**
		A**Flu, AIDS**	A**Flu**	A**Flu**
		B**Respiratory disease**	B**Respiratory disease**	B**Dengue**
		C**Malaria**	C**Malaria**	C
		D	D	D
		E	E	E

	Access to Electricity လျှပ်စစ်မီးရရှိမှု	**j. Type of electricity supply**	**k. No. of HHs utilizing**	**l. Frequency of power cuts**
		p. Government Electricity အစိုးရလျှပ်စစ်မီး		
		q. Electricity organised by the Village ကျေးရွာကိုယ်ထူကိုယ်ထလျှပ်စစ်မီး		
		r. Electricity by private/ commercial generator	**135**	**24hrs**
		s. Solar		
		t. No electricity		

Water Services

	Water source	**xiii. Proportion of HHs dependent**	**xiv. Distance from the village**	**xv. Availability of water (In months)**	**xvi. Quality (Good/ Average/ Bad)**
	qq. River မြစ်				
	rr. Creekချောင်း				
	ss. Pondကန်				
	tt. Brick Well အုတ်ရေတွင်း				
	uu. Hand –Dug Well vv. လက်ရက်တွင်း				
	ww.Tube Well (Motor Pump)အဝီစိတွင်း				
	xx. Tube Well (Hand Pump) လက်နှိပ်တွင်း				
	yy. Spring Water (natural) စမ်းရေ				
	zz. Spring Water (stored) စမ်းရေ(သိုလှောင်)	**135**	**30mins**	**12month**	**Good**
	aaa. Public Water Supply				

	ရေပေးဝေရေးစနစ်				
	bbb. Damဆည်ရေ				
	ccc. Rain Water Storage Tank မိုးရေလှောင်ကန်				
	ddd. Other (Specify)အခြား**(Mountain torrent)**				

Livelihood
အသက်မွေးဝမ်းကျောင်း

	Number of people engaged in these sources of livelihood အောက်ပါအသက်မွေးဝမ်းကြောင်းများလုပ်ကိုင်သူအရေအတွက်	**Source of livelihood အသက်မွေးဝမ်းကျောင်းများ**	**vii. Number of HHs engaged အိမ်အရေအတွက်**	**viii. Dominance of Men/Women အမျိုးသားသာ၊ အမျိုးသမီးသာ**
		bb. Cultivatorတောင်သူ	**25**	**Both**
		cc. Agricultural labourer စိုက်ပျိုးရေးလုပ်သား	**22**	**Both**
		dd. Fishingငါးဖမ်းလုပ်ငန်း	**-**	**-**
		ee. Business (SME, shop, trading etc.) ff. ကိုယ်ပိုင်စီးပွားရေးလုပ်ငန်း (အသေးစား၊အလတ်စား၊ဆိုင်၊ ကုန်သွယ်ရေး)	**15** **35**	**Both** **Both**
		gg. Forest userတောတက်သူ	**3**	**Men**
		hh. Livestock rearing မွေးမြူရေး	**-**	**-**
		ii. Casual Labourကျဘန်း	**35**	**Both**
		jj. Other (specify) အခြား	**-**	**-**

Village Infrastructure

Distance to the following facilities (in time or kms) အောက်ပါ အရပ်ဒေသသို့ အကွာအဝေး ကိုကြာချိန်(သို့) ကီလိုမီတာ ဖြင့်ပြပါ။

Infrastructure အခြေခံအဆောက်အဒုံ	**x. Distance in Wet Season (in Minutes) မိုးရာသီ ကြာချိန်**	**xi. Distance in Dry Season (in Minutes) ပွင့်လင်းရာသီ ကြာချိန်**	**xii. Preferred mode of Transport အဓိကသယ်ယူပို့ဆောင်ရေးနည်းလမ်း**	**Mode of Transport သယ်ယူပို့ဆောင်ရေးနည်းလမ်းများ**
Health Center ကျန်းမာရေးဌာန	**15mins**	**15mins**	**Walking**	*Walking, Bicycle, Motor-Cycle, Car, Boat etc.*
Seed/grain bank စပါးကျီ				
Cyclone shelter				

	မုန်တိုင်းဒဏ်ခံနိုင်သောအဆောက်အဦး				
	Hand pumps တုံကင်				
	Grocery shops ကုန်စုံဆိုင်	10mins	10mins	Walking	
	Chemist ဆေးဆိုင်	15mins	15mins	Walking	
	Post office စာတိုက်	10mins	10mins	Walking	
	Nearest Township အနီးဆုံးမြို့နယ်	6hrs	8hrs	Motor-Cycle	
	Bankဘဏ်	10mins	15mins	Walking	
	Other (specify).....				
	Access to Road Facilities in the village (tick the appropriate) လမ်းပန်းဆက်သွယ်ရေးအနေအထား	No Road (reaching all the way to the village);လမ်းမပေါက်သေးပါ Rough Track (Bullock Cart or Walking only); လမ်းကြမ်း (နွားလှည်း(သို့) ခြေလျှင် ခရီး Accessible by trawlargee but not cars/trucks;ထော်လာဂျီ ဖြင့် သွားနိုင်သည် (ကားထရပ်မပါ) Accessible by car/ truck in dry weather only; ပွင့် လင်းရာသီတွင် ကားထရပ်များသွားလာနိုင်သည်။ Accessible by car/truck in all weatherရာသီမရွေးကားထရပ်များသွားလာနိုင်သည်။☑			

2.2.4 Socio-economic Profile of the Affected Area

Gender, Age Composition and Family Size

Field surveys and semi- structured interviews were done in eleven sample groups within the project area. The respondents are 82 males (51 percent of total respondents) and remaining are 81 females (49 percent of the respondents). Most of the respondents belong to Ngaw Chang and La Chait ethnic groups and 88 percents are Christians but 12 percents are Buddhism. The major ethnic group in all wards is Ngaw Chang and La Chait people (Kachin).Respondents on semi- structured interviews mainly represented age group between 20 years old and over 65 years old. Most of the respondents belong to age group above 35 -49 years and age group 20-34 years is also high. (Table 2.8 and Figure 2.5)

Table 2.8 Age Composition of respondents (%)

Study Area	20-34 years	35-49	50-65	>65 years
Barle	26	39	31	4
Kan Paing Yan	23	32	32	13
Oake kut	31	38	18	13
Yitlaw	34	34	27	5
Power plant	76	24	0	0

(Source: Field Survey, August 2016)

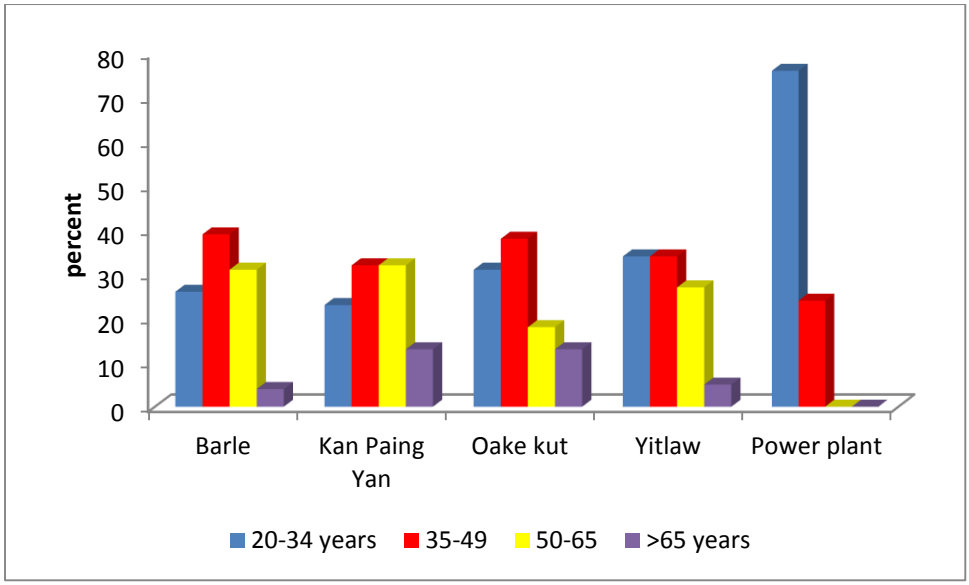


Figure 2.5 Age Composition of respondents (%)

Family size of respondents can be grouped into three classes as;

1. Family with 1 to 3 persons,
2. Family with 4 to 6 persons, and
3. Family with more than 6 persons.

High number of respondents with big families 4 to 6 persons is found in all wards. Respondents with small families (1 to 3 persons) are mainly found in Power plant. (Table 2.9 and Figure 2.3)

Table 2.9 Family size of respondents (%)

Study Area	1 to 3 persons	4 to 6 persons	above 6 persons
Barle	17	48	45
Kan Paing Yan	18	55	27
Oake kut	5	51	44
Yitlaw	10	50	40
Power plant	35	35	30

(Source: Field Survey, August 2016)

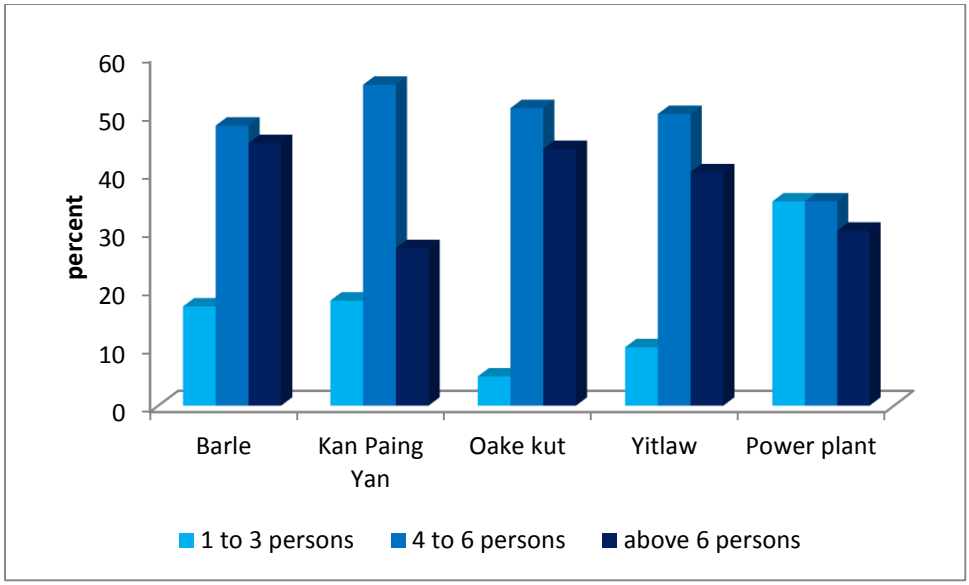


Figure 2.6 Family sizes of respondents (%)

Education Level

High percentage of middle schooling level among the respondents is found in the study area. High percentage of high school level is found only in Yitlaw Ward. Respondents of Gradulate education level are found in the study area but very few percentge. In general, most of the respondents are in the basic education levels from primary school to high school. (Table 2.10 and Figure 2.7)

Table 2.10 Education Level of Respondents (%)

Study area	no schooling	Primary school	Middle school	High school	graduate
Barle	13	22	52	9	4
Kan Paing Yan	14	32	27	18	9
Oake kut	3	15	31	41	10
Yitlaw	5	5	26	56	8
Power plant	18	12	24	40	6

(Source: Field Survey, August 2016)

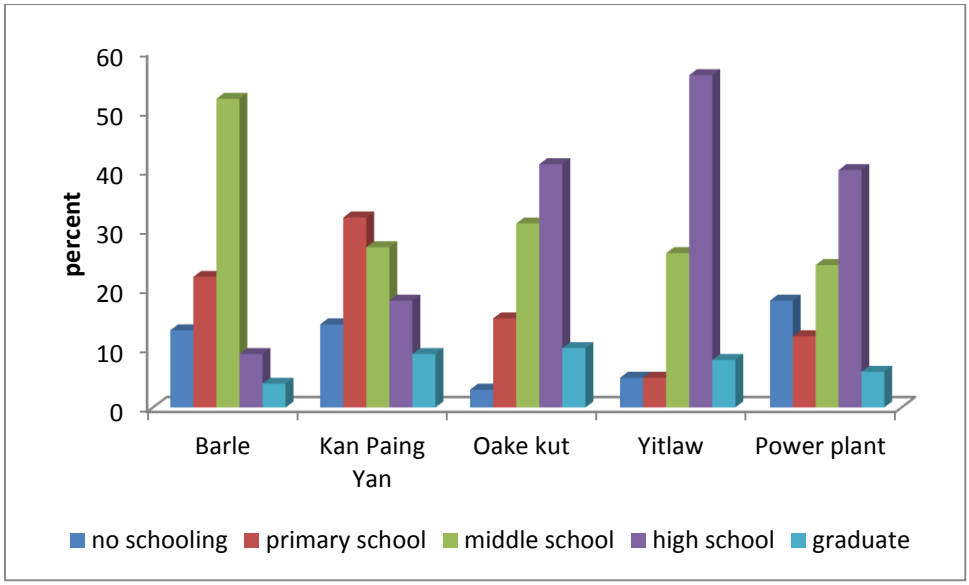


Figure 2.7 Education Level of Respondents (%)

Occupational Structure

According to the field survey data, type of occupation includes, agriculture especially *Taung Yar* and paddy cultivation, government staff, dependent, private business and Power plant' workers. Most of the respondents are farmers. Government staffs are mainly found in Kan Paing Yan, Oake kut and Yitlaw wards. Business jobs are only found in Oake kut and Yilaw wards. (Table 2.11 and Figure 2.8).

Table 2.11 Profile of Occupational Structure of Respondents (%)

Study area	Agriculture	Dependent	Private business	Government staff	Power plant
Barle	48	17	35	0	0
Kan Paing Yan	59	18	0	23	0
Oake kut	33	3	38	26	0
Yitlaw	18	15	52	15	0
Power plant	0	0	0	0	100

(Source: Field Survey, August 2016)

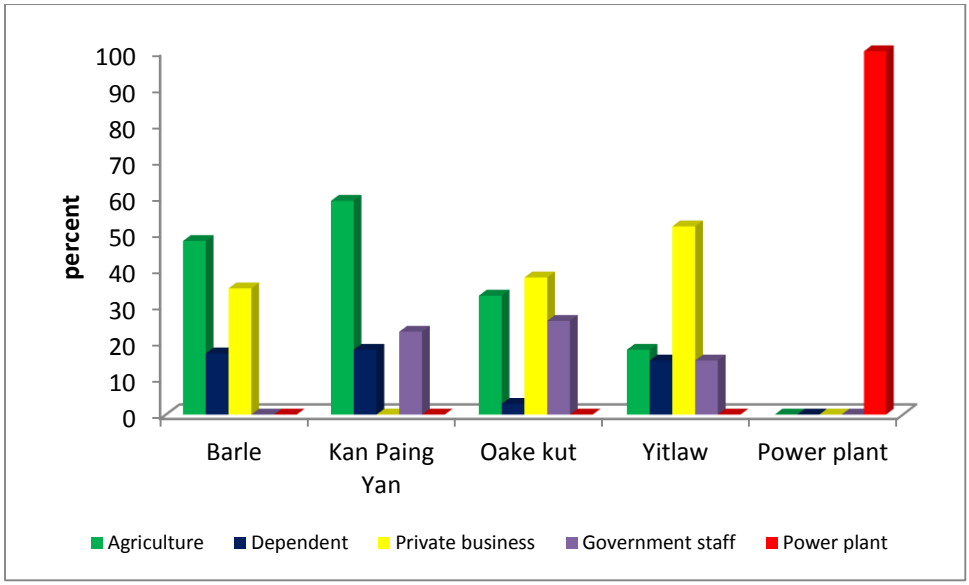


Figure 2.8 Profile of Occupational Structure of Respondents (%)

Income Level and Source of Income

Average income level of people in the affected wards was measured by using primary data received from field survey in August 2016. More than 200,000 kyats per month received of respondents are Oake kut Ward, Yinlaw Ward and Power plant.

Most of the respondents spend less than 200,000 kyats for their family monthly expenditure. Power plant' workers have monthly expenditure of 250,000 kyats. (Table 2.12 and Figure 2.9)

Table 2.12 Monthly Average Incomes Level and Expenditure of Respondents (%)

Study Area	Income	Expenditure
Barle	150,000	150,000
Kan Paing Yan	130,000	128,000
Oake kut	210,000	230,000
Yitlaw	230,000	200,000
Power plant	300,000	250,000

(Source: Field Survey, August 2016)

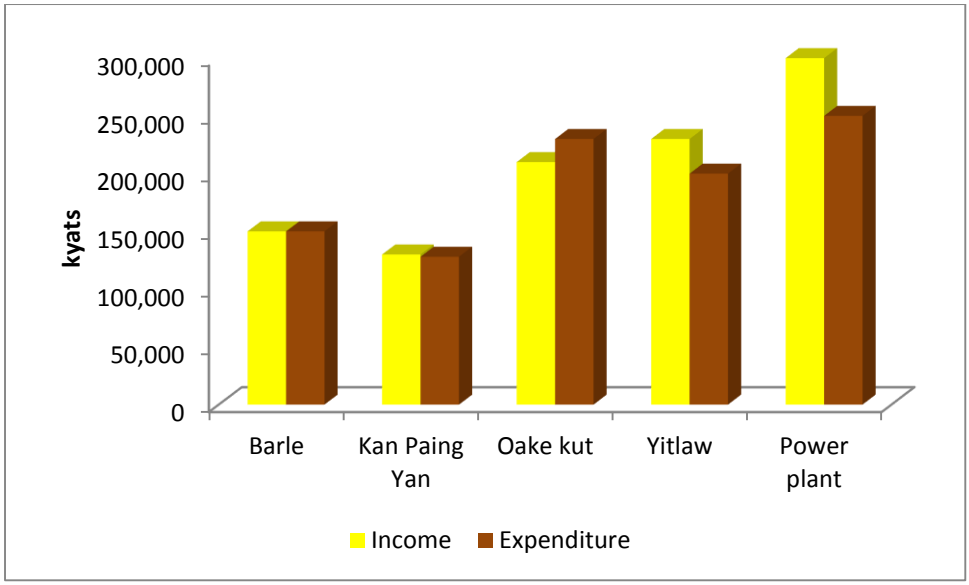


Figure 2.9 Monthly Average income Level and Expenditure of Respondents (%)

Source of Income

Main sources of income for respondents, especially Power plant' workers are company and government staff. Main source of income for other wards is Taung ya and paddy cultivation. Other important income sources are livestock.

Possession

All respondents own their houses. Types of house found in the affected villages are Semi-pucca, wooden and huts. Most of the respondents own wooden houses and houses with zinc roof. Houses are built by wood and brick. Most of the respondents posses mobile phone, television and DVD player. (Table 2.13 and Figure 2.10)

Table 2.13 Possession of Respondents (%)

Study area	car	Electronic goods	Mobile	Sewing	Television	DVD	Fridge
Barle	4	9	30	4	35	22	9
Kan Paing Yan	0	9	18	0	36	9	5
Oake kut	3	31	59	8	64	64	5
Yitlaw	8	16	63	0	71	61	23
Power plant	0	29	59	12	47	47	18

(Source: Field Survey, August 2016)

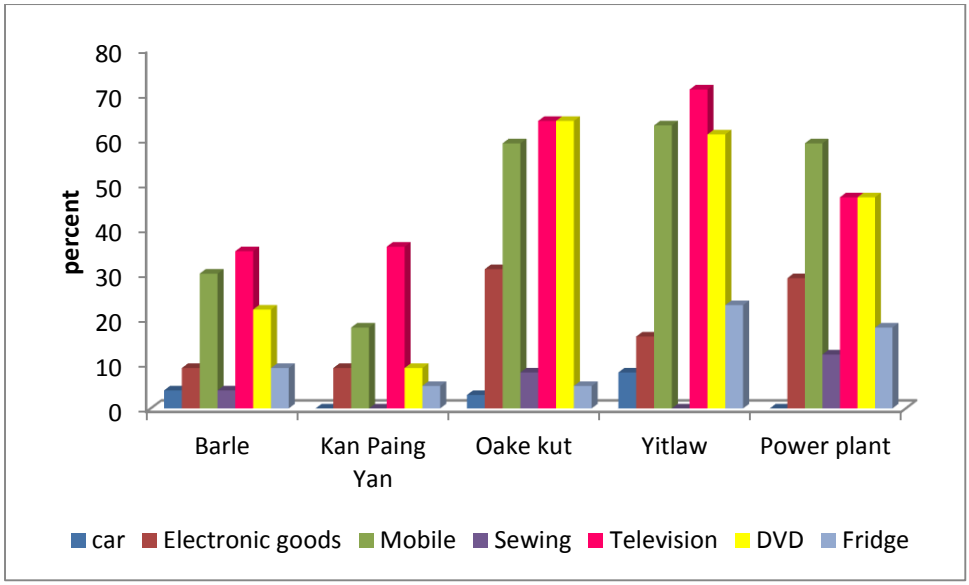


Figure 2.10 Possession of Respondents (%)

Transport

All respondents travel to Myinkyina at least once a month for shopping, medical treatments and others. They also travel to China, Panwa and Yangon.

Most of the respondents from all villages considered that transport is in a bad condition. However, high percentages from all respondents showed that transport in the region is bad. Some percentages from all respondents revealed that transport condition is normal and enough for them. (Table 2.14 and Figure 2.11)

Table 2.14 Opinion on Transport of Respondents (%)

Study area	satisfied	not satisfied	Good	Normal	Bad
Barle	22	78	4	35	61
Kan Paing Yan	23	77	9	14	77
Oake kut	33	67	0	44	56
Yitlaw	31	79	2	16	82
Power plant	41	59	6	36	58

(Source: Field Survey, August 2016)

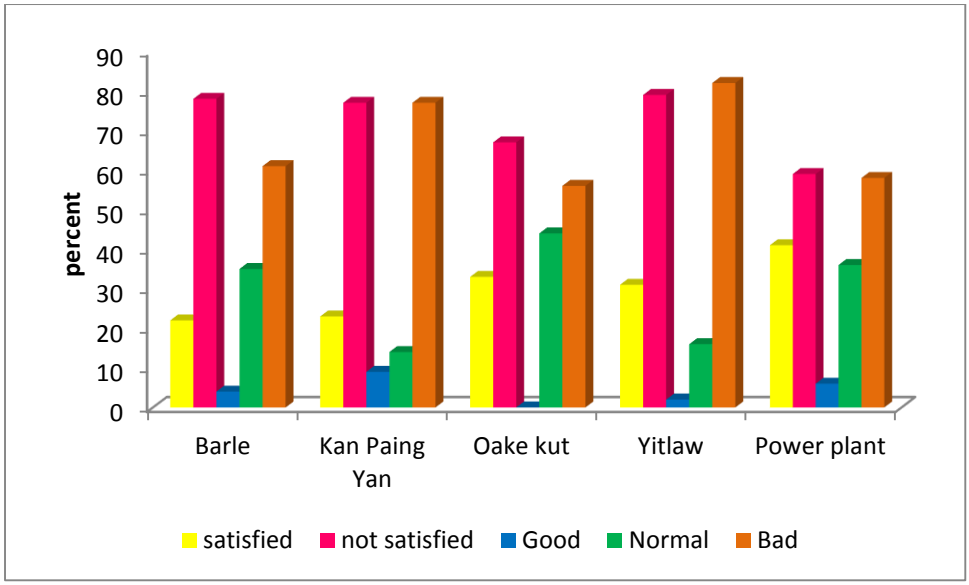


Figure 2.11 Opinion on Transport of Respondents (%)

Chapter III

Health Impact Assessment

3.1 Introduction

Health impact assessment is a combination of procedures, methods and tools by which a policy, program, or a project may be judged as to its potential effects on the health of a population and the distribution of those effects within the population.

Health Impact Assessment (HIA) process for Chipwi Nge Hydro Power plant Project was conducted at four Wards and Power plant' workers, Chipwi Township, Myinkyina District, Kachin State commencing on August 2016.

3.2 Legal Framework

The HIA team carried out law review processes and some of the relevant laws and their relevancy could be summarized as follow.

Public Health Law (1972): The law is concerned with protection of people's health, controlling the quality and cleanliness of food, drugs, environmental sanitation and epidemic diseases.

Prevention and Control of communicable diseases Law (1995) (Revised in 2011): The law described the functions and responsibilities of citizens and health personnel in relation to prevention and control of communicable diseases. It also describes measures to be taken in relation to environmental sanitation, reporting and control of outbreaks of epidemics.

National Food Law (1997): The law enacted to enable the public to consume food of genuine quality, free from danger to prevent public from consuming food that may cause danger or are injurious to health, to supervise production of controlled food systematically and to control and regulate the production, import, export, storage, distribution and sale of food systematically.

3.3 Scope of the study

The HIA study, focusing the project area and its vicinity, includes four Wards and one Power Plant workers which are Barle, Yitlaw, Oakekat and Kanpaingyan (a) Scoping: In scoping process, specific information such as gender, age group, education and occupation information are collected.

(c) Household Survey: To obtain the basic health profile survey of the study area is conducted with a structured questionnaire especially devised for this project by questionnaire.

(d) Impact Identification and Assessment: Anticipated impacts of the project relating to its environment are assessed from baseline health conditions, usage of domestic and drinking water and comments, suggestions of local community from public meetings and mobile clinic works.

(e) Mitigation Recommendation: Mitigation recommendations are based on impacts ratings and rankings with the aim to enhance predicted positive health impacts and minimize negative ones.

3.4 Health Impact Assessment Methodology

This HIA followed the standard steps of scoping, developing a baseline health profile, assessing impacts, developing recommendations and reports writing. Prioritizing health effect category is used to assess the health impact of the project on its environment.

3.5 Baseline Condition

Baseline health conditions are the fundamental component for the overall health impact assessment (HIA) process. The baseline health summary provides a point of reference for the health status of a community prior to development of proposed project and also describes an overall health profile for an area. Moreover, the health profile can inform decision makers about health vulnerabilities in a region as well as positive health traits present in population.

3.6 Source of Information

Baseline health studies were conducted through a survey of 163 households. According to this, the most common complaint were malaria, diarrhea, TB, hepatitis, heart disease, hypertension, Respiratory Tract Infection (RTI), Acute Viral Infection (AVI) and Urinary Tract Infection (UTI). Concerning health services utilization, majority of household members consulted with doctor either public or private clinics for their illness. The other gave the answer of consulting with health care personnel or among family members. For the utilization purpose especially for cooking, most of them used water from spring and took no treatment.

3.7 Health Status of Project Area

To collect the baseline information on health of the people in and around the proposed Coal Mine and Power Plant site, present survey was conducted by using questionnaire on 150 representative households. Health condition is determined on the basis of population, level of education, water and sanitation systems, health knowledge and its application, health facility and utilization, usage of tobacco smoking, alcohol, betel and medical history etc.

There are 163 respondents, 49 percentages of households in the survey, and the survey focused to measure on baseline data of health conditions of the project to surrounding residential area. Primary data are collected and later, assessed by qualitative and quantitative measurements.

Table 3.1 Samples of the study area (2016)

Study Area	Household	Male	Female	Total	No. of Sample
Barle	41	109	105	214	23
Kan Paing Yan	34	77	62	139	22
Oake kut	97	289	319	608	39
Yitlaw	135	359	344	703	62
Power plant	27	42	34	76	17
Total	334	876	864	1740	163

(Source: Field Survey, August 2016)

Drinking water and domestic water sources are surface wells from surrounding areas but most of the respondents drink boiled water but some respondents drink water naturally without processing.Some of the respondent's drinks purified water. (Table 3.2 and Figure 3.1) Most of the houses have safe toilets.

Table 3.2 Responses on Drinking water (%)

Study Area	Natural water	Boiled water	Purified water
Barle	57	43	0
Kan Paing Yan	27	73	0
Oake kut	21	61	18
Yitlaw	31	51	18
Power plant	18	47	35

(Source: Field Survey, August 2016)

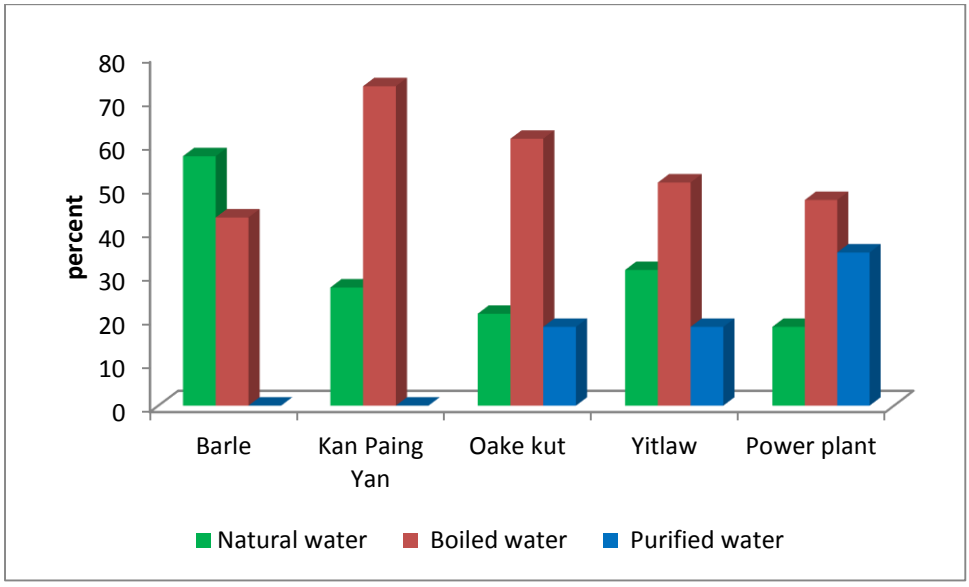


Figure 3.1 Responses on Drinking water (%)

Present survey approves nearly 40% of the people regularly take tobacco and drink alcohol. Frquent daily large amout of alcohol can cause hypertension and promote to get high blood pressure, reduce control of high blood pressure, so susceptible to get stroke. In this area, many people have hypertension. Usage of tobacco smoking causes coronary artery disease, hypertension, stroke, CA leds etc. In this area, the most common disease other than common cold is hypertension which is most probably due to excessive smoking and unhealthy style of alcohol drinking. (Table 3.3 and Figure 3.2)

Table 3.3 Behaviors' of Respondents (%)

Study Area	Smoking	Betel leaf	Dani/Alcohol/Beer	Narcotic
Barle	26	13	35	17
Kan Paing Yan	32	14	32	23
Oake kut	13	15	15	0
Yitlaw	13	10	15	0
Power plant	47	18	35	0

(Source: Field Survey, August 2016)

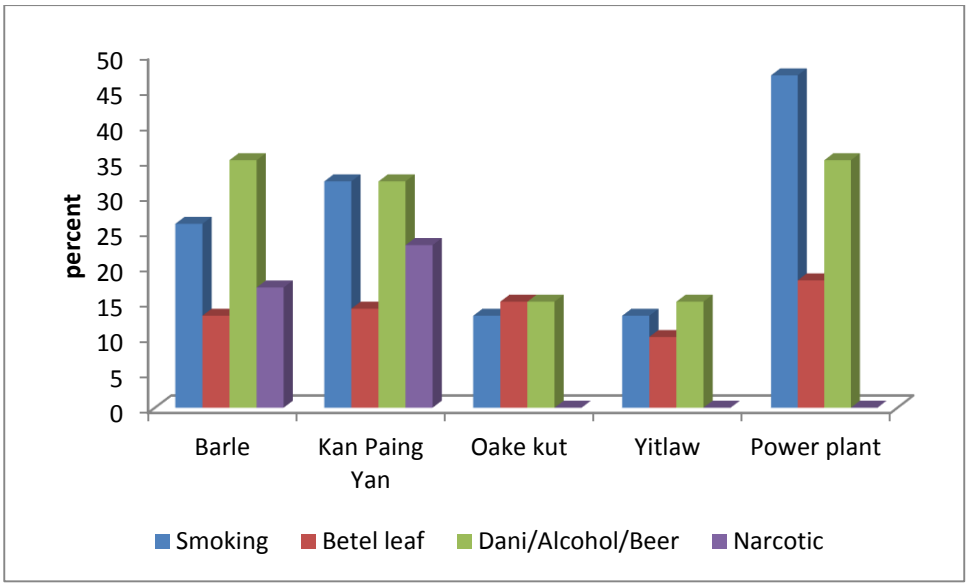


Figure 3.2 Behaviors' of Respondents (%)

The survey team asked the respondents that do their household have any diseases six months ago. In this area has Malaria, AVI, Lung disease, piles, Flu, DHF, Stomach ache, Asthma, Liver, and Diabetes. About 71 % of respondents answered they had diseases six months ago. In this area, most people could suffer Acute Viral Infection (AVI) because all places faced forest fired and dust. 20 % of the health problem is Hypertension. So, the project owner should give awareness of health and mobile clinic to surrounding villages. (Table 3.4 and Figure 3.3)

Table 3.4 Family' Health Status of Respondents (%)

Study area	Malaria	Diarrhea	Dysentery	Hypertension	Flu	AVI
Barle	39	4	4	13	4	26
Kan Paing Yan	32	0	0	24	46	36
Oake kut	8	8	0	0	21	41
Yitlaw	10	10	0	16	11	43
Power plant	24	0	6	24	24	12

(Source: Field Survey, August 2016)

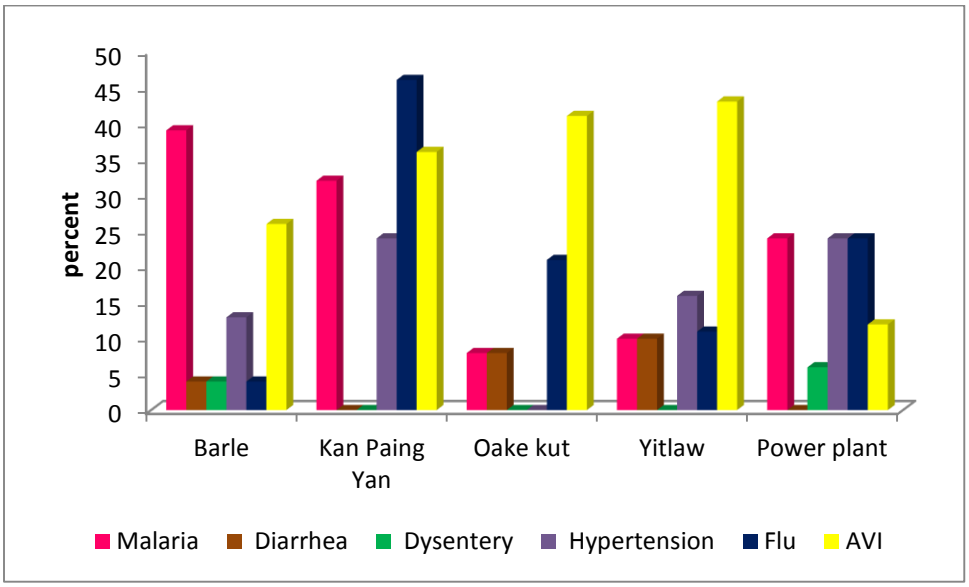


Figure 3.3 Family' Health Status of Respondents (%)

Most of the respondents went to Township Hospital for treatment and some of the respondents go to private clinic. (Figure 3.4)

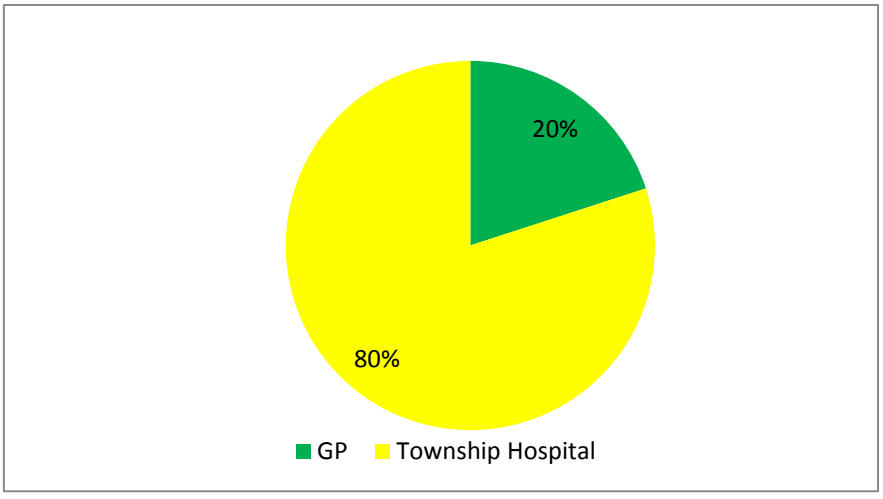


Figure 3.4 Place for Medical Treatment (%)

All figures indicated that knowledge and education of the PAP's to be positive but air pollution and other factors to be considerable. Environmental sanitation seems to be moderate to high. Drinking water system is low as they have substantial knowledge for quality of drinking water.

3.8 Suggestions on Health Status

Study area	Suggestions/ Requirement
Barle	To need skillful doctors who can live in the local community To Need for enough medicine Want to take care old men and women
Kan Paing Yan	not enough medical staffs and medicine
Oake kut	skillful medical doctors Health care should be promoted Puclic health care/ spraying to reduce mosquitoes Surgeons Mosquito spraying (three time a year)
Yitlaw	Not enough medical staffs and medicine at the hospital Clinics should be developed. Malaria should be freed in the region. Clean Water Not enough latrines need of medicine
Power plant	need for clinic

3.9 Health Impact Assessment and Mitigation

Health Effect Categories (HECs)

The World Health Organization (WHO)' view of health

Health is the extent to which an individual or group is able:

- To satisfy needs
- To realize aspirations
- To change or cope with their environment

Health is a resource for everyday life, not the objective for living: it is a positive concept mina emphasizing social and personal resources as well as physical capabilities. The HECs are a standard set of effects categories that have been developed and published by WHO.

For HIA process, data were collected based on existing family structure and health services utilization, source of water supply and uses, fuel uses, environmental sanitation, maternal and child health. Public concerns related to Power Plant project were collected through household data survey and open discussion in public meetings. It terms of health impact categorization based on the facts obtained from

the survey and study, the following determinants of health are described as recommended by World Health Organization.

(a) Social determinants of health (SDH)

(b) Air and cleanliness

(c) Communicable diseases

(d) Food, nutrition and sustenance activity

(e) Exposure to potentially hazardous materials

(f) Accidents and injuries

(g) Health services infrastructure and capacity

This HIA has assessed the existing health conditions and studies the data from varieties of sources to predict the potential impacts of the proposed project based on the seven determinants of health effect categories. Among these HEC, social determinants of health, exposure to potentially hazardous materials and waste and sanitation are major stakeholder concerns regarding the proposed project. For the potential negative impacts, a number of mitigation measures are delineated in this report. Adoption of policies, guidelines and programs (eg; WHO, IFC) and plans maximize the positive effects and minimized the negative health effects. However, the proposed project is expected to create jobs opportunities for local residents and to assist the economic development of the region.

Table 3.5 Significance of Potential Impacts

Health Effect Category	**Potential Impact**	**Distribution**
Social determinants of health	Negative/ Medium	Resident, Local workers, Migrant workers and their families
Air and Cleanliness	Negative/ Medium	Residents
Communicable diseases	Negative/ Low	Local people, Migrant workers
Food, Nutrition and Subsistence activity	Negative/ Low	Residents
Exposure to Potentially Hazardous Materials	Negative/ Medium	Local Residents
Accidents And Injuries	Negative/ Low	Road user/ Local residents
Health services and infrastructure and capacity	Positive/ Medium	Improvement in socio economic program, greater access to health care, emergency management plan

Chapter IV

Public Involvement and Information Disclosure

Stakeholder Engagement

This chapter describes the stakeholder engagement activities undertaken during development of the ESIA. This includes key issues raised by stakeholder and how each of these issues has been addressed in the ESIA.

Introduction

The Project team is committed to undertaking a process that delivers an inclusive and continuous dialogue with the project stakeholders. This includes;

- Providing relevant information to stakeholders in a timely manner;
- Facilitating two-way discussions to cover stakeholder issues and priorities as well as concerns and needs of the Projects;
- Ensuring engagement is in a language and format that is understandable and accessible to local stakeholders, including vulnerable groups, and is culturally appropriate;
- Feeding stakeholder issues, concerns and priorities into Project decision making processes, and demonstrating how decisions may have changed as a result; and
- Providing a mechanism for grievances to be raised and resolved.

Stakeholder Identification

The first step in establishing a dialogue is identifying the Project stakeholders. Stakeholders are persons or groups who are directly or indirectly affected by a project, and those who may have interests in and or the abilities to influence a project's outcomes (either positively or negatively).

A stakeholder mapping exercise was undertaken to identify the Project stakeholders as well as issues likely to be of concern to the stakeholders. A key part of this process was identifying individuals and groups who may be find it difficult to participate as well as those who may be differentially or disproportionately affected by the Project Stakeholders because of their marginalized or vulnerable status.

The mapping exercises included the following steps;

1. Step 1; Development of a draft list of stakeholders. The initial list was developed based on a desktop review of maps detailing the Project site and surrounding land uses/ activities, data gathered during early site visits, and the scoping reporting that was prepared for the Project; and
2. Step 2: An internal workshop to confirm and prioritize the draft list of the stakeholders and identify likely issues of concern. This included key issues such as impacts associated with air and noise emissions. Stakeholders were prioritized based on their level of interest in the

Project and power or ability to influence the project. The workshop was conducted with key members of the ESIA Project team. By identifying the Project stakeholders early, the ESIA team was able to tailor the engagement approach to meet the needs and expectations of the stakeholders eg. address the issue of the most concern to stakeholders during meetings.

A range of stakeholders were identified that may be impacted by the project or have an interest in air or ability to influence of the outcome of the project.

Table 16.1 provides the list of the Project stakeholders that were identified during the mapping exercises. This includes villages located in close proximity to the Project site and / or its associated facilities.

Summary of key Stakeholders Feedback

Stakeholders were encouraged to ask questions and raise concerns throughout the engagement process. For those stakeholders not confortable speaking up or who identified concerns after the stakeholder meeting, alternative methods for raising issues were provided. This included; A questionnaire. Following the meetings in August, a questionnaire was distributed to attendees.

The purpose was to elicit feedback, specifically on the predicted impacts, proposed management measures, and preferences regerdingfuture engagement. A copy of the questionnaire and the results are contained and a local contact. The details of a local point of the contact were provided to stakeholders. To the extent possible, concerns raised with the local point of the contact were addressed during the August stakeholder engagement meeting.

4.1 Stakeholder Consultation and Focus Group Meetings

Field surveys and observations were conducted during the period from 5th to 15th August, 2016. Survey team met authorities of Myitkyina District, Kachin State and local people from Chipwi Township. (Table 4.1)

Table 4.1 Stakeholder Consultation and Focus Group Meetings

No.	Date	Name of Town/Village	Participation	Arranged by
1	8.8.2016	Myitkyina	Respondents and REM Co.	Director, ECD, Myitkyina
2	12.8.2016	Chipwi	Respondents and REM Co.	Administrator, Chipwi GAD
3	13.8.2016	Barle	Respondents and REM Co.	Head of Ward
4	11.8.2016	Kan Paing Yan	Respondents and REM Co.	Head of Ward
5	14.8.2016	Oake kut	Respondents and REM Co.	Head of Ward
6	12.8.2016	Yitlaw	Respondents and REM Co.	Head of Ward
7	10.8.2016	Power plant	Respondents and REM Co.	Factory Manager

(Source: Field Survey, August 2016)

4.2 Explanation on the Project by REM Team leader

The team leader explained about the objectives of the project, detailed information on the project, plan map of the project, production system and protection system, the role of Environmental Impact Assessment. The team Leader requested to ask the questionnaire on the requirements of regional development and suggestions from Head of Wards and local people. The Heads of Wards and local people gave their suggestions and requested to fulfill various needs as mentioned below:

Meeting Program for Stakeholder Consultation (I)

Date – 8.8.2016

Place –Environmental Conservation Department, Myitkyina

Time – 1:00 PM -3:00PM

Agenda	1:00–1:15 Opening address by U H La Aung Minister, Ministry of Natural Resource and Environmental Conservation, Kachin State Government. 1:15–1:35 Presentation about the project by Mr.Kyan Hwan Kwe, Director (CPI). 1:35-2:00 Presentation about the project description and EIA process by Daw Khin Ohnmar Htwe, Principal Consultant from Resource and Environment Myanmar (REM). Content: Introduction, project description, potential impact, impact assessment for EIA and EIA time line 2:00– 3:00 Questions and Answers
	Opening speechby U H.La Aung (Minister, Ministry of Natural Resource and Environmental Conservation, Kachin State Government) Minister said that "I am thankful to project proponent, Consultant Company and also all local people for coming and meeting with local people. I want all of you to negotiate and to have transparency in implementing the project without argument. The project proponent should implement the project as the way they disclosed the local people. So, all of us will meet with the success in future." Mr.Kyan Hwan Kwe (CPI) I will explain about the hydropower project of Kachin state. This project is implemented by cooperating Ministry of Electrical Power and Environmental Conservation Department. I am going to present about the hydropower project and environmental issues. I have worked in this hydropower project. Hydropower industry is located on Chipwi Stream, upper Chipwi, Kachin State. The industry is located 9 Km away from Chipwi township and on the left side of Maykha river. Chinese SPI is the first hydropower project. Chipwi Ngal hydropower has 99 MW and production is 25.9 MW and the time is 6050 hours per

	year. The cost is 0.6 billion per year and amount for this year is 25.9 MW. The project was implemented in December 2008 and the production was started in December 2011. In April 2012, Chipwi Nge Hydropower was destroyed because of battles. After repairing Chipwi Nge Hydropower, the operation started in September 2013 and distributed the power to Chipwi and in October 2013 to Myitkyina. The power was distributed to Moe Kaung in 2013 October 21 and Moe Nyin in October 28. In December 19, the power was distributed to Chipwi Nambar. The total is 400 Kilometer. In May 2014, the project was joined with Myanmar Power Line. Our company was communicated with Government Hluttaw, media, local people and Non-Government Organization in special consideration. We also invited other social network and other interested organization. The company disclosed the reports and met with the local people. In 2011, we constructed concrete road (width 6m and length 2300 m) for Chipwi Nge and supported the required stationaries for schools. We supported the hospitals by distributing power. In 2015, we provided in middle Myanmar was affected by flood. We made promise to distribute the power in country. Local people are employed in our factory. We are going to upgrade the employee capacity. 80% of the workers are Myanmar. We are implementing the project according to Myanmar Environmental Conservation Laws in operation phase. We also dispose waste in setting area. The lands that used temporarily are restored as normal. Trees are also replanted. The project is implemented by international standards. Everyone can observe the project. They should know the advantages of the project for the area. I hope to develop our country future. Daw Khin Ohnmar Htwe (REM) Presentation about the project description and EIA process. Introduction, project description, potential impact, impact assessment for EIA and EIA time line Local People (Chipwi) I want to tell you about feeling and needs in Chipwi. I have been a Chairman in Hydropower project. We have to pay 170 kyats per unit in Chipwi. We got no compensation. We don't access electricity all the time. Taungya and planting trees beside roads are prohibited. Farmers are struggle for food. Even widows didn't access the compensation. They only record the photo and no one came and gave the compensation. Farmer didn't dare to say something. City Development Council and

	construction group threatened and not allowed the shop in road boundary they didn't make public consultation meeting. U Zaung Lwan Hydropower project is located near Chipwi. They should consider local people. I want you to know what is going on local people. I want to know usage of electricity and cost for it. We are really welcome. I want to know how local people can get the benefits. They said that they have no responsibilities if we died during fishing in restricted area. U Zaw Min Thant (Deputy Director, Environmental Conservation Department) We should discuss the emergency case. I want to know how you prepare for earthquake and also for EMP. I want you to prepare management plan. Mr. Kyan Hwan Kwe(CPI) We have a contract of electricity cost with Ministry of Electricity and also with Sunlin Company and Chinese Company. The cost is the same for all. I think more cost for electricity depends on investment. I will negotiate about this as much as I can. Tay Zaw Oo (Resource, Myitkyina- Oak Pho) In Chipwi Nge, there are places that are enough for returning heavy trucks. Kachin Sawbwar gave the permission of minding to Chinese. There are 3 tunnels and why it is happening. I want to know about the resources that had existed there. Is that included in MOU. We can't go there because of Chinese police. There is no currently supporting in school. The people who have to migrate face with difficulties for livelihood. I want to know how you will manage the socio-economic of the local people in long term. Mr Kyan Hwan Kwe (CPI) The earth getting from digging tunnels are placed in defined area. This area is located on Nan oo- Chipwi road

Photo 1 Stakeholder Consultation Meeting in Environmental Conservation Department, Myitkyina

Meeting Program for Stakeholder Consultation (2)

Date – 12.8.2016

Place – Township Administrative Office, Chipwi Township

Time – 1:00 PM -2:30 PM

Agenda	13:15–13:30 Opening address by U Ya Wai Soe, township administrator, Chipwi Township Administrative Department. 13:30–13:50 Presentation about the project by Mr.Kyan Hwan Kwe, Director (CPI). 13:50-14:10 Presentation about the project description and EIA process by Daw Phyu Phyu Shein Consultant from Resource and Environment Myanmar (REM). Content: Introduction, project description, potential impact, impact assessment for EIA and EIA time line 13:30– 2:30 Questions and Answers
	Opening speechbyU Ya Wai Soe, township administrator, Chipwi Township Administrative Department.

	He said that "I am thankful to project proponent, Consultant Company and also all local people for coming and meeting with local people. Today meeting is only for Chipwi Nge Hydropower Project not related for Chipwi - Panwar road project. Now we check the previous compensation list for Chipwi Nge Hydropower Project. Mr.Kyan Hwan Kwe (CPI) I will explain about the hydropower project of Kachin state. This project is implemented by cooperating Ministry of Electrical Power and Environmental Conservation Department. I am going to present about the hydropower project and environmental issues. I have worked in this hydropower project. Hydropower industry is located on Chipwi Stream, upper Chipwi, Kachin State. The industry is located 9 Km away from Chipwi township and on the left side of Maykha river. Chinese SPI is the first hydropower project. Chipwi Ngal hydropower has 99 MW and production is 25.9 MW and the time is 6050 hours per year. The cost is 0.6 billion per year and amount for this year is 25.9 MW. The project was implemented in December 2008 and the production was started in December 2011. In April 2012, Chipwi Nge Hydropower was destroyed because of battles. After repairing Chipwi Nge Hydropower, the operation started in September 2013 and distributed the power to Chipwi and in October 2013 to Myitkyina. The power was distributed to Moe Kaung in 2013 October 21 and Moe Nyin in October 28. In December 19, the power was distributed to Chipwi Nambar. The total is 400 Kilometer. In May 2014, the project was joined with Myanmar Power Line. Our company was communicated with Government Hluttaw, media, local people and Non-Government Organization in special consideration. We also invited other social network and other interested organization. The company disclosed the reports and met with the local people. In 2011, we constructed concrete road (width 6m and length 2300 m) for Chipwi Nge and supported the required stationaries for schools. We supported the hospitals by distributing power. In 2015, we provided in middle Myanmar was affected by flood. We made promise to distribute the power in country. Local people are employed in our factory. We are going to upgrade the employee capacity. 80% of the workers are Myanmar. We are implementing the project according to Myanmar Environmental Conservation Laws in operation phase. We also dispose waste in setting area. The lands that used temporarily are restored as normal. Trees are also replanted. The project is implemented by international standards. Everyone can observe the project. They should know the advantages of the project for the area. I hope to develop our country future. Daw Phyu Phyu Shein (REM)

	Presentation about the project description and EIA process. Introduction, project description, potential impact, impact assessment for EIA and EIA time line U Kyi Khaung Yan(Retired from Information Department) I established orange orchard and also livestock in 7 miles. Machines from CPI came and destroyed my orchard. When I said to administrator, he told that this was directed by order. They gave compensation for grievance farmers in 10/02/2010 and they didn't inform local people. Six people from Chipwi Ngal Power include in it. They also have the compensation letter. The amount in compensation letter is not the same with the real compensation. I want to regain crop compensation. I want you to do for justice. U Att Lann Baung (Chairman of La Chate Literature and Culture) There will be more in impacts because of Chipwi Ngal. There are orange plants along the first power line and they dig the earth when the owner is out. When I submit to department, they organize a field inspector group. But we don't get deserve compensation. If they want to dig the orchard, they should inform by the chairman. There were so many problems. They constructed approach road in cave 2, 3 and it is getting enter to my orchard. I grew black pepper for shade and they came and dig the earth with machine. When I asked "why did you do like that", Chinese told me to ask the Burmese. The chairman also explained that this is for the local development. In 2011, the Chinese arrived in again and offered compensation. But we got nothing because of war. All orchards were buried although there was a field inspector group. There were also controversies. There is no land use right along the Chipwi Road. The farms were destroyed and fields over 150 feet of road area didn't get the compensation. They should negotiate with the owners. In 22/12/2011 stakeholder meeting, they told that they will distribute free during the Chipwi Ngal. They imported the food stuffs from China for workers of Chinese Company. They need no taxes. Although there are local people translators in this company, they don't pay attention to us. Although we told that our crops were destroyed by project, they translate that crops hadn't fruited yet. They didn't also say whether the hydropower is good or bad. Getting electricity is good but cost for electricity is much in Chipwi. U La Kain Khaung (Retired) I am glad for development project in Chipwi. Local people have grievances as current authorized government took the bribe with the company last some year. Projects should be implemented according to local people agreements. U Saung Zone (CDC)

	We have to do “taungya” with difficulties because the area is not peaceful and too much mountain. I want you to do appropriately for the local people grievances. I also want you to consult with local people for the next projects. Township Officer U Yawai Soe (General Administration Department) There are pending compensations for Chipwi Power line. We didn’t find the plants in surveying. When the compensations start, there are plants variously. As the plants don’t exist, we have to collect data to local people. We are going to carry on for getting back the compensation and perform according to company, local people and government departments. The project should be disclosed good and bad impacts. I want you to help by cooperating together.

Photo 2 Stakeholder Consultation Meeting in Office, Chipwi Township

Chapter 5

Environmental and Social Impacts and Mitigation

Measures and Management Plan

In the survey, about 163 sample respondents who were selected from 4 wards such as Barle, Yitlaw, Oake kut and Kan paing yan wards and Power plant' workers within the project area were interviewed. To understand their existing situations, attitudes and impacts from the project development, the interviews were undertaken with the help of the structured questionnaires which cover the contents of basic information of interviewees, their socio-economic conditions, education and current environmental problems, facilities and social problems, perceptions of the project and attitudes towards the project, regarding the impact caused by the project development.

5.1 Project Information

It is also important to survey whether the people in the project area know about the project or not. If they know about the project they can prepare and provide proper opinion for the impacts of the project. The survey results showed that most of the respondents have already known about the project. (Table 5.1 and Figure 5.1)

Table 5.1 Information about the project (%)

Study area	Know	Did not know
Barle	81	19
Kan Paing Yan	77	22
Oake kut	82	18
Yitlaw	81	19
Power plant	100	0

(Source: Field Survey, August 2016)

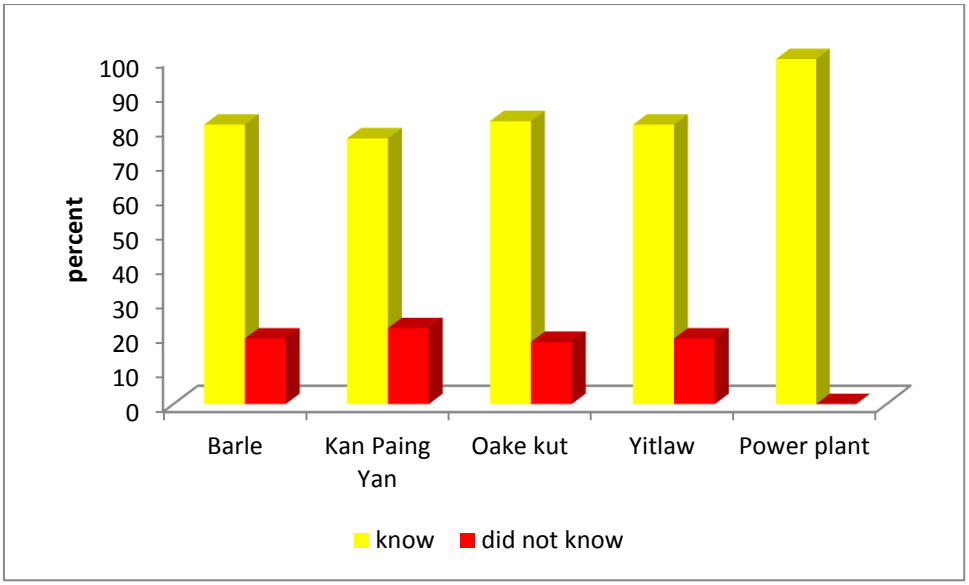


Figure 5.1 Information about the project (%)

The survey also stressed on the sources of information about the project from which the respondents received. The result of the survey showed that information about the project came from the authorities and project owner.

5.2 Attitudes on the Project

Most of respondents showed postive attitude on the project. All respondents prefer the project. About 32 % of respondents from Kan paing yan Ward dislike the project. However, it is to be considered that certain number of respondents from affected villages have postive attitude on the project. (Table 5.2 and Figure 5.2) Most of the respondents of degree of attitute are in normal condition. (Table 5.3 and Figure 5.3)

Table 5.2 Attitude of Respondents on the Project (%)

Study area	Like	Dislike
Barle	87	13
Kan Paing Yan	68	32
Oake kut	90	10
Yitlaw	75	25
Power plant	94	6

(Source: Field Survey, August 2016)

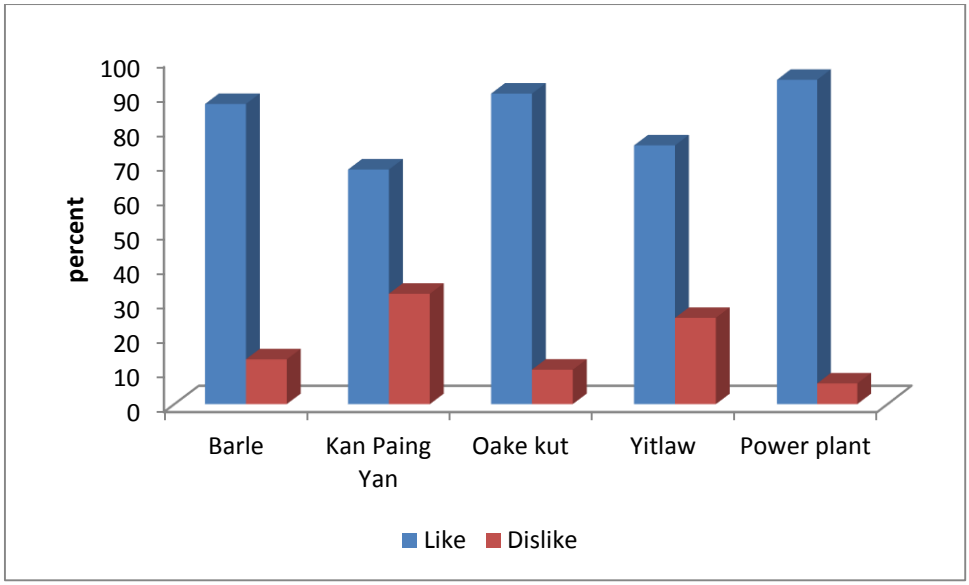


Figure 5.2 Attitude of Respondents on the Project (%)

Table 5.3 Degree of Attitute of Respondents on the Project (%)

Study area	No	Less	Normal	Very	Most
Barle	0	0	100	0	0
Kan Paing Yan	13	9	81	0	0
Oake kut	0	0	95	5	0
Yitlaw	2	2	95	1	0
Power plant	0	0	100	0	0

(Source: Field Survey, August 2016)

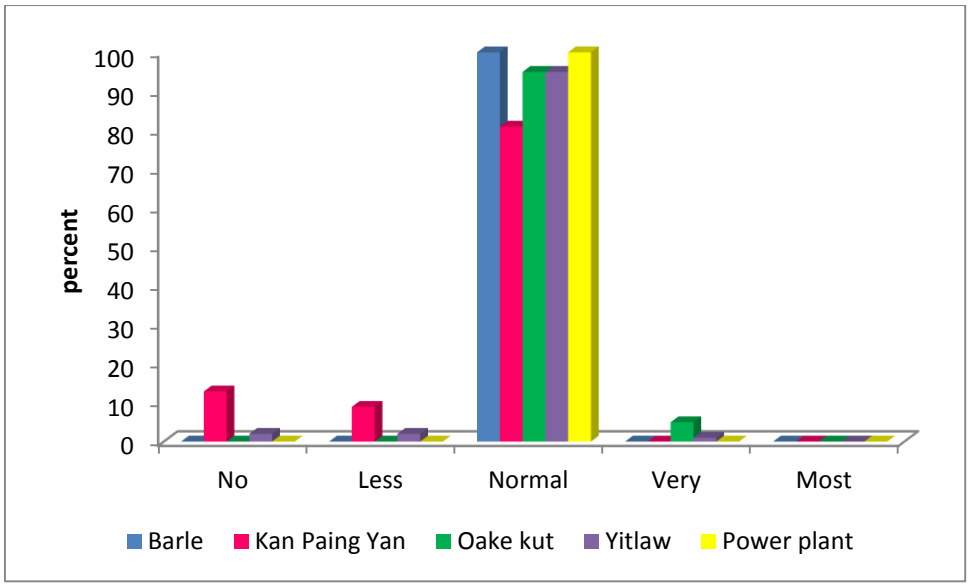


Figure 5.3 Degree of Attitute of Respondents on the Project (%)

Most of the respondents like and some respondnets dislike on the project is as shown in the table below.

Study area	Why don't you like it?	Why do you like it?
Barle	-not get Electricity	-Electric meter fees are expensive
Kan Paing Yan	-Loss of agricultural lands	- Get access electricity - Electric meter fees are expensive
Oake kut	-not fair in giving compensation. -loss of agricultural lands, no compensation	-Get access to electricity -regional development and get access to electricity ,it is good.
Yitlaw	-The company did not respect the community and did as they liked. More drug additions in the community because of the project. -Expensive electricity cost -Don't do as they said. No opportunities -Roads are damaged. Low job opportunities -loss of farmlands	-Get access to electricity -Development
Power plant	it is small if the projecct is for the whole country. Discrimination in employees	-for the country's development -get access to electricity and job opportunities

5.3 Opinion towards the mitigation measures of the Project

According to the survey results, most of the respondents believed that the project will not have prominent negative, social, health and agricultural impacts on their livelihood and surrounding region. However, high percentage of respondents from all villages considered that there would be environmental impact of the project on their areas.

Most respondents from some villages believed that agricultural impact of the project would be expected. (Table 5.4 and Figure 5.4)

Table 5.4 Opinion towards the impact of the project

Study area	Environmental impact		Social impact		Helath impact		Agricultural impact	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Barle	22	78	0	100	9	91	13	87
Kan Paing Yan	23	77	9	91	18	82	41	59
Oake kut	26	74	10	90	10	90	31	69
Yitlaw	19	81	16	84	10	90	31	69
Power plant	18	82	12	88	0	100	18	82

(Source: Field Survey, August 2016)

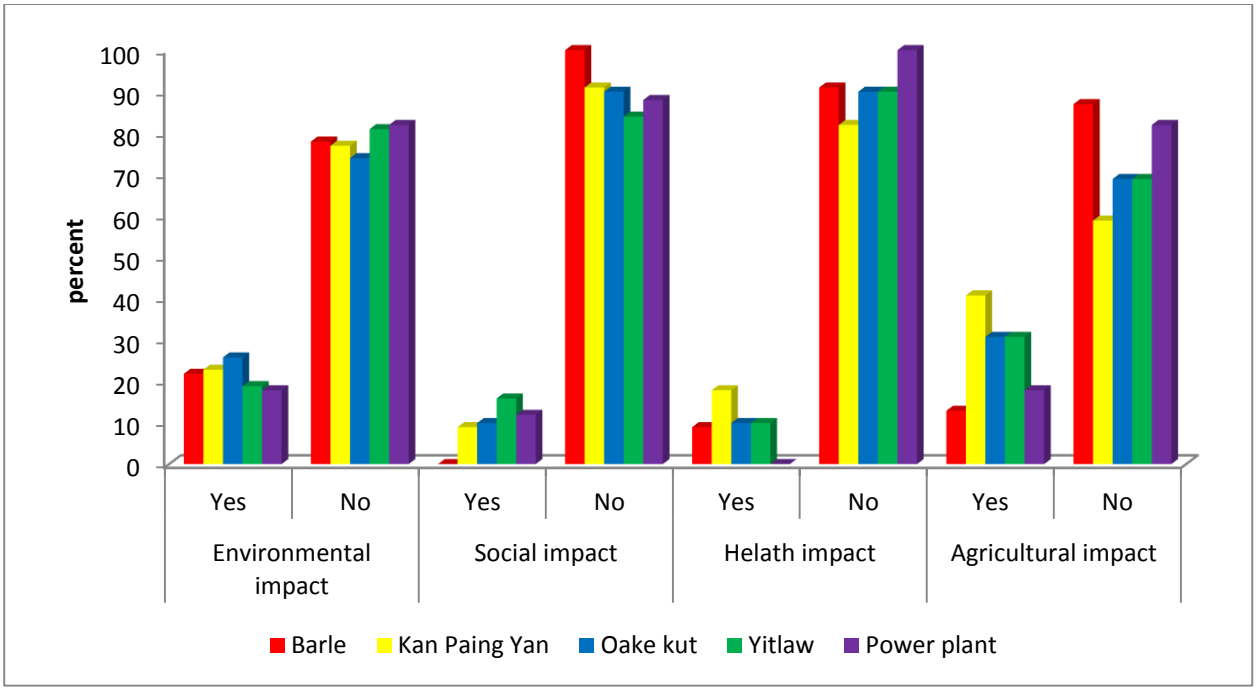


Figure 5.4 Opinion for the impact of the project

5.4 Opinion and Suggestion of Participants and Respondents

Table 5.5 Feedbacks of Stakeholder Meeting at Myitkyina

1. U Sot Bwum Rain (Pyoe CSO) REM should have listen local voices and put public hearing in EIA reports.
2. DawRoi Nu (Kachin State Civil Society) When doing survey as a SIA, please take more time to communicate with local people because most local people are dare not speak in public. What is the responsibility of the CPI if it is impact on people?
3. U Kay ZawLum (Otthone CBO) I have found that weakness of the translation and sharing information sheet. No transparency at all that's why should explain again. And where are the extracted resources and soils when excavations about 15 kilometers cave.
4. U Shee Zaw Zaung Naing (CSOs) To get electricity to Chi Pwe city. There has no electricity in project area. Interpreter is not qualified. (Did not understand) Electricity bill is higher price. Drainage system was destroyed because of the construction of roads. Should give fair compensation rate.

5. U Myo Aye Lwn (AE) Should give appropriate compensation rate to project affected people. To get electricity to near the villages near dam. 170 kyats for electricity bill is too expensive. Should reduce it.
6. U Yan NaingTun (Deputy Administrator) To form the committee of the Rights of local people founding with members of parliament, administrative and local people on the other hand developer should express power distribution, consumption, electricity waste to local committee in every month.
7. U ThanTun Make a transparency to express the public what the benefit according to the contract with Government is and should express environmental management plan and mitigation measure.
8. UTunTunOo (AD – Irrigation) We, local people was feel uncomfortable about the sign board, near dam which was stated that "Not Responsible" by CPI. That's why could you please remove this sign board as we want to get duty and responsibility.
9. U Aung Swe Win Chi PweNge hydropower is the type of reservoir, not the dam. Just water control dam and spillway dam and irrigation tunnel is 6 to 9 miles long. Less impact on environment as we construct underground tunnel. Each and every project might be impact on environment more or less. However I would like to suggest is resurveying and calculation again for the better situation.
10. U Lun Khung Hope to get fair electricity meter price to along the villages where the transmission line was passing by. Fulfill the needs of local first and transmit to other country connect with the grid later.
11. U KharZel (Metta Organization) Should analyze the development of the local people because of the project and if it is impact on local people, should have plan CSR program for sustainable livelihood of local people. Should survey cultural impact assessment and if it is impact on cultural, consult with the local people and listen local voices. It will get mutual benefit if developer will respect and responsible of the local people rights.

Table 5.6 Feedbacks of Stakeholder Meeting at Chipwi Township

1. DawLwanNywae (Local people) Free electric distribution for Chi Pwi and I would like to ask is possible to answer our suggestion letter. Please make a try this project definitely benefits for our local people. Please discuss suggestion letter.
2. U ZantBwam (Local people)

Thank you so much for implementing Chi PwiNge Hydropower project. Please provide electricity to local consumer without charges. We would like to have compensation for our land which has lost for Chi pwinge hydropower project.
3. U KhanugZel (Farmer) I would like to suggest as a local resident, before implementing the project, consulting with local people and s crop compensation to those who lost their crop. After this process, should implement the project.
4. U Zae Kham (Farmer) Compensate the land and vegetation is which is lost by Chi PwiNge project. If CPI wants to donate something for Chi Pwi, please announce to all village representative levels. And the last one is we would like to have power supply from Chi PweNge hydropower to distribute without charges.
5. U D Zal Dai (No.1 , YitLaung Ward) I would like to suggest should distribute electric power near around the villages and should compensate appropriate amount and to decrease electric meter. Before starting the project, should explain about the project to land owner.
6. DawZal Naw (Local People) Want to get electricity as a free.
7. U Ba Chaw KhumZal (Village head administrator, ZanNaung Village) In 2008 crop compensation rate was 7600 kyats per one orange tree, but I would like to request please raise the rate as 35000 kyats per one orange tree.
8. U Lonn Daung (Okka District) Please consider about the impact of Environmental issues and implement least impact as much as you can.
9. U Gee Baw Khum (Government Employee – Education sector) I would like to say, because of this CPI hydropower project, our local people can get electricity and some advantages. But for the rate of electricity meter we want to get equal rate for all cities. Should installed safety electric meter box.
10. U Tun Shein Zun Kyan (Farmer) I would like to say disadvantages of Chi PweNge hydropower, Because of the construction of the road some soils are erosion Lost per annual trees Raise cost of electric meter But for advantages are getting electricity was good for the students and local people.
11. U PhawMyawKumLwam (Department of Communication)

I would like to thanks to hold this consultation meeting. In 2008, 6 farmers were loss of their orange yard which is located in near Nan Oo main generator because of the project. Compensate with lower prices that's why could you please consider again for this.
12. U Sein Min Everything is good.
13. U Lann Kyaww Taint Khum As I know that this project is essential for development but development should be grow together with state and regional. Should considering resettlement plan for project affected people.
14. U Zone Khum (Administrator – Rtd) Even we get electricity but can't afford for all quarter because of the electric bill is very high. A village which is situated along the high way road where transmission line is passing through but for the inner part of the villages was not assessable. Along the right of way some asset was lost that's why we already submit list of losing asset to the authority. I would like to request, please solve this issues for sake of local interest.
15. U Hla Shein Daung Khung (B/C retired) If implementing this project please consider local benefit.
16. Daw Zung Nyawe To conserve the environment should cultivate plants and should have consider loan program for the tree plantation. Because of the construction of road, our orange farm and fence were destroyed but we still didn't get any compensation. That's why I would like to request to get compensation for the lost.
17. U Khum Bum (Farmer) Thank you for the benefit of this project; get electricity and concrete road in city. However there have some disadvantages, before starting the project there has no consultation meeting and compensation for the lost. But still didn't find any environmental impact. That's why please consider for this case.
18. U MyintHtwe (Education) I would like to request CPI would be consider support and initiate to construct the school hall of Chi Pwe Basic Education High School.
19. U Taik Song (Representative, Li su literature and arts committee) Implementing the Chi Pwe hydropower has both pros and cons. Some impacts were losing their crops and some were get compensation and some aren't. And because of the construction, it is impact on environment and it will be erosion when rainy season.
20. U Sai Maw (Kan Pan Quarter) Hydropower project is good for the developing country and we want to see our country would be developing as like as our neighbor country.
21. U S Lann Bwam (Education – Rtd)

I suggest giving full compensation for those who affected from project (impact on infrastructure, farm and crops). In Chi Pwe, there has another hydropower project and people are impact from this project. If they do not get relevant compensation rate, they will facing difficulties. So, I would like to suggest if implement project in here, should have to get local people voices and opinion.
22. U Jun Zan Zahum (La wow literature and arts committee) We discovered that they did not survey farmland, crop and detail data located in project area and there has no labour Rights such as did not get equal salary. So I would like to suggest that should do pilot survey before implementing the project.

Table 5.7 Opinion and Requirements for Regional Development from Respondents

Sr.	Study Area	Needs for your region's development.
1	Barle	Needs for jobs opportunities and good transportation
		Want to give seeds and technical guidances
		Needs for transportation and health
		Roads and Electricity
		Will develop more if there are more farmlands
		Needs jobs for young people
		Should clearly explain to public and elevate for livelihood
2	Kan Paing Yan	good roads
		support for health
		peace in the region, support for water and houses
		good transportation
3	Oake kut	Good transportation
		Creating job opportunities, Improving education standards, implementing projects for youths' development
		Electricity and Water
		Improving eduation standards and public health care
		Health facilities
		Peace and anti-drug addiction
4	Yitlaw	in needs of roads and good public servants
		Peace, Health facilities, development of the village
		School, roads, water and electricity
		Electricity cost should be reduced to 50 kyats even if it is not distributed for free. Town hall should be rebuilt a new.
		Creation of job opportunities of the local people

		Peace. Explosive mines should be cleared.
		Many things for regional development
5	Power plant	roads and transportation, good telephone connection
		more space and techniques for agriculture
		roads and transportation, health facilities
		Peace
		floods during and after the rainy season

5.5 Environmental and Social Check list on Chipwi Nge Hydro Power plan Project

About 56 percent and 48 percent of respondents mentioned the impact of project on pollution of water at site and / or downstream and in the increase in salt content. About eutrophication 26 percent showed the psddibility of impact whereas 59 percent of respondents thought there would be no impact of the project on eutrophication of downstream wetlands. (Table 5.8 and Figure 5.5)

Table 5.8 Check list of Hydrology on Chipwi Nge Hydro Power Project

Hydrology	**Yes**	**No**	**Don't know**
reduce flooding of areas below or upstream	9	83	8
modify the timing of floods	6	81	13
increase or decrease of dry season flows downstream	30	61	9
drying out of the wetland	28	65	7
permanent changes in the water table of the wetland	30	61	9
reduction in the capacity of a wetland to store water	18	69	13

(Source: Field Survey, August 2016)

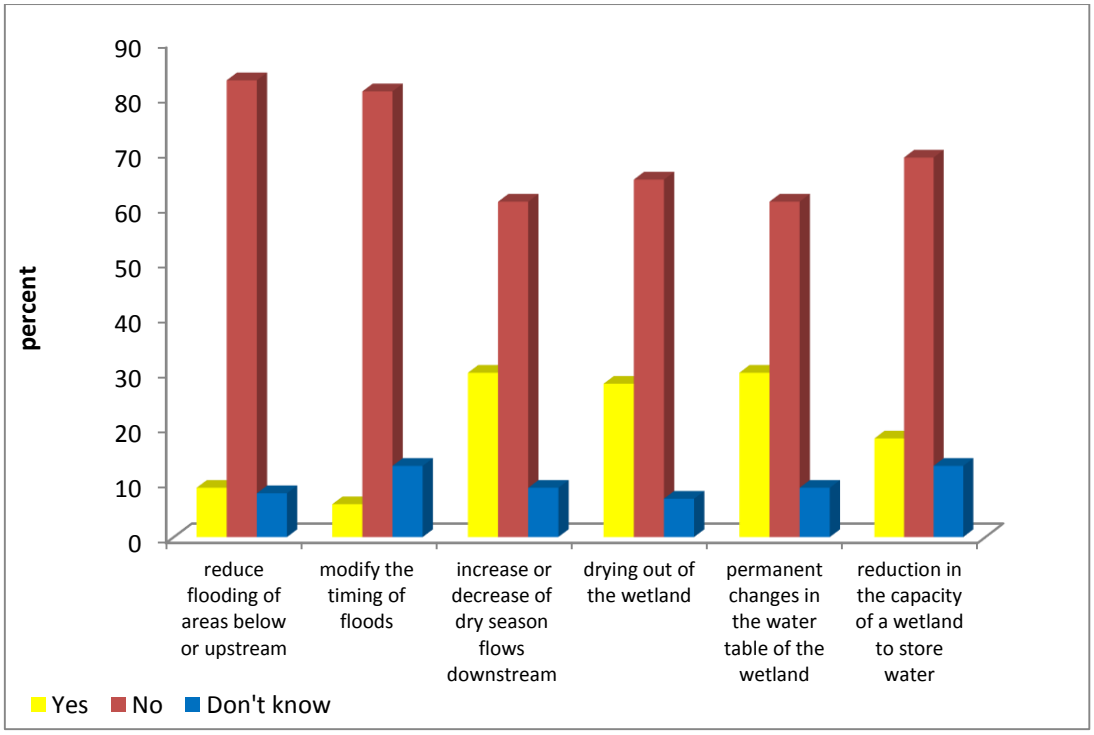


Figure 5.5 Check list of Hydrology on Chipwi Nge Hydro Power Project

Impact check list of respondents showed that more than 80 percent of respondents think no significant impact of reduce flooding of areas below or up stream and modify the tining of floods. However, about 30 percent each of respondents groups revealed that there will be impact of project on dry season flows, drying out of the wetland and permanent changes in the water table of the wetlands. (Table 5.9 and Figure 5.6)

Table 5.9 Check list of Water Quality and Soil on Chipwi Nge Hydro Power Plant Project

Water Quality and Soil	Yes	No	Don't know
pollute the wetland at the site, and /or downstream	56	43	1
reduction in the ability for the wetland to retain nutrients	44	48	8
eutrophication of downstream wetlands	26	59	15
increase in silt content of the water flowing through the proposed site	48	41	11
increase in salt content of the wetland	17	48	35
increase in soil erosion of downstream areas	38	48	14

(Source: Field Survey, August 2016)

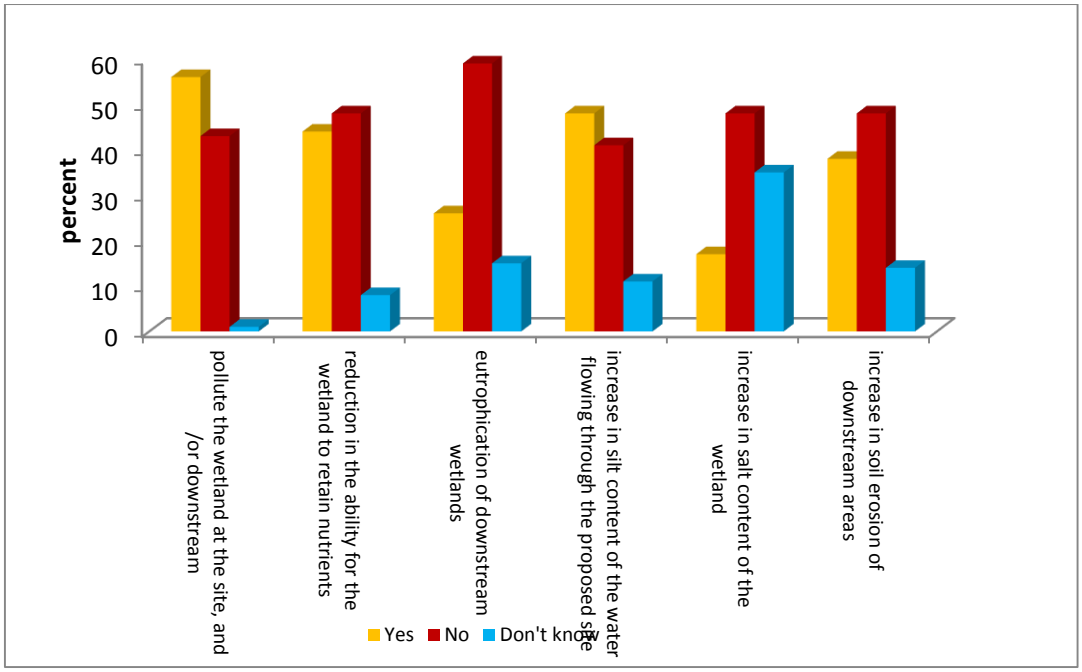


Figure 5.6 Check list of Water Quality and Soil on Chipwi Nge Hydro Power Project

For the impact o biological condition, significant percent of respondents revealed that there would be impacts of the project on biological conditions especially on fauna and flora of the wetlands. (Table 5.10 and Figure 5.10) **Table 5.10 Check list of Biological Condition on Chipwi Nge Hydro Power Project**

Biological conditon	**Yes**	**No**	**Don't know**
impacts on fauna and flora of the wetland	63	31	6
change the composition of fauna	51	42	7
change the composition of flora	52	39	9
reduction in the diversity of plant spieces	56	35	9
reduction in the diversity of animal spieces	54	38	8
to loss of any rare plant spieces	39	48	13
to loss of any rare animal spieces	48	44	8
to loss of endemic plant spieces	43	42	15
to loss of endemic animal spieces	44	41	15
obstruct the natural movement of fauna	44	41	15
creation of new habitats	48	35	17

(Source: Field Survey, August 2016)

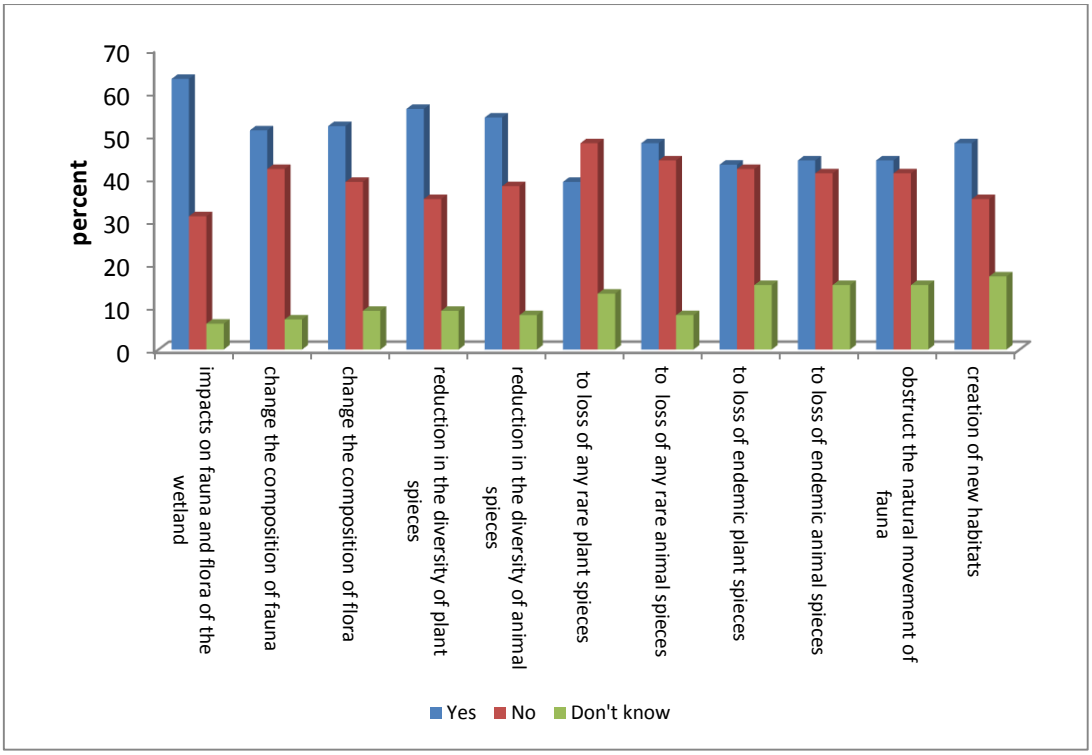


Figure 5.7 Check list of Biological Condition on Chipwi Nge Hydro Power Plant Project

More than 50 percent of respondents revealed the impact of project on socio-economic condition such as reduction of area fro agriculture, loss of access to grazing area, changes in income distribution and changes in access to wetland resources. (Table 5.11 and Figure 5.8)

Table 5.11 Check list of Socio-economic Condition on Chipwi Nge Hydro Power Plant Project

Socio-economic condition	Yes	No	Don't know
changes in increase access to wetland resources by the communities	52	26	22
changes in decrease access to wetland resources by the communities	35	37	28
elimination of resources of the wetland	37	48	15
loss of access to grazing area for livestock	72	22	6
reduction of area for flood-recession agriculture	65	31	4
changes in income distribution among the local communities	55	41	4

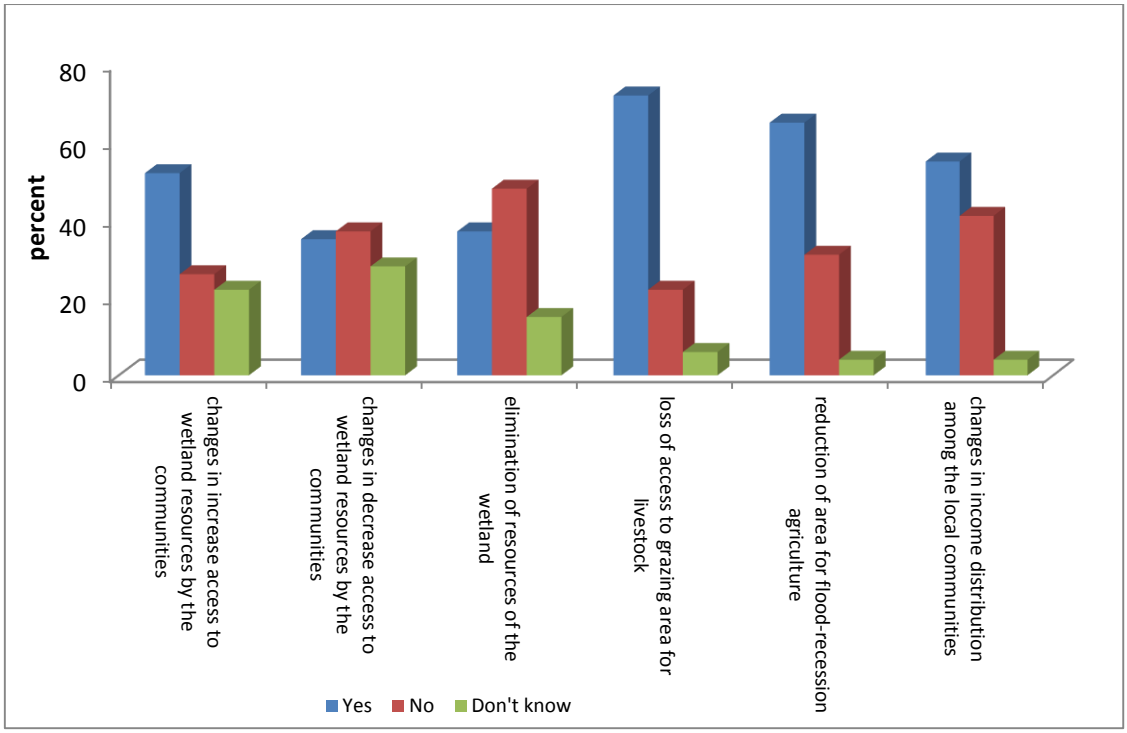


Figure 5.8 Check list of Socio-economic Condition on Chipwi Nge Hydro Power Plant Project

5.6 Social Impact Management Plan

Social impact assessment (SIA) is a proactive tool used to understand the potential impact, adverse or beneficial, that proposed project could have on the affected communities and to recommend effective mitigation measures so as to reduce those identified impacts to a lesser degree of significance.

According to IAIA (International Association for Impact Assessment), SIA is generally defined as a process of analyzing, managing and monitoring the consequence of the project.

More precisely, Social Impact Assessment includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative of planned interventions (policies, programs, plans, projects) and any social change invoked by those interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment.

The evaluation and assessment involves the assessment of both qualitative and quantitative data with professional judgment and stakeholder consultation.

In assessing the characteristics of the individual impact, following factors are taken into consideration. (Table 6.1)

- Nature of impact (beneficial or adverse)
- Duration of impact (temporary and permanent)
- Likelihood
- Severity
- Significance of impact

Table 5.11 SOCIAL IMPACT SIGNIFICANCE MATRIX

		Severity of Impact				
		Minor	**Low**	**Medium**	**High**	**Very High**
Likelihood of Impact	**Very Unlikely**	Negligible	Negligible	Negligible	Minor	Minor-Moderate
	Unlikely	Negligible	Negligible	Minor	Minor-Moderate	Moderate-Major
	Likely	Negligible	Negligible	Minor	Moderate	Major

This section presents the summary of Social Impact Management Plan of the project with the purpose of mitigation or enhancement to the potential adverse and beneficial impacts identified and evaluated in the assessment.

The objectives of the Social Impact management plan are

- To describe the project's commitments in managing and mitigating social impacts raised from the existence of project in defined location and in enhancing identified benefits to communities and stake holders
- To formulate the mechanism to mitigate and monitor these potential impacts
- To establish a system in which public participation is paramount in setting up strategies for the dealing of identified impacts and benefit throughout the life of project
- To recommend the additional social control measures

PREDICTED SOCIAL IMPACTS AND SIGNIFICANCE

No.	Item	Nature	Duration	Likelihood	Severity	Significance
1	Population and demographic change	Negative	Long	Likely	Medium	Minor
2	Access and movement	Negative	Short	Unlikely	Low	Negligible
3	Employment, Skill and Business	**Positive**	Short	Likely	High	Moderate
4	Land Use and Property	Negative	No	Likely	Low	Negligible
5	Community Value and Life Style and Social Cohesion	Negative	Long	Likely	High	Moderate
6	Local Economy	**Positive**	Long	Certain	Medium	Moderate
7	Community Health, safety and environment	Negative	Long	Likely	Medium	Minor

5.6.1 Potential Impact to Population and demographic change

Potential impact of migration to the project affected area by the development of Chipwi Ngwe Hydropower Project area likely to result mainly from the migration of personnel with the hope of getting job and receiving potential health, education and other social services that may result from the project.

However, it is expected that number of personnel moving into the project affected area is low in comparison with the existing local population. As a result, there may be not much alteration in the number of residential population around the project areas or affect their demographic structure.

Thus, it is considered the potential impact related to population demographic structure of local communities is negligible.

5.6.2 Potential Impact to Employment, Skill and Business

Project will source its operative work forces mainly from the local area due to the reason of project's commitment of prioritizing the selection to local people and availability in adjacent areas for the basic level semi-skill and non-skilled works.

Since construction phase is the period of high demand of job openings with temporary employment, the numbers of employees will be dramatically high.

The prospect of an increased income and greater autonomy is likely to cause an increase in the aspirations of local communities both those involved with the project and, to a lesser extent, those from other working individually. This is a direct positive effect with a moderate extent and long-term duration. As consequence, it is considered as a beneficial impact resulted from the project.

Company is intending to conduct both awareness and critical training necessary to its employees, it is perceived that capacity building which is expected by both company and local community is one of the beneficial effects as well. As this will be long term income stability to the hired employees assuring the economy security to its family members.

The project is located in Chipwi Township which is known as agricultural and plantation zone of the region consisting of wide paddy fields, plantation of rubber and oil coconut, there will be potential of having withdrawing labors from those areas. In comparison with population of labors from existing farming and proposed project requirement, this will be assumed as negligible.

Both during the construction and operational phase, it has the high opportunity to employ local people in all level of full- skilled, semi-skilled, unskilled and technicians. In this regard, company shall develop local hiring plan. Here, local people refer to the people living in the affected areas or entire project area of influence.

This project is anticipated to source the operative force on local basis and has the potential to increase the educational and technical qualification of local work forces through onsite technical transferring and in house training programs.

The project will definitely have significant beneficial impacts on the local communities.

One of the effective implementation of the Social Impact Management Plan of the project is the development of a capacity and local awareness building.

In order to enhance the local capacity building, and avoid unnecessary social conflict and dispute related to the employment within local communities, following measures are suggested.

Recommended Mitigation and Enhance Measures

- *Identify the range of skill required for the labor force and conduct a gap analysis against skills availability*
- *Notify local people of job openings through local advertising, information center, project notice boards*
- *Develop and implement a local employment policy for the people of affected communities*
- *Careful management to be practiced about the expectation of local people in regard to the employment to avoid any disputes*
- *Undertake regular review of labor requirement and skill demands ensuring that training strategies meet the needs of project*
- *Initiate training and job skill development programs*
- *Company is intending to conduct both awareness and critical training necessary to its employees, it is perceived that capacity building which is expected by both company and local community is one of the beneficial effects as well. As this will be long term income stability to the hired employees assuring the economy security to its family members.*
- *This project is anticipated to source the operative force on local basis and has the potential to increase the educational and technical qualification of local work forces through onsite technical transferring and in house training programs.*
- *The project will definitely have significant beneficial impacts on the local communities.*
- *One of the effective implementation of the Social Impact Management Plan of the project is the development of a capacity and local awareness building.*
- *Community management committee shall be organized to establish an effect channel and appropriate mechanism in communicating local residents and gain the feedback of project related community issues.*
- *Community management committee shall engage with local community through ongoing disclosure of the project information and consultation on matters that directly affect them.*
- *It is to be ensure that communication is free of external manipulation and influences*
- *Provided that recommended additional mitigation measures are fully implement and prove effective, the significant of impact is reduced to minor.*

5.6.3 Impact on Local Economy

There is some probability that the workforce will patronize local retail services, such as food outlets during lunch time, which would be beneficial to the economy at the local scale.

On the project side, it is certain that some materials required for the project use could be locally available and due to the easy accessibility, there might be greater consumption for local market and increase business opportunity for local business.

In addition, the arrival of newcomers to project area could result in increased economic activity, greater exposure to markets and opportunities, larger customer bases for local businesses and positive diversity with the community.

Following measures to enhance this beneficial effect are recommended

- Investigate the possible procurement needs of the project that can be sourced locally
- Investigate the possible employment needs of the project that can be sourced locally

5.6.4 Community Health, Safety and Environmental Consideration

As complexity of prediction the impacts supposed to come out from the project, the community health and safety concentrates first and foremost the avoiding methodology of risk hierarchy.

The following key health and safety issues are identified in the project and affected area in the form of intersecting workers' health and community's health.

1. Accidents - anticipated to cause by project's vehicle movement on public road
2. Exposure to environment contaminants (i.e. dust emission, noise, water)
3. Communicable diseases such as HIV, Tuberculosis, Hepatitis.
4. Community concerns on the damage to existing environmental receptors
5. Reduced sense of community safety and security due to influx of the new comers into the project affected area
6. Public Concerns on potential fire hazard from the project

Recommended mitigation and management measures are also listed to reduce the anticipated risks associated with project activities.

Following mitigation and control measures are adopted to minimize such risks related to projects

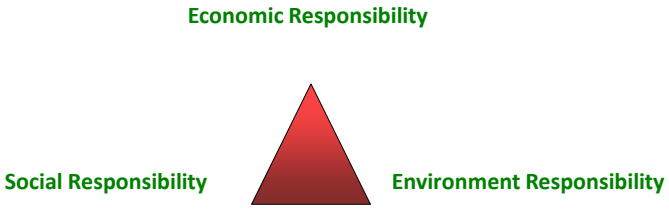
- Develop and implement Rural Health Initiative, to support rural health services delivery
- Provide medical assistance wherever possible to local communities
- An emergency management plan shall be maintained and implemented with co-operation from local health services and monitored through consultation by local residents
- Regular engagement of health and social infrastructure stakeholders to acquire demands and responses (corporate social responsibility)
- Annual medical surveillance to project employees to monitor the trend and pattern of communicable disease within the project premise

- Initiate community health education as part of socio –economic management of the project for workers and communities health and integrate them into safety orientation program.
- Coordinate with local /government medical officers on identification, reporting and monitoring of any potential outbreak of communicable diseases in camps or residential areas.
- Preparation of annual environmental monitoring reports and available to the public in the form of summary
- Preparation of annual safety report and available to the public in the form of summary
- Ensure that project will have minor or insignificant impact on environment and known to public
- Developing environmental awareness campaigns among employees and local residents in the area of project influence.
- Enhance safety culture at work to reduce risk of accidents and injuries associated with construction and operation work activities

5. 7 Corporate Social Responsibility (CSR)

Expecting part of the profit of the project to share the social benefit of the community, the developer would manage to fulfill the following request of the local residents during stakeholder meetings.

The Corporate Social Responsibility (CSR) program had already planned by the project as follows.



Chipwi Nge HPP was started in April 2008 and completed in September 2011. The conflicts in the Northern Myanmar led to the evacuation of all site personnel and left some facilities and equipment damages. It was repaired and restored for the local power supply in 2013. Electricity from Chipwi Nge is supplied to the local people. The abundant, cheap and stable power supply bring about rapid local economic development.

The Company will give priority to hire the PAPs and residents in the neighboring area and cooperate with the local companies. All the workers at the project sites will be trained before they are posted. The Company has trained 2 batches of senior management and operation personnel in China. They have returned to Myanmar after qualification and taken up important jobs. The Company has more than 80% of Myanmar staff. The cultural integration has been promoted through regular medical check-ups, insurance coverage, cultural and sports activities, labor law training, festival celebration and outstanding Myanmar staff China visits etc.

Education assistance

The “ACHC scholarship” was established to aid the outstanding students to support the education.

Disaster assistance

Firefighting assistance had been given in Myitkyina for 15 times.

Disaster donation

- In May 2008, donation of 100 million Kyat was given to the victims of the Cyclone Nargis.
- In March 2010, donation of USD 50,000 was given to the victims of the earthquake in Shan state.
- In November 2012, 25 tons of living materials were donated to the Thabeikkyin region worst hit in the "November 11" earthquake.

Disaster relief

On 30 June, 2012, 20 million kyat was donated to 27 war refugee camps in Myitkyina.

Assistance

- Public utility: Chipwi town road hardening has been completed to improve the traffic conditions for better quality of life of the local people.
- Poverty alleviation: The "assistance foundation" has been established to help the livelihoods of the resettled people.
- Deliver project information in various media channels
- The portal websites in Myanmar, English have been opened to the public, publishing company news and trends, promoting the company image
- Open Facebook account
- Publish social responsibility reports, all situations of doing corporate social responsibility will be shared with the public

A large number of local employees in Myanmar are recruited and the localized management is adopted so as to increase income of local people and promote regional economic development.

Leaflets (Myanmar language) are made and more than 20 speeches are taken in Chipwi and surrounding villages, which makes nearly 3000 citizens know about safe use of electricity.

The training on common diseases prevention is conducted. Villagers nearby the HPP are invited to participate in Christmas celebrations.

Donate office tables, chairs, and equipment to local schools; donate medicines to local hospitals; make donations and offer condolences to Myanmar employees affected by flood; mobilize employees to send donations to poor Myanmar staff for operation fee.

Voluntary Publicity and Explanation of Safe Use of Electricity

Voluntary Publicity and Explanation of Safe Use of Electricity

Training on Common Diseases Prevention

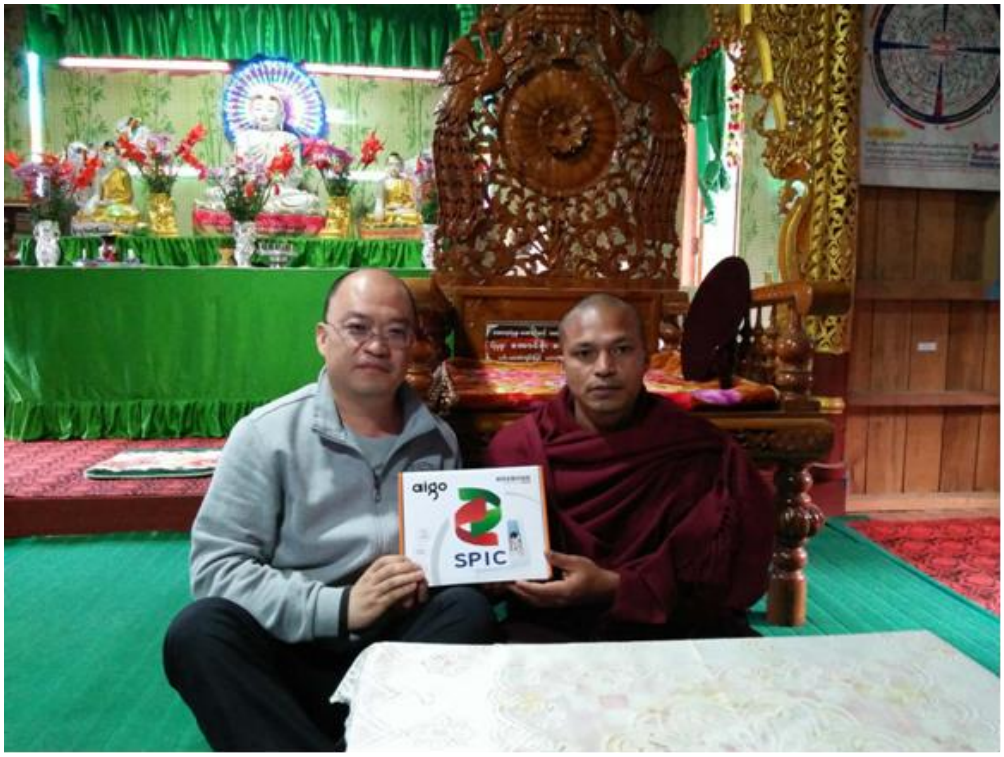
Christmas Celebrations with Villagers nearby the HPP

Donation of Office Equipment to Local School

Donation of Tables and Chairs to Local School

Donation of Medicines to Local Hospital

Donation of Composite Wooden Plate to Na Maw Zup School



Donation of Electronic Albums to Abbot of Chipwi Temple

Donation Certificate

Education Assistance

Disaster Assistance

Disaster Donatoin

Hardarned Chipwi Town Road

Appendx 1 Photographs

Appendix 2 List of Participants in Stakeholder Consultation Meetings

1. Myitkyina Meeting

Sr.	Name	Department/Address	Phone Number
1	U Ye Myint Tun	Myothitgyi Ward	9256077747
2	U Thu Raine Soe	Myothitgyi Ward	9454322864
3	U L Zaung Lwin	GD-110 Sikarpu FFI	9400037527
4	Hkun Myat	Nyein Foundation	9440002901
5	U Nyunt Sein	Planning	9250343165
6	U She Zaw Zaung Dine	TANKS	973251150
7	U Tun Tun Oo	AD/ Irrigation	9205550217
8	U Sut Bown Rain	Myo Foundation	9257432089
9	U Saw Win	Settlement & Land Record Dept.,	92402122
10	U Aung Swe Win	Hydropower	95185114
11	U Phone Aye Lwin		9971224020
12	U K Zaw Loon	Uakthan	9257066248
13	U Myint Thein	Water Resources Utilization	9258172772
14	Daw May Yee Kaw Lwin	Spectrum	
15	Daw Ywe Nuu	KSCN	9259183737
16	U Kyi Paw	Electric Power	9250232375
17	U Yan Naing Tun	District GAD	9400465044
18	Zhang Huan Gui	SPIC	95166332
19	Du Yeke	SPIC	9263899311
20	Tan Meisheng	SPIC	977064967
21	U Than Tun Win	Rural Development Afair	947026285
22	U Khar Le	Metta	944696310
23	U Lwan Khaung	Metta	936002897
24	U Aung Swe Lat	Electric Power	96400981
25	U Htay Aung	Dept. of Health	92401397
26	Daw Nwar May Mee	Township GAD	9781065920
27	U H Hla Aung		
28	U Kyaw Aung Moe	MONREP	
29	U Zaw Min Thant	MONREP	
30	Daw Khin Ohnmar Htwe	REM Co.,	
31	U Zaw Naing Oo	REM Co.,	

2. Chipwi Ngwe Meeting

No	Name	Address
1	U Htet Than Aung	Yit Law Quarter
2	U Htike Aung	Yit Law Quarter
3	U Mal Aungg	Nat Ka Pa
4	U Aung Lamm Khaung Swan	Nat Ka Pa
5	U Lay May Gu	Nat Ka Pa
6	U Khaw Aung	Bar Lei Quarter
7	U Zone Khaw	That Ka Quarter
8	U Tun Shein Zone Kyan	That Ka Quarter
9	U Gee Baw Khaw	Oakat Quarter
10	U Sein Min	Yit Law Quarter
11	U Sai Maw	Kat Pa Ya
12	Daw Daung Nyee	Bar Lei Quarter
13	Daw Zaung Nyunt	Oakat Quarter
14	Daw Daing Nyunt	
15	U Satu Mine	Bar Lei Quarter
16	U Mal Kham	Kan Paing Yan
17	U Hla Shein Daung Khaung	Oakat Quarter
18	Daw Zal Than	Yit Law Quarter
19	U De Kat Khine	Sit Shaung
20	U Aung Min	Sit Shaung
21	U Bawm Tain	Sit Shaung
22	U Jone Daing	Sit Shaung
23	U Saung Zone	Bar Lei Quarter
24	U Ma Daing Main Saung	Bar Lei Quarter
25	U Khaw Zone	Bar Lei Quarter
26	Daw Saung Winn	Bar Lei Quarter
27	U Tun Nyein	Oakat Quarter
28	U Kaung Lwann	Oakat Quarter
29	U Gee Khaw Zone	Oakat Quarter

30	U Zaung Lwann	Oakat Quarter
31	U Khaung Jone	Yit Law Quarter
32	Daw Chone Htann	Bar Lei Quarter
33	Daw Khaw Swann	Bar Lei Quarter
34	U Lunn Aung	Bar Lei Quarter
35	U Htein Bawl	Sit Shaung
36	Daw Lwan Thwe	Sit Shaung
37	Daw Zal Hnaw	Sit Shaung
38	U Lwan Khaung	Sit Shaung
39	U Yein Thann	Sit Shaung
40	Daw Khaung Naw	Kan Paing Yan
41	Daw Khaung Sae	Kan Paing Yan
42	Daw Khaung Sai	Kan Paing Yan
43	U Haung Khaung	Yit Law Quarter
44	U La Nam Khaw Ki	Yit Law Quarter
45	U La Maw Daung Lwann	Sit Shaung
46	Daw Kham Nwal	Yit Law Quarter
47	Daw Daung Naw	Kan Paing Yan
48	Daw Daung Nan	Yit Law Quarter
49	U Phote Myaw Lwan Woung	Oakat Quarter
50	U Khaung Lwan	Oakat Quarter
51	U Taw Khaung	Sit Shaung
52	U Guan Gyar	Oakat Quarter

3. List of respondents

Sr	Ward	Respondents
1	Barle Ward	U Chan Poung
2		U Daung Khaung
3		U Zonee Yein
4		U Khaung Daung
5		U Jyi Lann Yaw
6		Daw Tain Myaw
7		Daw Daung Naw
8		Daw Daung Nan
9		Daw Bawm Myaw
10		U Bone Pin
11		U Kaw Son
12		Daw Saw Win
13		Daw Chan Kha
14		Daw Houng Naw
15		Daw Saung Nan
16		Daw Tein Soan
17		Daw Tein Win
18		U Sakuu Myy
19		Daw Boyen Nan
20		U Yain Saung
21		U Koat Saung
22		U Gyi Kaw Bym
23		U Khaing Chone
24	Kanpaingyan Ward	U Ou Lan Naw
25		U Saung Zonn
26		U Koung Dong
27		Daw Doung Lann
28		Daw Zin Noon
29		Daw Lann Loon
30		U Boan Sint
31		Daw Koung Sai
32		Daw Koung Sai
33		U Yow Phaw
34		U Htun Lawn
35		U San Koung
36		U Saung Koung
37		U Zae Sann

38		Daw Yoor Win
39		Daw Zan Nann
40		U Saung Koung
41		U Koung Sein
42		U Soung Sai
43		U Yoor Koung
44		U Pha Yet Bawm Khaw
45		U Kyan Sone
46	Oakekat Ward	Daw Yay Myaw
47		Daw Khaw Nan
48		Daw Chan War
49		Daw Htu Sai Kham
50		Daw Yaie Swe
51		Daw Kyane Swan
52		Daw Zone Myaw
53		U Chan Kee
54		U Myint Thein
55		Daw Lwan Naw
56		U Tain Kyar Bone Lan
57		Daw Ni Ni Win
58		Daw Yain Lon
59		U Lan Jyawt Tain Kaw
60		U Zaung Saung
61		U Tun Nyain
62		U Yar Khu
63		U Lan Yaw
64		U Jyi Khaw Yein
65		U Nyunt Linn
66		U Hpoke Myaw Kaung Lwan
67		U Lunn Khaung
68		Daw Yaine Lwan
69		Daw Dhaine Ywae
70		Daw Mar Yi
71		Daw Lawm
72		Daw Htwan Lann
73		Dae Chan Maw
74		Daw Chan Yee
75		Daw Khaung Pann
76		U Lwan Aung

77		U Aung Sonee
78		Daw Khaung Chan
79		Daw Khaw Nam
80		Daw Yain Wan
81		U Knaw Chan
82		Daw Daung Daung Nyi
83		Daw Yain Lwant
84		Daw Khaw Nan
85	Yitlawe Ward	U Sein Min
86		Daw Zaun Noon
87		Daw Tite Ngwal
88		Daw Yin Ngan
89		U Tain Baw
90		Daw Lwan Ngwal
91		Daw Lwan Naw
92		Daw kok Taung
93		Daw La Kain Za Naw
94		U Yit Nan
95		Daw Dain Naw
96		U As Lan Bout
97		Daw Rain Wan
98		U Kyaw Min Oo
99		U Rain Baw
100		U Taung Haung
101		U Zal Thaung
102		U Zoun Khaung
103		U Zoun Zay
104		U D Zal Daing
105		U Lwan Khaung
106		Daw Nan
107		Daw Tu
108		U Bwan Laung
109		Daw Lone Nan
110		Daw Kyone Sein
111		U Lu Ying
112		U Khaw Kae
113		Daw Khaung Naw
114		U Khan Taung
115		U Thein Than Toe

116		Daw Baung Te
117		Daw Ray Swa
118		Daw Baw Swan
119		Daw Daung Ngwee
120		Daw Chan Nan
121		Daw Lwan Swan
122		U An Khaung Daung
123		Daw Lwan Lar
124		U Tin Moe
125		Daw Lwan Noon
126		Daw Khin Hnin Mar
127		Daw Zal Naw
128		U Yein Baw
129		Daw Nu Mar
130		Daw San San Maw
131		Daw Kyan Ngot
132		U Aung Tun
133		Daw Htu Sai
134		Daw Zaung Nyee
135		Daw Kot Bu
136		U Gan Aung
137		Daw Ni Lar
138		Daw Khaung Say
139		Daw Khaung Nyi
140		Daw Khaung Sai
141		U Tint Lwin Oo
142		Daw Daung Nan
143		U Khon Kaung
144		U Taw Kaung
145		Daw Lu Bu
146		U Yan Naing Soe
147	Power Plant	U Soe Ko Ko Oo
148		U Kyaw Soe Win
149		U Hlaing Kyi Win
150		U Pyae Phyo Mg Mg
151		U Thein Naing Tun
152		U Won Naw Sai
153		U Mayan Kan
154		U San Htun

155		U Gan Aung
156		U Zaw Lot
157		U Paung Qyee
158		Daw Saung San
159		Daw Byint Myaw
160		U Win Zaw Oo
161		U Aung Myint
162		Daw Naw Mu Tin
163		U Htun Zaw Linn

Appendix – 3 Questionnaire Form

QUESTIONNAIRE FOR SOCIAL and HEALTH IMPACT ASSESSMENT (SIA & HIA)

Chipwi Ngwe Hydro Power Project

NO ..... Date of interview..... Name of interviewee.....

Part A Interviewee information(ဖြေဆိုသူ၏အချက်အလက်များ)

A.1. Sex (ကျား/မ)

1)Male(ကျား) 2)Female (မ)

A.2. Age(years) (အသက် / နှစ်)

1) 20-34 2) 35-49 3)5 0-64 4) >65

(၂၀ နှစ်-၃၄နှစ်) (၃၅ နှစ်-၄၉နှစ်) (၅၀ နှစ်-၆၄နှစ်) (၆၅နှစ် အထက်)

A.3.Religion(ဘာသာ)

1) Buddhism 2) Christian 3) Others(please specify)

(ဗုဒ္ဓ) (ခရစ်ယာန်) (အခြား)

A.4. Marital status (အိမ်ထောင်ရှိ/ မရှိ)

1) Single(လူလွတ်) 2)Married (အိမ်ထောင်ရှိ)

3) Windowed(မုဆိုးမ) 4) Divorced (ကွာရှင်းထားသူ)

A.5. Level of education (ပညာအရည်အချင်း)

1) No Schooling 2) Primary school 3) Middle school 4) Hight school (ကျောင်းမတက်ဘူးသူ)

(မူလတန်း) (အလယ်တန်း)(အထက်တန်းကျောင်း)

5) Bachelor Degree 6) University Student 7) Monastic

(ဘွဲ့.ရ) (တက္ကသိုလ် ကျောင်းသား) (ဘုန်းကြီးကျောင်း)

A.6. Occupation (အလုပ်အကိုင်) ----------

.....

Part B Household Information (အိမ်ထောင်စုအချက် အလက်များ)

B.1. Please give us some brief information about your family :

1. Member in your household now() ကျား၊ ( ) မ .....ပေါင်း

B.2. Please let me know your household income sources per month or year?တနှစ်/ တလ

----------Kyatsအဓိက ဝင်ငွေရရှိမှု ----------

B.3. Please inform your household monthly expenses?(လစဉ် ကုန်ကျငွေ)

----------Kyatsအဓိကကုန်ကျမှု ----------

B.4. What is your household house ownership: (အိမ်ပိုင်ဆိုင်မှု)

1.owned (အိမ်ပိုင်) 2. Rented (အိမ်ငှား) 3. Other(အခြား)

B.5.If your HH owns the house, what is its type?(အိမ်အမျိုးအစား)

Concrete with Brick (တိုက်)	
Concrete with wood (တိုက်ခံ)	
Wooden (သစ်သား)	
Hut (တဲ)	

B.6.Which asset below your HH owns: (အိမ်ထောင်စုပိုင်ဆိုင်မှု.)

Asset	No	Asset	No
1.Car (ကား)		7.Electricity generator (မီးစက်)	
2.Rowed Boat(လှေ)		8.Television (တီဗွီ)	
3.Electric fan(လျှပ်စစ်ပန်ကာ)		9.DVD player(ဒီဗွီဒီ)	
4.Homephone(အိမ်ဖုန်း)		10.Fridge (ရေခဲသေတ္တာ)	
5.Mobile phone(ဟန်ဖုန်း)		11.Washing Machine(အဝတ်လျှော်စက်)	
6.Sewing Machine(အပ်ချုပ်စက်)		1 12.Motor Bike (မော်တော်ဆိုင်ကယ်)	

B.7. Now, what type of living standards is your household in?

(သင့်အိမ်ထောင်စု၏ လူနေမှု.အဆင့်)

1. poor(ဆင်းရဲ) 2. Normal (အလယ်အလတ်) 3. Well-off (ချမ်းသာ)

Part C Transportation/Movement information(လမ်းပန်းဆက်သွယ်ရေးအချက်အလက်များ)

C.1 How often do you use this alignment ?(to Myintkyina)

Every day (နေ့.စဉ်)	
Sometime per week(တစ်ပတ်တစ်ကြိမ်)	
Sometime per month(တစ်လတစ်ကြိမ်)	
Less than once per month(တစ်လတစ်ကြိမ်ထက်နည်း)	

C.2. Which purpose do your household members uses the alignment for?

Go to visit(အလည်သွားရန်)	
Go to markets(ဈေးဝယ်ထွက်ရန်)	
Go to school (ကျောင်းသွားရန်)	
Go health services, to other civil institutions (ကျန်းမာရေး၊လူမှု.ရေးကိစ္စ)	
Other (note down) (အခြား)	

C.3. Now, do the roads meet your demands? (ယခုလမ်းအသုံးပြုမှု.အဆင်ပြေမပြေ)

1. Yes (ပြေ) 2. No (မပြေ)

C.4. How is your transportation state in your community?

(လမ်းပန်းဆက်သွယ်ရေးအပေါ်ထင်မြင်ချက်)

1.Good (ကောင်း) 2. Normal (ပုံမှန်) 3.Bad(လမ်းဆိုး)

Part D Opinions upon the project(သဘောထားထင်မြင်ချက်)

D.1. Do you know this project?

Yes No

If Yes မည်သည်.နေရာမှ သိသနည်း----------

D.2. Are you satisfied about the project?(ကျနပ်မှုရှိ/မရှိ)

1) No (မရှိ)2)Yes (ရှိ)

ရှိပါက ----------

မရှိပါက----------

D.3.Do you feel worried about environmental impact during operational phase of the project?(စီမံကိန်းနှင့်ပတ်သတ်သောပတ်ဝန်းကျင်ဆိုင်ရာအကျိုးသက်ရောက်မှုအပေါ်စိုးရိမ်မှု)(ရေ၊လေ၊အသံဆူညံမှု)

1.No2.Yes, specify----------

D.4.Do you feel worried about social impact during operational phase of the project? (စီမံကိန်းနှင့်ပါတ်သတ်သောလူမှုဆိုင်ရာအကျိုးသက်ရောက်မှု.အပေါ်စိုးရိမ်မှု.)

1.No2.Yes, specify _----------

D.5. Do you feel worried about health impact during operational phase of the project? (စီမံကိန်းနှင့်ကျန်းမာရေးဆိုင်ရာအကျိုးသက်ရောက်မှု.အပေါ်စိုးရိမ်မှု.)

1.No2.Yes, specify _----------

D.6. Do you feel worried about agriculture impact during operational phase of the project? (စီမံကိန်းနှင့်စိုက်ပျိုးရေးဆိုင်ရာအကျိုးသက်ရောက်မှု.အပေါ်စိုးရိမ်မှု.)

1.No 2.Yes, specify _----------

D.7.Opinion on the project.စီမံကိန်းပေါ်ထားရှိသောသဘောထား

Item	No	Less	Normal	Very	Most
Overview					

Why do you like the project?----------

Why you don't like the project?----------

D.8. Needs for your Village/Quarter's development.(ကျေးရွာဖွံ့ဖြိုးမှုအတွက်လိုအပ်ချက်)

D.8. Needs for your region's development..(ဒေသဖွံ့ဖြိုးမှုအတွက်လိုအပ်ချက်)

D.9.Your suggestions on the project.အကြံပြုချက်

Part E. HIA Section

1.Do your household have diseases previous 6 months?

သင်၏နေအိမ်တွင် လွန်ခဲ့သော(၆)လအတွင်းရောဂါဖြစ်ဘူးသူရှိပါသလား။ Yes (ရှိ) No. (မရှိ)

If Yes, (What diseases) ရှိပါကမည်သည့်ရောဂါနည်း။----------

2. What kind of diseases occur most in your family?

*Malaria (ငှက်ဖျား) *Diarrhea(ဝမ်းပျက်ဝမ်းလျော) * TB * Dysentery (ဝမ်းကိုက်)

* Hepatitis(အသဲရောင်) *Heart disease * Hypertension (သွေးတိုး) * Others

Please specify ----------

3. How many times a year? ----------

4.What kind of diseases occur most in your Village/Quarter?

* Malaria (ငှက်ဖျား) * Diarrhea(ဝမ်းပျက်ဝမ်းလျော) * TB * Dysentery (ဝမ်းကိုက်)

* Hepatitis(အသဲရောင်) * Heart disease * Hypertension (သွေးတိုး) * Others

5.In what season? *Summer * Raining Season *Winter

6.Where did you go treatment? မည်သည့်နေရာသို.သွားရောက်ကုသနည်း။----------

---

7.Do your home have nearest place following treatment place?

သင်၏နေထိုင်ရာအရပ်နှင့်အနီးဆုံးတွင် အောက်ပါတို.အနက်မှမည်သည့်နေရာရှိသနည်း။

(1) GP ပြင်ပဆေးခန်း(2) Government Clinic အစိုးရဆေးပေးခန်း(3) Hospital အစိုးရဆေးရုံ

8.Have you use following behiviours? သင်သည် အောက်ပါတို.ကိုသုံးစွဲပါသလား

(1) Smoking ဆေးလိပ်သောက်ခြင်း (2) Betel ဆေးပါသောကွမ်းယာစားခြင်း/ဆေးငုံခြင်း

(3) Dani/ Alcohol / Beer ဓနိရည်/ထန်းရည်/ဘီယာ/အရက်သောက်သုံးခြင်း

(4) Yama စိတ်ကြွဆေး (ဥပမာ-ယာဘာ၊ ဆေးခြောက်)

9.Where do you get domestic water?သုံးရေကိုမည်သည့်နေရာမှရရှိသနည်း။----------10.Which water where are you drinking?မည်သည့်ရေကိုသောက်သနည်း။----------

How do you drink? မည်သို.သောက်သုံးသနည်း။ ----------

(1) Natural water (ရိုးရိုးရေ) (2) B) Boiled Water (ကျိုချက်ရေ) (3)Purified Water (ရေသန်.)

11. Using Toilets အသုံးပြု သောအိမ်သာ

(1)No (မရှိပါ) (2) fly (ယင်လုံ) (3) open pit (ယင်မလုံ)

12.How do you throw the waste?အမှိုက်များကိုမည်သို.စွန့်ပစ်သနည်း။ မည်သို.လုပ်ဆောင်သနည်း။

13.Other suggestions အခြားပြောပြလိုသောအချက်များရှိပါကပြောပြပေးပါ။----------

Appendix – 4 Impact Questionnaire Checklist

IMPACT QUESTIONNAIRE CHECKLIST

HYDROLOGY

1. Will the development reduce flooding of areas below or upstream of the proposed development site?
   0 Yes 0 No 0 Don't know
2. Will the development modify the timing of floods at the proposed site?
   0 Yes 0 No 0 Don't know
3. Will the development modify the base flows hence leading to an increase or decrease of dry season flows downstream of the development site?
   0 Yes 0 No 0 Don't know
4. Will the development lead to drying out of the wetland?
   0 Yes 0 No 0 Don't know
5. Will the development cause permanent changes in the water table of the wetland?
   0 Yes 0 No 0 Don't know
6. Will the development lead to a reduction in the capacity of a wetland to store water?
   0 Yes 0 No 0 Don't know

WATER QUALITY

7. Will the development pollute the wetland at the site, and /or downstream?
   0 Yes 0 No 0 Don't know
8. Will the development cause reduction in the ability for the wetland to retain nutrients?
   0 Yes 0 No 0 Don't know

9. Will the development lead to eutrophication of downstream wetlands?
   0 Yes 0 No 0 Don't know
10. Will the development lead to increase in silt content of the water flowing through the proposed site?
   0 Yes 0 No 0 Don't know
11. Will the development lead to increase in salt content of the wetland?
   0 Yes 0 No 0 Don't know

SOIL AND MORPHOLOGY

12. Will the development lead to increase in soil erosion of downstream areas?

0 Yes 0 No 0 Don't know

BIOLOGICAL IMPACTS

13. Will the development have any impacts on fauna and flora of the wetland?
    0 Yes 0 No 0 Don't know
14. Will the development change the composition of :
    FAUNA 0 Yes 0 No 0 Don't know
    FLORA 0 Yes 0 No 0 Don't know
15. Will the development lead to reduction in the diversity of :
    PLANT SPECIES 0 Yes 0 No 0 Don't know

    ANIMAL SPECIES 0 Yes 0 No 0 Don't know

16. Will the development lead to loss of any rare

PLANT SPECIES 0 Yes 0 No 0 Don't know

ANIMAL SPECIES 0 Yes 0 No 0 Don't know

17. Will the development lead to loss of endemic

PLANT SPECIES 0 Yes 0 No 0 Don't know
ANIMAL SPECIES 0 Yes 0 No 0 Don't know

18. Will the development obstruct the natural movement of fauna?
    0 Yes 0 No 0 Don't know
19. Will the development lead to creation of new habitats?
    0 Yes 0 No 0 Don't know

SOCIO-ECONOMIC IMPACTS

20. Will the development lead to changes in access to wetland resources by the communities?

Increased access 0 Yes 0 No 0 Don't know
Decreased access 0 Yes 0 No 0 Don't know

21. Will the development lead to elimination of resources of the wetland?
    0 Yes 0 No 0 Don't know
22. Will the development lead to loss of access to grazing area for livestock?
    0 Yes 0 No 0 Don't know
23. Will the development lead to a reduction of area for flood-recession agriculture?
    0 Yes 0 No 0 Don't know
24. Will the development lead to changes in income distribution among the local communities?
    0 Yes 0 No 0 Don't know

Appendix IV
Emergency Preparedness Plan
For
Flood Risk Caused by Dam Failure

May 2019

Introduction

The emergency preparedness plan (EPP) has been prepared for the emergency situations that could occur in operation phases. The CPI Yunnan International Power Investment Co., Ltd. has developed this EPP in accordance with the comments of Environmental Conservation Department (ECD) dated on 31 January 2019. According to the following plan, Coordinator of Emergency Action Plan identified missions and responsibilities of every individual, and the procedures that should be implemented in emergency situations via forming an Emergency Action Team. This Emergency Preparedness Plan will be improved during operation phases by the Coordinator and Emergency Action Team as necessary.

Purpose

The purpose of this Emergency Preparedness Plan (EPP) is to protect lives that would be affected from emergency events that are not foreseen during operation phases of the project, natural disasters (fire, earthquake, flooding etc.), hold up, communication loss, incidents in facility, wrong operation, disordered maintenance, and reduce the potential impact on dam and nearby settlements.

In order to implement this plan, an Emergency Action Plan Coordinator and team will be assigned by the project owner. These persons will be trained and their mission will be clearly specified. Thus, it will be ensured that each staff would know his/her own responsibility in a potential emergency situation.

The purpose of the EPP is also to:

- Provide a plan, which facilitates public safety by notifying all appropriate authorities
- Provide information to all stakeholders (especially living in downstream areas) to allow for an informed evaluation to be made during emergency events
- Provide for a plan of action to carry out repairs and reduce the impact of any such event where possible

The plan is intended to assist the project company, local authorities, Township Management Body, The State Management Body, Relief and Resettlement Department and other agencies in responding swiftly and effectively in the event of a dam safety emergency at the Chipwi Nge Hydropower Facility.

Description of Hydropower Station

Chipwi Nge Hydropower Station dam is located at Chipwi River – a tributary on left bank of Nmaihka River, in a straight river valley around 1.5km~2.0km upstream Labang Bridge, approximately 15km from ChipwiTown. The powerhouse is on the left bank of Nmaihka River, around 9km from the upstream ChipwiTown, 62km from the downstream Myitsone Hydropower Station and 20km from the upstream Chipwi Hydropower Station.

Chipwi Nge Hydropower Station is a diversion type and main structures include dam, water diversion and power generation system, diversion structure and power house etc.

Recommended layout of Chipwi Nge Hydropower Station is described as follows: dam and water intake are located at Chipwi River, concrete gravity dam, dam type intake; diversion line

adopts the polygonal scheme, internal diameter of tunnel 4.0m; power house and tailrace tunnel on left bank of Nmaihka River; open type power house; axis of the power house inclines to axis of the penstock at an angle of 30°. The dam type of the hydropower project is concrete gravity dam. The length and elevation of the dam crest is 220m and 747.5m respectively. The maximum height of the dam is 47.5m. The backwater height in front of the dam is about 30m. The seismic design intensity is Ⅷ degree. The classification for earthquake-resistance of the project is C-class. The security and stability of dam were fully considered in the design of the dam. The anti-sliding stability and the stress of dam were calculated according to the limited states of bearing capacity and normal use.

The normal poor level of the power station reservoir is 740m, the dead water level is 735m, the storage capacity is 281,000m^3, and the dead storage is 508,000m^3. The average annual total sediment transport capacity at the dam site is 869,000 tons, and the reservoir capacity below the normal water level is 789,000 m^3， so the siltation rate is fast. At present, the capacity below dead water level has been basically deposited by sediment, making the reservoir volume smaller. The dam is a concrete gravity dam, so the safe operation is fully guaranteed. Even if the flood flows over the dam, the possibility of dam failure is small. In addition, because of the small volume, the downstream impact will be small in case of dam failure.

Dam Safety

The main safety risk of Chipwi Nge HPP can be assessed from the aspects of dam stability, structure strength, flood discharge and energy dissipation, and seismic risk. According to calculation result and analysis, the major findings and main conclusions of dam safety assessment are as follows:

1) Calculation and analysis has been made on the anti-sliding stability considering static working condition. The results show that the safety margin of dam sliding is large, and the risk of dam stability is very low.

2) According to the calculation result considering static working condition, the maximum dam stress is much smaller than the concrete strength, the safety margin is large, and the structure strength risk is very low.

3) According to hydraulic calculation result, the discharging ability is greater than the peak value of checking flood and design flood. During discharging, the flow speed is not very high, with concrete of high ability of scour-resistant and wear-resistant, it can effectively protect the passageway. According to the hydraulic calculation result, the concrete apron and revetment can effectively protect the dam and bank, satisfying discharging capacity needs and energy dispersion requirement. Thus, the risk of scouring during flooding is small.

4) Seismic calculation results show that the anti-sliding stability and stress of the dam under the earthquake load meet the requirements, and there is a certain safety margin, and the seismic safety risk of the dam is small.

From above all, the dam safety risk is low.

Mission and Responsibility

Project Owner/Developer

All the activities that are performed during operation phases of the project are under the responsibility of the project owner (his representative).

The missions and responsibilities of the project owner in the context of Emergency Action Plan are summarized below:

- Selection of the Emergency Action Plan Coordinator and approval of Emergency Action Team
- Attending the annual review meetings related to EAP and approval of the recent version of the EAP
- Approval of the activities that are not included in EAP during emergency situation
- Analyzing the reports prepared after any emergency situation

Emergency Action Plan Coordinator (EAPC)

In general implementation of the activities developed and specified in the Emergency Action Plan, and improving this plan are the main responsibilities of the Emergency Action Plan Coordinator. More detailed responsibilities of EAPC can be summarized as follows:

- Establishment of the Emergency Action Team (EAT)
- Training the EAT and the project staff for emergency situations
- Making the division of responsibilities between EAT members
- Reviewing and improving, if necessary, the EAP with the EAT annually
- Controlling functionality and practicality of the EAP by performing maneuvers in specified intervals
- According to type of emergency situation, determination of the people that will be contacted during emergency action, and keeping contact information of these people in written form in a place that everybody in the EAT can reach
- Keeping the contact information of the EAT and people that will be contacted in emergency situations updated
- In emergency situations, coordinating the EAT in order to successfully implement the EAP
- Implementation of the necessary measures, which are not specified in the

EAP, in an emergency situation after the approval of the project owner and after the end of emergency revising the EAP accordingly

- After the end of emergency, reviewing the situation with the EAT and reporting to the project owner

Emergency Action Team (EAT)

Emergency Action Team will be established from the project staff according to their abilities. The responsibilities of the EAT can be summarized as follows:

- Attending the training sections and maneuvers for implementing the EAP
- Reviewing and improving, if necessary, the EAP annually together with the EAPC
- Informing EAPC when an emergency situation occurs
- According to type of emergency situation, implementing the necessary measures in accordance with the EAP
- Notifying the relevant contact people as required in the EAP
- Reviewing the situation with the EAPC after the emergency situation, and preparation of the report

Dam Surveillance

The Dam area of Chipwi Nge HPP has 4 personnel and some securities responsible for daily duties. The main tasks include dam water level monitoring, dam deformation observation, guarding of dam buildings and dam emergency disposal, etc.

Outside Agencies

A copy of the EPP is provided to all outside agencies such as Township Management Body, the Kachin State Management Body, Relief and Resettlement Department, Department of Meteorology and Hydrology, Chipwi Township Fire Department, Chipwi Township Police Station, Chipwi Township Hospital and Chipwi Township Administration Department.

Possible Emergency Situations

Earthquake

Trainings will be provided to all workers related to actions to be taken during an earthquake for their safety. If an earthquake greater with a scale of more than 5 on Richter scale is determined in the area, and workers on duty feel earth tremor or are exposed to specified earthquake consequences (feeling of the earthquake by everybody, moving/falling of objects in the shelves, moving/falling down of furniture, fracturing of some plasters and walls, quaking of trees and shrubs), the steps given below will be followed and implemented:

1. After the incident, general visual control of dam shall be done.

2. After audits and controls are completed, relevant authority shall be notified regarding the results.

3. If dam collapses or a serious damage is of concern, settlements located in the downstream, and other dams shall be informed immediately.

Furthermore, water level in reservoir shall be reduced under control.

4. If a serious damage on the embankment of the dam is determined, water level in the reservoir shall be reduced under control. Water releasing shall continue until dam embankment is controlled by an authorized engineer or dam owner.

5. If a minor damage on the dam is of concern, monitoring of relevant elements of the environment shall be initiated immediately and collapse risk of dam shall be assessed. Afterwards, instructions shall be applied via contacting with local and national institutions.

Flood Risk

The water level in the reservoir may increase rather quickly due to high intensity of precipitation and increased flows in the tributaries and surface runoff. In such situations, steps given below shall be followed in order to prevent any adverse impacts on dam embankment, reservoir area and its surrounding, settlements located in the downstream:

1. Local emergency units shall be contacted. Information related to below subjects shall be given.

· Existing reservoir height and free board (safety portion/height) height

· Reservoir rising velocity

· Weather conditions (past-momentary-future)

· Discharge/drainage conditions of downstream of river

· Leakage velocity from canals

2. If it is possible, discharge amounts at gates and spillways shall be increased incrementally.

3. Public living at the downstream will be warned and discharge amount shall be increased incrementally in order not to affect them adversely.

4. Depending on the change in water level, increased or decreased leakage shall be controlled.

5. Areas close to dam foundation or crest shall be controlled against leakage, decadence, collapse, slide and other dangerous situations. If such situations exist, settlements located at the downstream and relevant authorities shall be informed immediately.

Dam Failure

A **Dam Failure** is defined as the failure of the dam itself or its foundation, which results in large or rapidly increasing uncontrolled releases of water from the reservoir. It can be identified by the formation of a breach in the dam or foundation. It is impossible to determine how long it will take for a complete failure to occur once a significant breach has formed. Once a significant breach has occurred regular updates of the warning will be issued as long as the threat exists.

Emergency Response

Technical Information

Response to any emergency arising out of a Dam Incident or Dam Failure will be greatly improved by having information in the hands of responsible persons in order to properly determine risks and possible outcomes. This information will allow the dam surveillance team

and EAP team to keep abreast of the prevailing hydrological condition and resulting rainfall/runoff patterns.

Access to the Site

Another important factor in responding to an emergency is access to the site.

Vehicles

EAP team has the following equipment at their disposal to travel to the site

• Four wheel drive car

• Van

• Loader

Vehicles required during an emergency will also be available from Hydropower station office and Office of Dam.

Road Access

Access to the Chipwi Nge dam site is via the car road from Chipwi town and hydropower station.

End of the Emergency Situation and Further Actions

When the emergency conditions end at the reservoir and power plant area and EAPC approves the safety of the project area, relevant units and authorities are informed related to the incidence. EAT makes a general assessment together with the EAPC and prepares the report regarding the emergency incidence. The activities taken during the emergency shall be assessed and any necessary adjustments and/or improvements shall be made in the EAP. If the emergency incidence is an unforeseen case, the precaution measures to prevent this type of emergency incidences and the action plan for such emergencies will be developed and integrated into the EAP.

Inundation Mapping

The simplified method was used for the estimation of downstream inundation. As the dam breach flood wave travels downstream there is usually a reduction in the peak flow. The downstream slope of the dam changes from 1：0.75 to vertical at el.738.0m and the storage capacity of the reservoir is less than 250 Ac-ft. (281,000m^3). According to the dam breach hydrograph attenuation curve shown in Figure 1 combine with Digital Elevation Model of the project area, the estimated extent of flooding resulting from the hypothetical breach (worst case scenario) of the Chipwi Nge dam is shown in Figure 2. There is no villages in the downstream of Chipwi Nge River till mouth of Maykha River except Chipwi town that located left bank of Makha River.

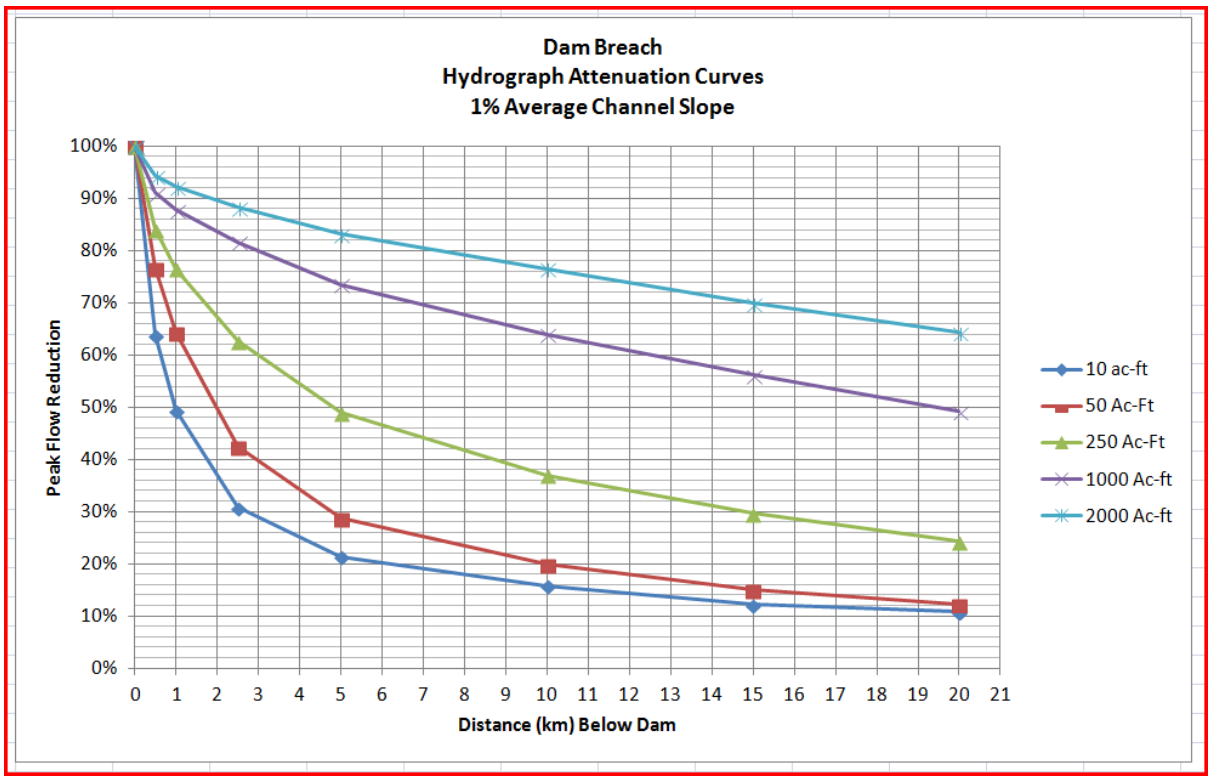


Figure 1 Dam breach hydrograph attenuation curves (DAMBRK (Fread, 1988))

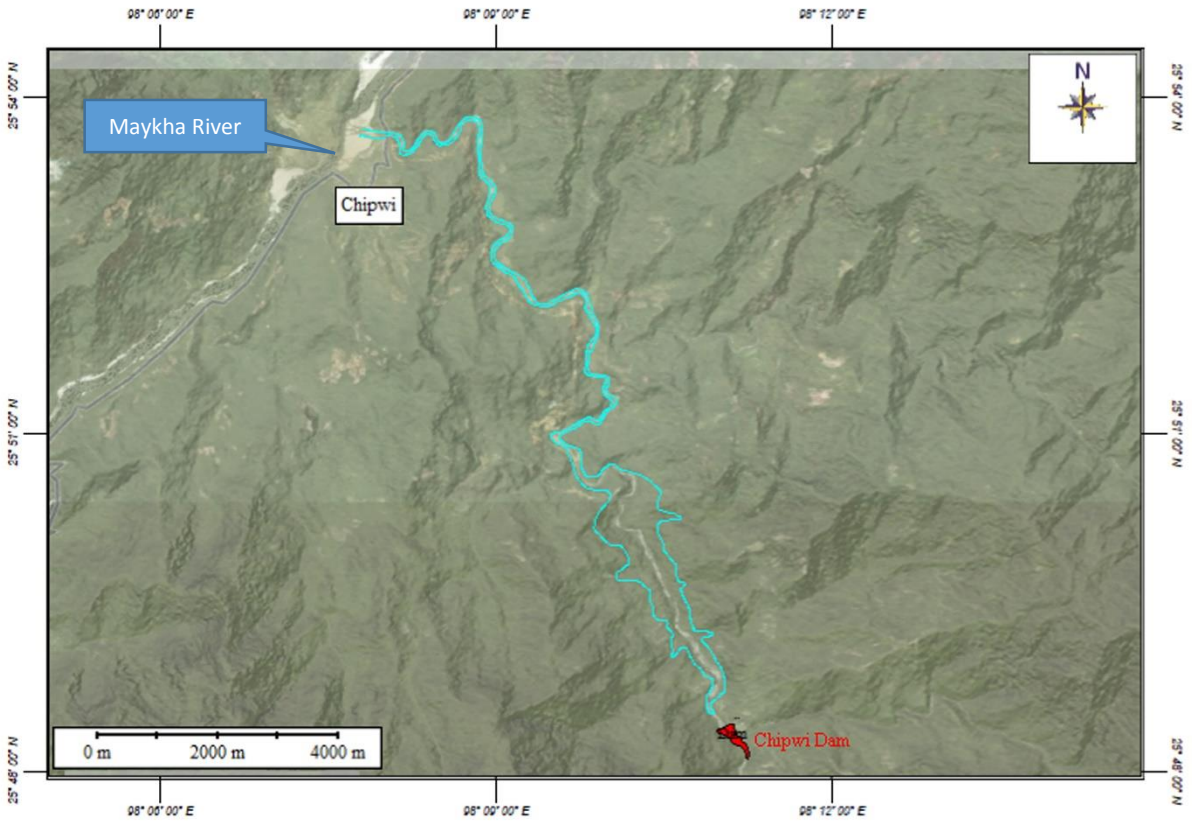
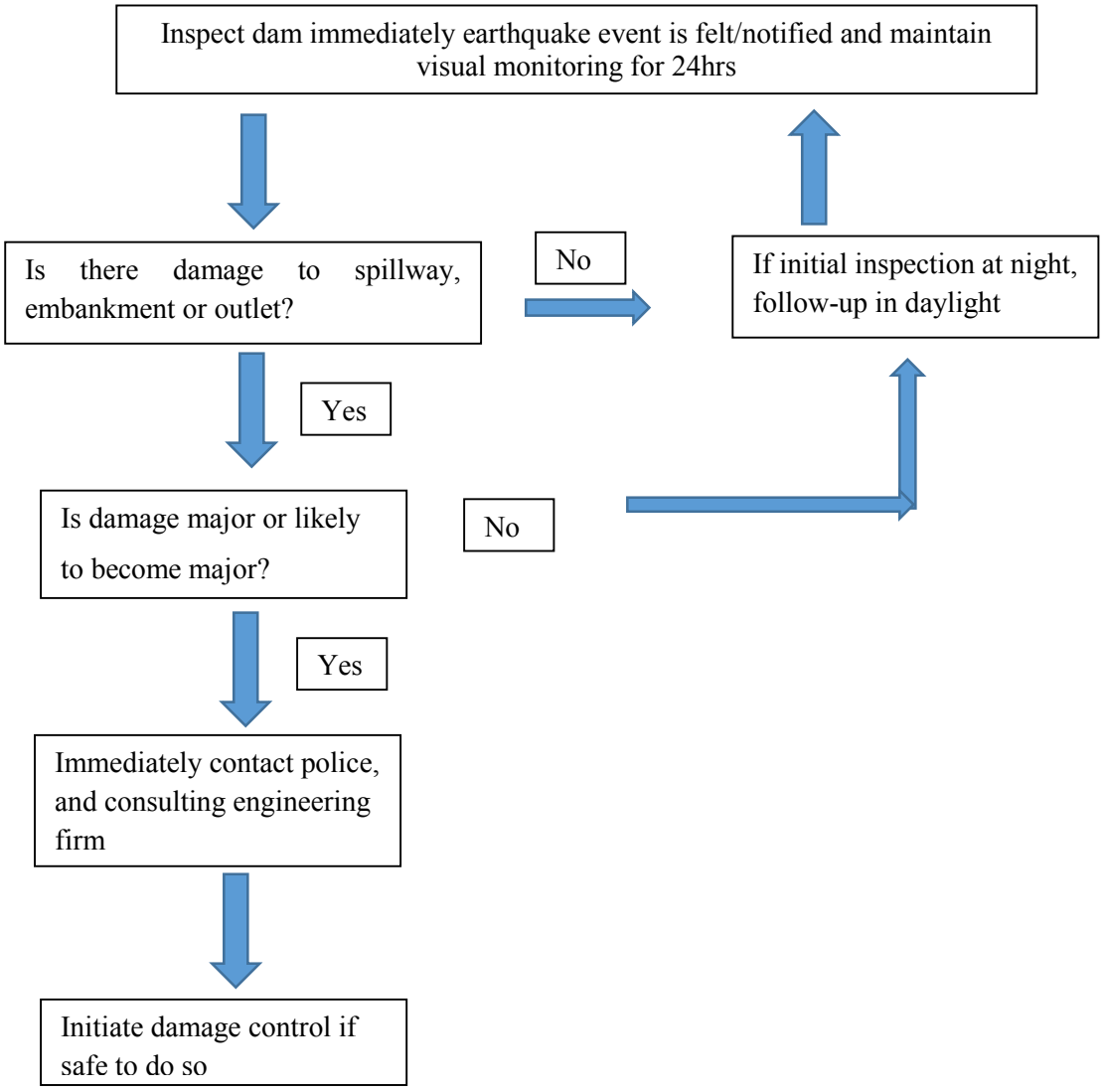


Figure 2 The hypothetical dam breach and inundation map of downstream

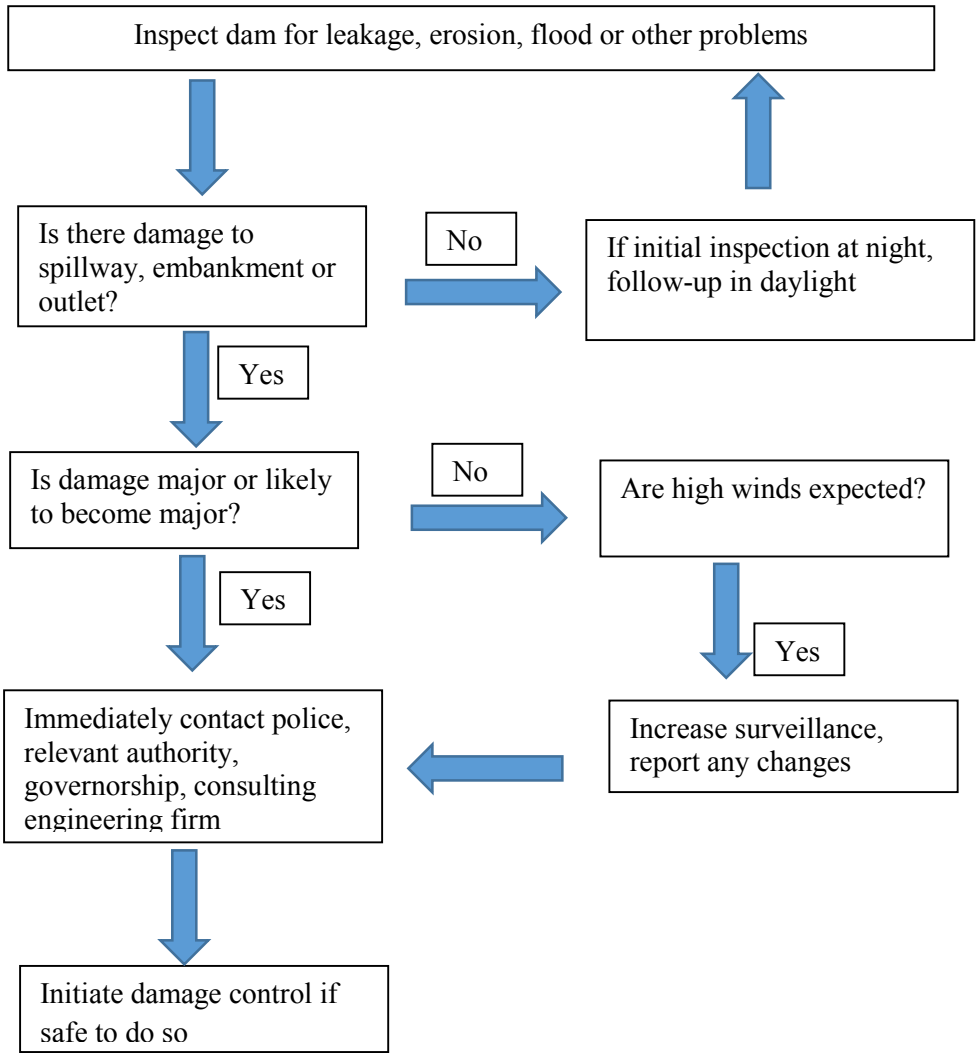
The followings are emergency action flow charts.

Emergency Action Flow-Charts

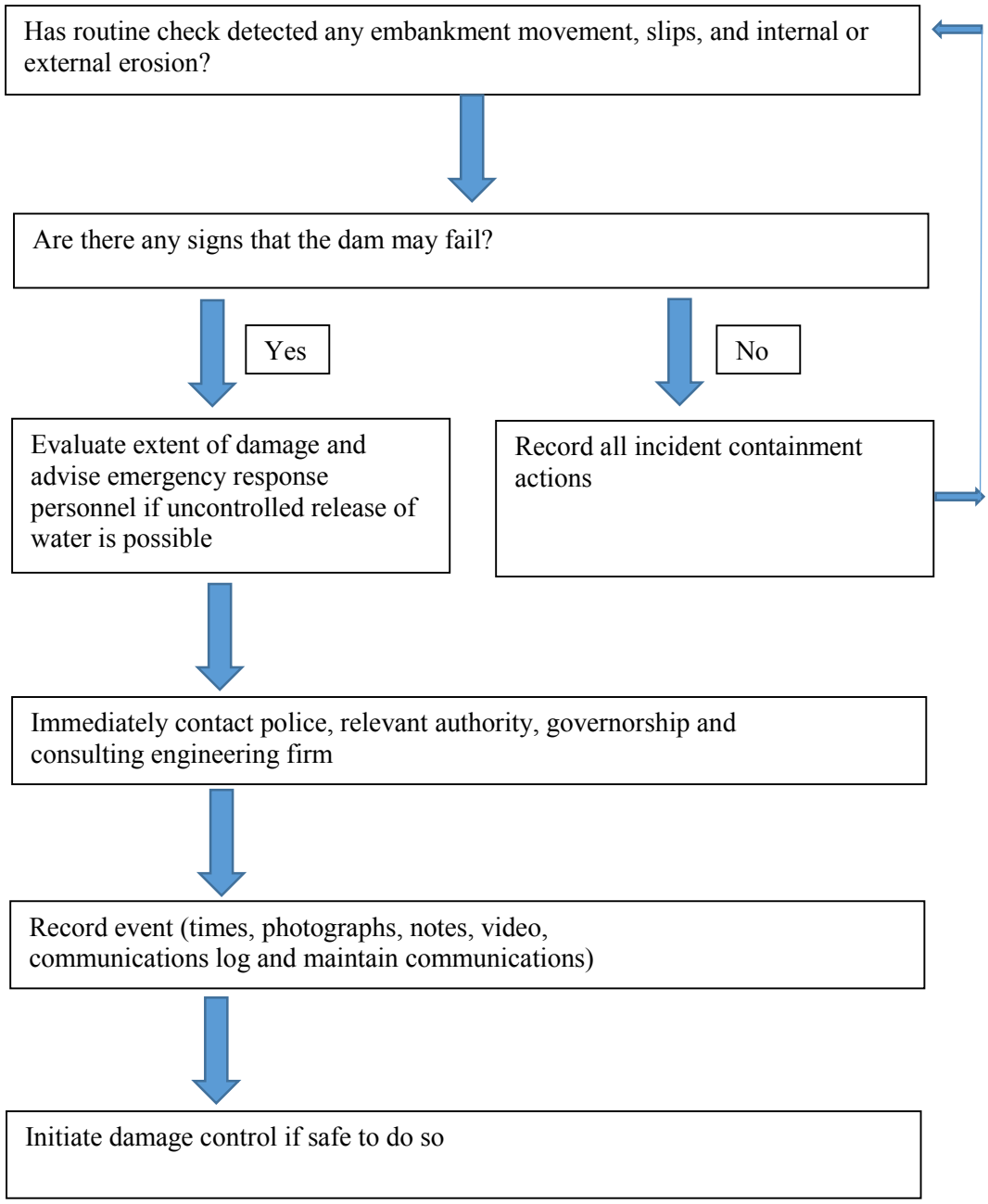
Earthquake:



Extreme flood/ flow:



Major Structural Failure:



Emergency Action Team (EAT)

Table of Emergency Contact List

Main Contact Numbers of Power Plant and Reservoir Area		
Name	**Position**	**Phone No:**
Mr. Xia Yuankang	Project Manager	0086-08756839001
Mr. Zheng Fumin	Health and Safety Supervisor	
Mr. Chen Feng	Assistant General Manager	0086-08756839002
Daw Moe Moe Aye	SE	
U Nay Chi Min	First-aider (Power House)	013331127
U Kawn Bawn	First-aider (Reservoir)	013336528
Mr. Fan Linpeng	Emergency Controller	013331127

Main Contact Numbers from Local Area		
Name	**Position**	**Phone No:**
Chipwi Township Fire Department	For emergency	09-753214
Chipwi Township Police Station	For security	09-451472
Chipwi Township Hospital	For injury	09-853214
Chipwi Township	Chief Administrator	0991001807

Budget Plan

The budget plan for the relief and rehabilitation in case of emergency occurred will be allocated in operation and maintenance cost.

Appendix -5

Public Consultation Meeting of Chipwi Nge Hydropower Project's Environmental and Impact Assessment in accordance with ECD guideline during Covid-19 Pandemic.

Date : 11.12.2020

Time : 1:30 PM to 3:300 PM

Venue : Meeting Hall, GAD Chipwi Township (Zoom Meeting)

Participants : 40 persons

Chipwi Nge Hydropower ProjectPublic Consultation Meeting Minutes

Sr.	Question & Answer
1	**Question :** **U S. Lan Bauk** **Chairman** **May Kha Saydanar Group** **Yin Law Ward** - Thank you for making the Chi Pwe Township to get access to electricity. In 2001, the road from the Chipwi Hydropower project site to 7-mile was constructed. - I had been living in the same yard with the Manager from Chipwi Hydropower project for about three years. - The lemon trees along the roads are lost due to the project but no compensation is given yet. - There had been discussions during the time of the former head of township of Chipwi concerning the compensation, but we still have not received any compensation for our loss. - After the constuctions of the drains along the roads, the calves sometimes dies from falling into those drains. Thus, it would be great if there are draincovers to prevent these incidents. **Answers by Chipwe Nge Hydrpower Company** - Concerning the compensation, we discusssed with the concerned Township Administration Department and already provided the compenstations. The evidence or record is needed for giving the compensation. Thus, in this case, it would be either the evidence or record is irrelvent or there is no proper document for evidence. If there is a relevent document as evidence, we will reconsider for the compensation. We have carried out the compensation process very systematically with proper consideration. - We do not know the exact location of the mentioned drains. I think it would be depending on the slope of the roads. We could not carry out any preventive measure since it could lead to some diffuculties for transportation. However, we will discuss with the concerned authority of Chi Pwe for resovling this matter, and the field surveying will also be carried out for assuring the exact locations of the drains. - **Response by U S. Lan Bauk** - There is still one lemon tree left that can be used as an evidence. I did not apply for the compensation since I considered it as the development of our region. But I mention this here because I did not receive any compenstion for the construction of Manton Road.
2	**Question:** **U Lachiek Lwan Zau**

	Laung Byik Khau Committee **Chipwi- Sawlaw Environmental Conservation Committee** - I am from Chi Pwe- Sawlaw enviromental conservation Committee. I have many things to suggest and propose. There arises many losts and effects on the regions due to the project although we welcome the project. - In the longrun, the dam will be damaged. Due to the mining in the upper course, the water in the dam is discharged for 2 or 3 times. Plus, the biodiversity in the May Kha River and Chi Pwe Stream are also affected. The mining industries should be monitored in accordance with the International Laws and Regulations to prevent the depositing. - If the mining continues, there will be loss of water in the dam, which could lead to the difficulty in generating electricity. Thus, there should be more concern on deterioration of the natural environment and the forest. **Answers by Daw Khin Ohnmar Htwe (REM)** - Thank you for sharing the information as a local resident as well as a member of the Chi Pwe- Sawlaw enviromental conservation Committee. The suggestions made are very reasonable and useful, particularly on the fact that, the mining industries should be monitored and taken action in accordance with local and international rules and regulations. This is very important for the sustainability of the dam itself. - In order to prevent the deforestration, the plants and trees should ne re-planted. The suggestions made for the conservation of the natural environment will also be mentioned in the report.
3	**Question:** **U Phare Bawm Kau** **Local Resident** **Maungon Village** - It is very delighted to know that the company is providing assistance to the township and the villages. We could not tell our opinion openly and there was any collection on the statistics of the agricultural lands before. In 2004, the collection of statistics of the agricultural lands were conducted by Adminstration team for compensation. In 2008, the compensation of 2 lakh MMK was received for the agricultural land and the tealeaf plantation yard. At one-mile, there were impacts due to the discharge of water from the dam. There is still no electricity in that area. Thus, I would like to suggest the company to work closely with the township administrators for this. - **Answers by Daw Khin Ohnmar Htwe(REM)** - Thank you and the information relating the compensation and access to electricity will be discussed later on by the Company.
4	**Question:** **U Chan Bawm** **Head of Village Administration** **Maungon Village** - Thank you very much for giving me the opportunity for discussions. I would like to say thank you to the Company for giving due respect to the local residents and helping for the school and access to safe drinking water. - The areas around the dam should be fenced since there were the incidents of the calves falling into the water.

	- For the areas around one-mile, I would like to request the company to help for getting the access to mobile communication services and the electricity. I heard that is is not concerned with the Company, but I would like to request the Company to consult with the Government and the concerned departments for the access to electricity in this area. - **Answers by Daw Khin Ohnmar Htwe(REM)** - Thank you and the Company and the Administration Department will discuss on the access to electricity and mobile communication services.
5	**Question:** **U Daung Naung** **Nanoo-Narmawzut Village** - In Narmawzut village, due to the quarrying, the football field was damaged and thus I would like to request the Company to reconstruct the field. - For Nanoo village, I would like to request the Company to construct the dorms for the teachers, and help to get the access to mobile communication services. **Answers by Chipwi Hydrpower Company** - Concerning the the access to mobile communication service, the Government has to initiate. The current communication service is got by connecting the fibre lines from Washaung to Chi Pwe. - Currently, the factory is running with only one machine and thus there is deficit. After 230 line is constructed, we will consider the construction of the dorm for teachers as well as the football field. - For the access to electricity, it could only be done by the Company after getting the permission from the Ministry of Electricity and EPGA, and it is also depend on the township's budget.
6	**Question:** **U S. Lan Bauk** **Chairman** **May Kha Saydanar Group** **Yin Law Ward** - I would like to request the Company to rennovate the current road from Panwar 7-mile to Nanoo into a tarred road. **Answers by Chipwi Hydrpower Company** - The Factory has a deficit. Since it is a big project, we need permission from MOEE ıCompany and Asia World.
7	**Question:** **U Taint Kau** **Head of Ukat Ward Administration** - Compansations were given to Myitkyina and Nan Oo Company for their yards, and utility poles are erected. But there is still no powerlines yet for electricity supply. Since only the utility poles along the roads are applied for power supply, I would like to know whether there are plans for using the poles located in the yards. **Answers by Chipwi Hydrpower Company** - These are carried out by DHPI, Asia World and SPCI during the construction phase. Since the compensation has been made, it could only be done with the permission from DHPI.

8	**Question:** **U Zau Yel** **Officer** **Township Development Council** - Chi Pwe is located in the hilly region and is the township with low budget. The Solar Panels of the lampposts in the city's main roads were constructed with the donation of 100 lakh MMK by SPIC Company. I would like to know whether the assistance will be continued by the Company for the next fiscal year since we need more lamposts. - The local people also expect to get more streetlights in the whole township from the hydropower project. There should also be schemes for lower electricity bills and if possible, with free of charge for streetlights. **Answers by Chipwi Hydrpower Company** - The electricity bill is defined by MOEE, and thus SPIC could not do anything with this. SPIC is just supplying electricity, and there are plans to continue the assisatnce on the lampposts. For constructing more lamposts in the areas needed, we will discuss with Chi Pwe Administrative Department.
9	**Question:** **U Tun Tun Naing** **Township Officer** **Department of Electric Power Transmission** - I would like to say thank you to the company for conducting the hydropower project in our region and because of this, there are developments in the region. - In Chi Pwe Township, only 460 households have electrcity supply. I would like to know whether SPIC Company has plans to build a Sub station (from 110 KV to 66/33 KV), and 66/33 KV in Chi Pwe for supplying electricity from Pan War to China. - I would like to request the company to construct the indoor Studio for the local people. **Answers by Chipwi Hydrpower Company** - The matters on 66/33 KV powerline and Panwar-sawlaw line are dependent on the project by MOEE. SPIC could only provide technical assistance for this. - Adding the construction of an indoor studio to 2021's CSR program will be discussed with Chi Pwe Township Administration.
10	**Question:** **U Aung Pyo Wai** **Township Incharge** **Township Fire Services Department** - Since there can be floods and landslides in the rainy season, the rescue services facilities are needed. The ladders are also needed to cut down the trees after landslides in the mountains. A pond is needed in the city as well. **Answers by Chipwi Hydrpower Company** - The provision of rescue services facilities will be added to the Social Sector in the next year program. The construction of the pond will also be added. There will be disuccsions on these for providing them based on priority.
11	Question : **U Aung Pyo Wai** **Township Incharge** **Township Fire Services Department**

	- Since there can be floods and landslides in the rainy season, the rescue services facilities are needed. The ladders are also needed to cut down the trees after landslides in the mountains. A pond is needed in the city as well. **Answers by Chipwi Hydrpower Company** - The provision of rescue services facilities will be added to the Social Sector in the next year program. The construction of the pond will also be added. There will be disuccsions on these for providing them based on priority.
12	**Question :** **U Taint Kaw** **Head of Ward Administration, Bar Le Dan Ward** - There are only 6 or 7 houses in Wan Kay. It is 5-mile far from the river. They need solar energy, and the village road is needed to be repaired. Thus I would like to request the Company to survey this area. **Answers by Chipwi Nge Hydrpower Company** - The provision of solar energy to this area will be added to the Social Sector in the next year program. We will also disuss with the concerned authory. If the road damaged due to landslides is clay road, we could help, but for the concrete roads, we need to discuss with our team.
13	**Question :** **Dr. Lin Lin Htun** **Medical Doctor** **Chi Pwe Township** - Thank you for the assistance for last year and this year. I would like to know if there is any plan to provide ambulance this year since it is necessary due the COVID-19 Pandemic. **Answers by Chipwi Hydrpower Company** - We have already discussed on this matter, since the ambulance is very expensive, we are now not in the condition to donate it.

Meeting Agenda, Invitation Letter and Invitees

ချီဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်းအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ၏လိုအပ်သော စီမံကိန်းနှင့်သက်ဆိုင်သူများနှင့် တွေ့ဆုံဆွေးနွေးခြင်း (Public Consultation Meeting) အခမ်းအနား

	အချိန်	အစီအစဉ်	တင်ပြဆွေးနွေးမည့်သူ
၁	နေ့လည်၁:၃၀	အစီအစဉ်စတင်ကြောင်းကြေငြာခြင်း	
၂	နေ့လည်၁:၃၀ နာရီမှ ၁:၄၅ နာရီ အထိ	ချီဖွေရေ အားလျှပ်စစ်စက်ရုံ၏လက်ရှိ အကြောင်းအရာများကိုရှင်းလင်းပြောကြားခြင်း	ဒေါ်မိုးမိုးအေး တာဝန်ခံအင်ဂျင်နီယာ၊လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေး၊(EPGE, MOEE) ချီဖွေရေ အားလျှပ်စစ်စက်ရုံ
၃	နေ့လည်၁:၄၅ နာရီ မှ ၂:၀၀ နာရီ အထိ	ချီဖွေရေအားလျှပ်စစ် စက်ရုံ၏လက်ရှိအခြေအနေနှင့် ဒေသဖွံ့ဖြိုးရေးဆောင်ရွက်မှုများကို ရှင်းလင်း တင်ပြခြင်း	ချီဖွေရေအားလျှပ်စစ် Co., Ltd,
၄	နေ့လည်၂:၀၀ နာရီ မှ ၂:၂၀ နာရီ အထိ	ချီဖွေရေအားလျှပ်စစ်စီမံကိန်း၏ပတ်ဝန်းကျင် လေ့လာဆန်းစစ်ခြင်းနှင့်ပတ်သက်သောအချက် အလက်များကိုရှင်းလင်းတင်ပြ အကြံဉာဏ်ရယူခြင်း	ဒေါ်ခင်ဥမွာထွေး၊ REM Company
၅	နေ့လည်၂:၂၀ နာရီ မှ ၃:၃၀ နာရီ အထိ	တက်ရောက်လာသူများမှ မေးခွန်းများမေးမြန်းခြင်းနှင့်အကြံဉာဏ်ရယူခြင်း	
၆		အစီအစဉ်ပြီးဆုံးကြောင်းကြေငြာခြင်း	

ဖိတ်ကြားလွှာ

ချီဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်းအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ၏လိုအပ်သော စီမံကိန်းနှင့်သက်ဆိုင်သူများနှင့် တွေ့ဆုံဆွေးနွေးခြင်း (Public Consultation Meeting) အခမ်းအနား

လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာနနှင့် SPIC Yunnan International Power Investment Co.,Ltd ၊Asia World Co., Ltd တို့ပူးပေါင်းဆောင်ရွက်သည့် **ချီဖွေငယ်ရေအားလျှပ်စစ်**စီမံကိန်း နှင့် ပတ်သက် သော ပတ်ဝန်း ကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းအစီရင်ခံစာကို မြန်မာနိုင်ငံမှ Resource and Environment Myanmar Co., Ltd. (REM) နှင့်တွဲဖက်လုပ်ဆောင်လျက်ရှိပါသည်။

သို့ဖြစ်ပါ၍ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာအတွက်လိုအပ်သော စီမံကိန်းနှင့် သက်ဆိုင်သူများအား တွေ့ဆုံဆွေးနွေးခြင်း (Public Consultation Meeting) အခမ်းအနားကို Zoom Meeting ဖြင့်ဆောင်ရွက်မည် ဖြစ်ပါသဖြင့် အောက်ဖော်ပြပါ အစီအစဉ်အတိုင်း ဆောင်ရွက်မည်ဖြစ်ပါသဖြင့် စိတ်ပါဝင်စားသူများ တက်ရောက်နိုင်ပါရန်လေးစားစွာ ဖိတ်ကြား အပ်ပါသည်။

(ZOOM Meeting ဖြင့် အစည်းအဝေး အစီအစဉ်ကျင်းပမည်ဖြစ်ပါသဖြင့် ချီဖွေမြို့နယ် အထွေထွေ အုပ်ချုပ်ရေးမှူးရုံးသို့ ၂၀၂၀ခုနှစ် ဒီဇင်ဘာလ(၁၁)ရက်၊ နေ့လည်(၁း၃၀)နာရီအရောက် ကြွရောက်ပါရန်)

<u>အစည်းအဝေးအစီအစဉ်</u>

ရက်စွဲ။ ။၂၀၂၀ခုနှစ် ဒီဇင်ဘာလ(၁၁)ရက်၊
အချိန်။ ။ နေ့လည်(၁း၃၀)နာရီ မှ (၃း၃၀) နာရီထိ
နေရာ။ ။ ချီဖွေမြို့နယ် အထွေထွေအုပ်ချုပ်ရေးမှူးရုံး၊ ချီဖွေမြို့နယ်

ဆက်သွယ်ရမည့် Zoom Meeting:
Meeting ID : 849 7599 6216
Passcode : 028855

<u>ဖိတ်ကြားမည့်သူများ</u>

စဉ်	ပန်ကြီးဌာန	ဌာန	မှတ်ချက်
၁	သယံဇာတနှင့်ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၊ ကချင်ပြည်နယ်	မြစ်ကြီးနား + ၁
		ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၊ မြစ်ကြီးနား ခရိုင်	မြစ်ကြီးနား + ၁
		လျှပ်စစ်စွမ်းအားစီမံရေးဦးစီးဌာန	နေပြည်တော်
၂	လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန	ရေအားလျှပ်စစ်ဦးစီးဌာန	မြစ်ကြီးနား
		ဒေါ်မိုးမိုးအေး၊ တာဝန်ခံအင်ဂျင်နီယာ၊လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေး၊ချီဖွေရေအားလျှပ်စစ်စက်ရုံ	ချီဖွေမြို့
		အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန	
၃	ချီဖွေမြို့နယ်	လယ်ယာမြေစီမံခန့်ခွဲရေးနှင့်စာရင်းအင်းဦးစီးဌာန	
		သစ်တောဦးစီးဌာန	
		ငါးလုပ်ငန်းဦးစီးဌာန	
		ကျေးလက်ဖွံ့ဖြိုးရေးဦးစီးဌာန	

		ကယ်ဆယ်ရေးနှင့်ပြန်လည်နေရာချထားရေး ဦးစီးဌာန	
		စိုက်ပျိုးရေးဝန်ကြီးဌာန	
		လူမှုဝန်ထမ်းကယ်ဆယ်ရေးနှင့် ပြန်လည်နေရာချထားရေး ဝန်ကြီးဌာန	
		မီးသတ်ဦးစီးဌာန	
		ချီဖွေမြို့နယ် ဆက်စပ်ဌာနဆိုင်ရာများ	
		CSO များ၊ ကော်မတီများ	
		ချီဖွေမြို့ပေါ်ရှိ ရပ်ကွက်အုပ်ချုပ်ရေးမှူးများ	
		SPIC Yunnan International Power Investment Co.,Ltd ၊Asia World Co., Ltd	
		REM Co., Ltd	

Meeting' Photographs

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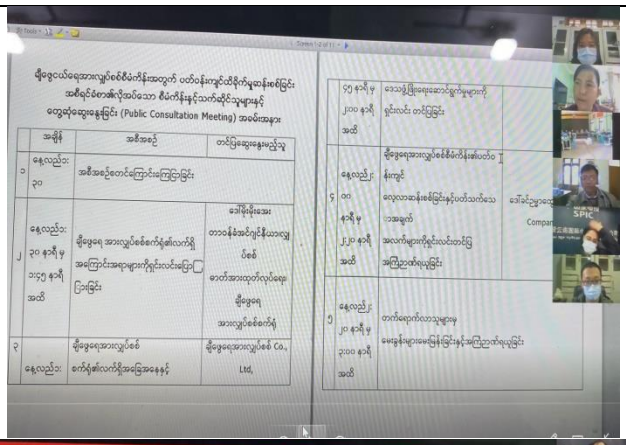
<td>  </td>
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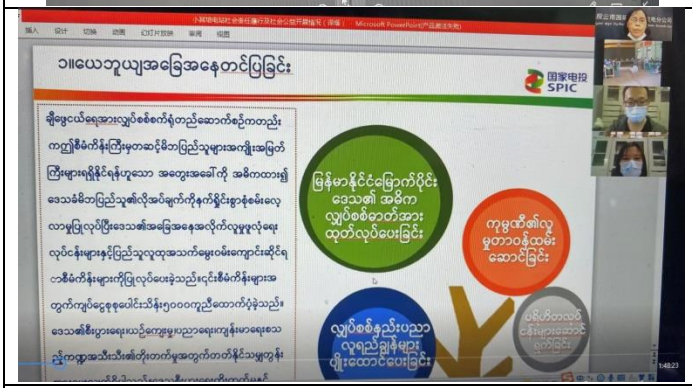
<td> 
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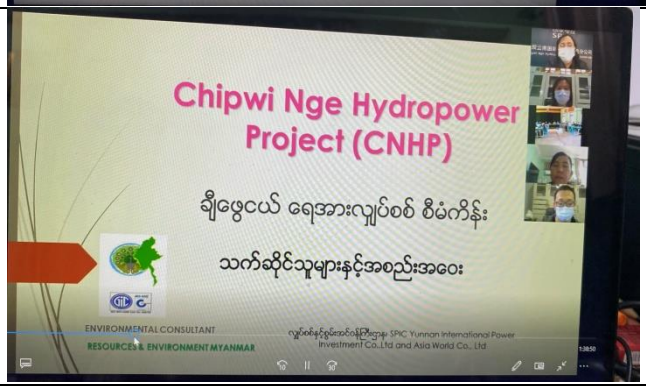
<td> 
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<td colspan="2">Chipwi Nge HPP' Public Consultation Meeting with Zoom Application (11.12.2020)</td>
</tr>
</table>

U S. Lan Bauk
Chairman, May Kha Saydanar Group, Yin Law Ward

U Lachiek Lwan Zau
Laung Byik Khau Committee

U Phare Bawm Kau
Local Resident, Maungon Village

U Chan Bawm
Head of Village Administration
Maungon Village

U Daung Naung
Nanoo-Narmawzut Village

U Taint Kau
Head of Ukat Ward Administration

U Taint Kaw
Head of Ward Administration, Bar Le Dan Ward

U Zau Yel, Officer
Township Development Council

 U Tun Tun Naing Township Officer Department of Electric Power Transmission	 U Nyunt Swe Head of Township Administration Department Township General Administration Department, Chipwi Township
 U Aung Pyo Wai Township Incharge Township Fire Services Department	 Dr. Lin Lin Htun Medical Doctor Chi Pwe Township

List of Attendances

ရှိဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်းအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း
အစီရင်ခံစာ၏လိုအပ်သောစီမံကိန်းနှင့်သက်ဆိုင်သူများနှင့်
တွေ့ဆုံဆွေးနွေးခြင်း (Public Consultation Meeting) အခမ်းအနားတက်ရောက်သူများ

စဉ်	အမည်	ဌာန/ရပ်ကွက်	လက်မှတ်
၁.	ဦးညွန့်ဆွေ ([illegible])	ဆွေ/[illegible]	[illegible]
၂			
၃			
၄	ဦး[illegible]	ပညာရေး	[illegible]
၅	ဦး[illegible]	[illegible]	[illegible]
၆	ဦး[illegible]	[illegible]	[illegible]
၇	ဦး[illegible]	[illegible]	[illegible]
၈	ဦး[illegible]	မြို့နယ်[illegible]	[illegible]
၉	ဦး[illegible]	လျှပ်စစ်	[illegible]
၁၀	ဦး[illegible]	[illegible]	[illegible]
၁၁	ဦး[illegible]	[illegible]	[illegible]

ရပ်ကွက်အုပ်ချုပ်ရေးမှူး ၊ အလယ်ပိုင်းကျေးရွာ ၊ ရပ်မိရပ်ဖများ

ရှီဖွေ့ငယ်ရေအားလျှပ်စစ်စီမံကိန်းအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း
အစီရင်ခံစာ၏လိုအပ်သောစီမံကိန်းနှင့်သက်ဆိုင်သူများနှင့်
တွေ့ဆုံဆွေးနွေးခြင်း (Public Consultation Meeting) အခမ်းအနားတက်ရောက်သူများ

စဉ်	အမည်	ဌာန/ရပ်ကွက်	လက်မှတ်
၁။	ဦးချိုးအောင်	မောင်ရှိ ရပ်ကွက်လူကြီး	[signature]
၂။	ဦးရဲအောင်ကြည်	" မောင်ရှိ ရပ်မိရပ်ဖ	[signature]
၃။	ဦးကျော်ကြီး	အုပ်ချုပ်ရေးမှူး	[signature]
၄။	ဦးအောင်ဝင်းအောင်	[illegible]	[signature]
၅	ဦးကာဒိုကျော်အောင်	[illegible]	[signature]
၆	ဦးစိုးနိုင်	[illegible]	[signature]
၇	ဦးဝေဇော်နိုင်	ဘားလဲ - အုပ်ချုပ်ရေးမှူး	[signature]
၈	ဒေါ်မြင့်ဝင်း	ဘားလဲ - ရပ်မိရပ်ဖ	[signature]
၉	ဦးမင်းကျော်	နာဂေါင် ရွာ	[signature]
၁၀	ဦးမြအေး	" ရပ်မိရပ်ဖ	[signature]
၁၁	ဦးဇော်မင်း	အုပ်ချုပ်ရေးမှူး ရှာပေါ	[signature]

ချီဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်းအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း
အစီရင်ခံစာ၏လိုအပ်သော စီမံကိန်းနှင့်သက်ဆိုင်သူများနှင့်
တွေ့ဆုံဆွေးနွေးခြင်း (Public Consultation Meeting) အခမ်းအနားတက်ရောက်သူများ

စဉ်	အမည်	ဌာန/ရုပ်ကွက်	လက်မှတ်
၁	ဒေါ်ရီရီမြင့်	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၊ကချင်ပြည်နယ်	
၂	ဦးရွှေပြည်စိုး	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၊မြစ်ကြီးနားခရိုင်၊ကချင်ပြည်နယ်	
၃	ဦးအောင်ဇော်ဝင်း	ဒုတိယညွှန်ကြားရေးမှူး၊ရေအားလျှပ်စစ်ဦးစီးဌာန၊မြစ်ကြီးနား	
၄	ဒေါ်မိုးမိုးအေး	တာဝန်ခံအင်ဂျင်နီယာ၊လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေး၊ချီဖွေရေအား လျှပ်စစ် စက်ရုံ	
၅	ဒေါက်တာလင်းလင်းထွန်း	မြို့နယ်ဆရာဝန်၊ချီဖွေဆေးရုံ	
၆	ဦးဝင်းနိုင်ထွန်း	Resource and Environment Myanmar, REM	
၇	ဦးကျော်ဇင်ဝင်း	Resource and Environment Myanmar, REM	
၈	ဒေါ်ခင်ဥမ္မာထွေး	Resource and Environment Myanmar, REM	
၉	ဦးသူရအောင်	Resource and Environment Myanmar, REM	
၁၀	Mr Xiayuankang	Vice-Manager, Chipwi Nge Hydrpower Company	
၁၁	Mr.Zheng Fumin	Chief Manager of Dept. of HSE	
၁၂	Mr.Li Wenbin	Chief Manager of Dept.of PR	
၁၃	Mr. Li Ning	Chief Manager of Dept.of Planning & Contract	
၁၄	Mr.Lin Shuli	Chipwi Nge Hydrpower Company' Staff	Ko Myint Lwin
၁၅	Ms.Tan Meisheng	Chipwi Nge Hydrpower Company' Staff	Ma U Yuzana Win
၁၆	Ms.Yuan Wenxi	Chipwi Nge Hydrpower Company' Staff	Ma Nu Nu Yee
၁၇	Daw Lin Lin Lwin	Chipwi Nge Hydrpower Company' Staff	Daw Lin Lin Lwin

၁၈	Mr.Yin Dingyong	Chipwi Nge Hydrpower Company' Staff	Mr.Yin Dingyong

Feedback Forms

အကြံပြုလွှာ

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ဆက်သွယ်ရန်ဖုန်းနံပါတ်	09-402662250	
ဌာနရပ်ကွက်	ဝေ့ချ/ဆုပ်	

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အကြံပြုလွှာ

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အကြံပြုလွှာ

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အကြံပြုလွှာ

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အကြံပြုလွှာ

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Appendix -6 Additional CSR Program

Chipwi Nge Hydropower Co., Ltd. had already planned to do CSR activities and performed the following areas.

- **Education Assistance**: The "ACHC scholarship" was established to aid the outstanding students to support the education.
- **Health,**
- **Disaster donation**
- **Road**
- **Electricity**

The proponent will make a commitment for CSR to accomplish the following tasks:

No.	CSR	2016-2020		Yearly		Description
		Myanmar Kyats	%	Myanmar Kyats	%	
1	Activities related to religious affairs	14 Million	9.3%	2.8 Million	9.3%	1. June 14, 2018, Donation of 10 Million MMK for renovation materials for the Buddhist temple in Chipwi Township ; 2.In 2018 and 2019, Donation of 2 Million MMK for Buddhist Lighting Lantern Day and the Offering Day activities; 2 Million for New Rice Festival and Christmas of Christianity and Catholicism.
2	Activities related to health of employees and their family	43.12 Million	28.7%	8.624 Million	28.7%	1. March 17, 2017, Funding 12 doctors in Yangon of 20 Million MMK for health examination of conflict displaced people in Chipwi and Upstream areas. 2. July 5, 2018, Donation of 20 Million MMK for conflict displaced people treatment expenses to "Kachin State Free Medical Fund". 3. October 15, 2018, Donation of 3 Million MMK drug procurement expenses to Chipwi Township Hospital ; 4. June 10, 2019, Donation 5 Million MMK drug

						procurement expenses to Chipwi Township Hospital； 5. October 22, 2020, Donation 5 Million MMK drug procurement expenses to Chipwi Township Hospital； 6. October 22, 2020, Donation of 3.5 Million MMK repair costs to Lupi Village clinic and Banwa Township People's Hospital. 7.In 2020，Donation of 5 Million MMK Anti-COVID19 materials for Chipwi Township Government.
3	Activities related to communication development in the region	/	/	/	/	In 2019, providing about 100 kilometers of communication optical fibers free of charge to MPT Company and base stations in Chipwi Nge HPP. The communication network between Waimaw Township and Chipwi Township has been greatly improved, and the public can use a smooth 4G network.
4	Activities related to education matters for the children of employees	41 Million	27.3%	8.2 Million	27.3%	1. October 12, 2017，Award 1 Million MMK scholarship to school students of Chipwi Township； 2. October 15, 2018，Award 4 Million MMK scholarship to school students of Chipwi Township； 3. January 24, 2019, Donation of 100 sets of panda schoolbags and school supplies to students of grades 1-4 in Chipwi Township worth 2 Million MMK. 4. October 28, 2019，Award 5 Million MMK scholarship to school students of Chipwi Township； 5. June 10, 2019，Donation of 10 Million MMK for renovation expenses for schools in Chipwi Township； 6. December 4, 2019, Donation of 10 Million MMK of literature and culture funds to government of Chipwi Township ；

						7. August 7, 2020, Donation of 4 Million MMK for repair and maintenance of school facilities in Maung Gu Na village , Chipwi Township 8. October 19, 2020, Award 5 Million MMK scholarship to school students of Chipwi Township ;
5	Activities in relation to regional development (Chipwi Township)	52.10 Million	34.7%	10.42 Million	34.7%	1. March 15, 2016, Donation of 5 Million MMK to Chipwi and Shalaw debris flow affected areas in northern Myanmar ; 2. October 19, 2018, Funding 10 Million MMK for the school children in areas hit by debris flow in the upper reaches of Ayeyawady River ; 3. June 10, 2019, Donation of 18 Million MMK for water supply facility construction in villages of Chipwi Township ; 4. August 8, 2020, Donate solar streetlights to Chipwi Township worth 10 Million MMK ; 5. August 8, 2020, Donation of 5 Million MMK construction cost for drinking water facilities to Woqi Village in Chipwi Township; 6. October 22, 2020, Donation of 3 Million MMK repair costs for cable suspension bridge of Yegyue Village in Chipwi Township ; 7. October 28, 2020, Donation of power transmission line renovation costs and electric poles to Woqi Village worth 1.1 Million MMK ; 8.From 2016 to 2020, Maintenance of Banwa-Chipwi Road during the rainy season.
	Total	150.22 Million		30.044 Million		

Appendix VII

List of Commitments

99MW Chipwi Nge Hydropower Station Project in Chipwi Township, Kachin State

Commitments for Environmental and Social Impact Assessment (ESIA) of the Project

Chapter 3 Laws and regulations of Myanmar	
Commitment Source	Commitment
Table 3.3-1 Legal Framework related to the present project	Chipwi Nge Hydropower Company shall follow these laws and regulation during construction and operation of the present hydropower project. ▪ National Environmental Policy (1994) ▪ Myanmar Agenda (1997) ▪ The 2008 Constitution ▪ Environmental Conservation Law (2012) ▪ Environmental Conservation Rule (2014) ▪ EIA Procedures (2015) ▪ National Environmental Quality (Emission) Guidelines (2015) ▪ The Forest law (1992) ▪ The protection of wildlife, wild plant and Conservation of Natural Area Law (1994) ▪ The protection of preservation of Cultural Heritage Region Law (1994) ▪ Land Acquisition Act (1894) ▪ Farmland Law and Rule 2012 ▪ The Myanmar Citizen Investment Law (2013) ▪ The Electricity Law (2015) ▪ The Conservation of Water Resources and River Law (2006) ▪ The Conservation of Cultural Heritage Objects Law (2015) ▪ Protection and prevention of ancient buildings (2015) ▪ The Prevention of Hazard from Chemical and Related Substances Law (2013) ▪ Social Security Law (2012) ▪ Workmen's Compensation Act (1923) ▪ The Minimum Wage Law (2013)

	▪ Employment and Skill Development Law (2013) ▪ The Leave and Holiday Act (1951) ▪ The Labour Organization Law (2011) ▪ The Labour Dispute Settlement Law (2012) ▪ Motor Vehicles Law (2015) ▪ Export and Import Law (2015) ▪ The Explosive Substances Act (1908) ▪ Kachin State Municipal Act (Kachin State Parliament Law No. 10/2013)

Chapter 4 Project overview	
Commitment Source	Commitment
4.4.2 Project scale and major features	According to Flood Control Standard (GB50201-94) and Classification & Design Safety Standard of Hydropower Projects (DL5180-2003), the project is a medium Grade III project, major buildings such as dam and diversion power generation system are of Grade III, secondary buildings of Grade IV, and temporary buildings of Grade V. Hydraulic structures are of Grade II security.
Table 4.4-1 Engineering Features of Chipwi Nge Hydropower Station	Chipwi Nge Hydropower Co., Ltd. shall implement the project according to Engineering Features of Chipwi Nge Hydropower Station that is mentioned in table 4.4-1.
4.6.2.2 Diversion standard	Water retaining dam of Chipwi Nge Hydropower Station belongs to Grade III permanent hydraulic structure. In the light of Specifications for Construction Planning of Water Resources and Hydropower Engineering (SDJ338-89), diversion building for the protection of permanent building construction is of Grade V. Upstream and downstream earth-rock cofferdams and diversion tunnel of water retaining dam are of Grade V.

Chapter 8 Environmental risk assessment	
Commitment Source	Commitment
8.3.1 Measures against	Chipwi Nge Hydropower Co., Ltd. shall commit to follow

environmental risk of oil depots	these measures against environmental risk of oil depots. (1) Formulate the rigorous oil depot safety management system, and standardize oil transportation, storage and use. (2) Oil depots are provided with telephones connected with local firefighting department for immediate contact. (3) Smoke and fire are forbidden in oil depots, and source of ignition likely to lead to fire should be checked periodically, such as wire; in oil loading and unloading and vehicle refueling, related personnel should make patrol inspection so as to eliminate smoking. (4) Fire pump house is provided with fire pump and fixed low-expansion foam fire extinguishing system, a sub-grounded fire pool that can provide enough water for extinguishing one fire. (5) Oil depots should be provided with some oil spilling control emergency equipment and appliances.
8.3.2 Explosive magazine environmental risk prevention measures	Chipwi Nge Hydropower Co., Ltd. shall commit to follow these Explosive magazine environmental risk prevention measures. (1) The stock of a single explosive magazine should meet requirements of criteria. (2) Explosive magazine is built with gate and fencing wall, and the distance between fencing wall and each warehouse is above 15m. Lookout posts are provided in explosive magazine; duty room is arranged at a suitable position 250m away from warehouse. (3) Explosive magazine and detonator magazine are provided with outdoor fire hydrants, and fire pools are arranged on the slope outside the magazines. (4) There is no electric equipment in warehouses according to criteria; cables in warehouses are buried, and outside power lines are laid overhead. (5) Independent lightning rod tower is adopted to protect warehouses against lightning stroke.
8.4 Risk accident emergency plan	Chipwi Nge Hydropower Co., Ltd. shall commit to implement Risk accident emergency plan and Emergency procedures. The following is the emergency plan for environmental risks of oil depots and explosive magazines: 1) Emergency plan areas 2) Framework and personnel of emergency organization

	▪ Emergency leadership ▪ Site command ▪ Emergent rescue personnel ▪ Alarm and communication ways ▪ Emergency protection measures ▪ Plans for personnel evacuation ▪ Close the emergency rescue and recovery measures ▪ Emergency Training Program ▪ Public education and information Chart 8.4-1 Emergency procedures

Chapter 11 Environmental management plan (EMP)	
Commitment Source	Commitment
11.1.1.1 Water environment protection measures	Chipwi Nge Hydropower Co., Ltd. shall implement following protection measures for water environment. ▪ Alkaline wastewater treatment processes ▪ Oily wastewater treatment process ▪ Domestic sewage
11.1.1.2 Ecological and environmental protection measures	Chipwi Nge Hydropower Co., Ltd. shall implement following Ecological and environmental protection measures. <u>Ecological environment protection measures</u> ▪ Raise awareness of construction workers to protection, and it is prohibited to hunt wild animals. ▪ Install animal protection warning signs in the construction area. ▪ Make a reasonable arrangement for the operation time of construction machines to try to avoid disturbances to the animals; and the highly noisy construction activities, such as blasting, shall be avoided in the breeding seasons of animals. ▪ Establish construction area fire prevention and fire alarm systems to prevent and avoid the damages caused by fire to the vegetation. <u>Restoration and compensation measures for ecological impacts</u> ▪ The on-site restoration and greening will be carried out as ecological environment construction. ▪ The vegetation surrounding the main structures,

	construction camps, spoil yards, excavation sites and two sides of the roads shall be restored, to maintain the vegetation coverage against construction activities and ensure the original ecological functions of the area. ▪ Carry out appropriate monitoring of dynamics of populations and species according to the habitat characteristics and distributions of mammals, birds, amphibians and reptiles.
11.1.1.3 Water and land conservation measures	According to the layout, functions, construction technologies and construction features of Chipwi Nge Hydropower Station, five water and land conservation zones are determined: prevention and treatment zone for main structures; prevention and treatment zone for roads; prevention and treatment zone for construction, production and living activities; prevention and treatment zone for excavation site; and prevention and treatment zone for spoil yard.
11.1.1.4 Population health protection	Chipwi Nge Hydropower Co., Ltd. shall conduct following Population health protection. 1) Environmental health management Carry out health inspections on a regular basis. In addition to daily cleaning, overall cleaning will be carried out at least once per month, and the living garbage shall be collected with garbage bins, and then sorted for treatments. 2) Health and epidemic prevention The diseases involved in quarantine include dengue fever, malaria, cholera, hepatitis and other infectious diseases, and these diseases must be treated in a timely manner upon found. Provide preventive medication, vaccination and other preventive measures on a regular basis to the construction workers. 3) Public health facilities Full-time health personnel will be appointed to take responsibilities of the general treatments of diseases and accidents; carry out inspection of epidemic prevention on a regular basis; and publicize and introduce relevant health and epidemic prevention knowledge to the construction workers. Improve the hygiene conditions at the construction area. 4) Labor protection for construction workers Provide dust prevention supplies, such as dust masks to the workers who work in highly dusty environment.

11.1.1.5 Atmospheric environmental protection	Chipwi Nge Hydropower Co., Ltd. shall implement following atmospheric environmental protection. ▪ Dust reduction and control for excavation and blasting ▪ Dust reduction and control for aggregate system and concrete system ▪ Fuel gas reduction and control ▪ Traffic dust reduction and control
11.1.1.6 Noise control	Chipwi Nge Hydropower Co., Ltd. shall implement following Noise control. Noise source control ▪ Make a reasonable arrangement for the construction time. Noise prevention for construction workers ▪ Provide anti-noise earplugs, anti-noise earmuffs, anti-noise helmets and other protective equipment to the construction workers who are under great noise impacts.
11.1.1.7 Disposal of solid wastes	Chipwi Nge Hydropower Co., Ltd. shall perform following arrangement for Disposal of solid wastes. (1) Disposal of domestic wastes Trash bins in different colors will be available in the construction and living area and they are used for collecting inorganic and organic wastes. Remove the wastes from the living camp and construction site on a regular basis, and transport them to designated waste collection stations for landfill as the disposal. (2) Disposal of construction wastes During the transport of building materials, the goods shall be well covered to avoid spilling of sand, gravel or soil, and the main roads shall be cleaned on a regular basis.
11.2.1 Environmental management department	Chipwi Nge Hydropower Co., Ltd. shall establish an environmental protection department.
11.2.2 Environmental management tasks during construction	Chipwi Nge Hydropower Co., Ltd. shall implement environmental management tasks during construction. ▪ Develop planning and management approaches for environmental protection in construction stage ▪ Develop annual environmental protection plans, including environmental investment plans ▪ Organize tendering for specific environmental protection tasks

	▪ Supervise the implementation of the contractor's environmental measures ▪ Supervise and inspect the operation of environmental protection measures related to construction ▪ Help the constructors to deal with environmental disputes and environmental pollution accidents related to construction activities ▪ Organize to implement environmental supervision and environmental monitoring works ▪ Organize to carry out publicity, education and training of environmental protection
11.2.3 Environment management tasks in operation periods	Chipwi Nge Hydropower Co., Ltd. shall implement environment management tasks in operation periods. ▪ Implement environment management measures and develop management practices and systems in operation periods of the project. ▪ Help the Myanmar authorities to carry out environmental protection works, and participate in ecological protection works. ▪ Implement environmental monitoring in the operation periods, and analyze the results statistically.
11.2.7.1 Terrestrial Ecology (Biodiversity) and Watershed Management Plan	The biodiversity and watershed management plan will contain measures to protect biodiversity within the Chipwi Nge Hydropower project area including all, or a combination of the following: ▪ Improvements to the physical demarcation of reserve areas; ▪ Coordination of the implementation of watershed area management plans; ▪ Capacity building and training for watershed area's wardens and patrols; ▪ Additional ecological baseline studies, as required; ▪ Coordination of establishment of necessary infrastructure – control posts, toll gates, staff housing, trails; ▪ Installation of signage and fencing, as required in watershed area; ▪ Development of an access management strategy including control of ingress and egress of vehicles to the project area, gates and access barriers; ▪ Development and implementation of a worker code of

	conduct prohibiting hunting, fishing and possession of wildlife for human consumption (bush meat); ▪ Development of mechanisms for inter-agency cooperation between the provincial forest management department and natural reserve management board; ▪ Environmental education and awareness in local communities and project personnel; ▪ Coordination of activities in the protected areas buffer zone; ▪ Strengthening forest patrolling and law enforcement ▪ Developing model of Community-based forest management (CBFM) Environmental education for project workers and local public Main activities include: - Install educational sign boards with conservation messages and forest fire prevention. - Print posters, leaflets, etc. with nature conservation messages and distribute them to worker camps, service facilities (shops, restaurants, office, etc.) in power plant, dam site, and villages within project area. - Environmental Engineer of Environmental Management Department will be responsible for implementation of these activities. Fund for these activities will be from Chipwi Nge Hydropower Company Ltd. ▪ Monitoring program for impacts on Endangered wildlife species in Project areas (Power Plant, Reservoir Area and Watershed) ▪ Vegetation Recovery in Power Plant Area (area, quantity and kinds)
11.2.7.2 Environmental Management Plan for Hydrology and Environmental Flow	Chipwi Nge Hydropower Company Ltd. shall commit to discharge 0.53m^3/s as the ecological flow from the reservoir. It is committed to control ecological flow for conserving basic ecological system of downstream if it is necessary.
11.2.7.3 Environmental Management Plan for Water Quality	Chipwi Nge Hydropower Company limited will employ an environmental monitoring contractor to monitor water quality in the reservoir and downstream. Laboratory Analysis and in-situ test

	(Tem., pH, Turbidity, TSS, DO, BOD, Ammonia, Nitrate, Phosphorous, Fecal Coliform, Total Coliform) Water Quality Monitoring Point 1 station in reservoir, 1 station in upstream of dam, 1 station in downstream of dam, 1 station in downstream of power house and 1 station in upstream of power house (surface, mid depth and bed,). Monitoring time: Every 6 months for 5 years
11.2.7.4. Environmental Management Plan for Dam Safety	Dam Safety Reviews The initial dam safety review should be carried out two years after construction is substantially complete and then every five years afterwards. Disaster Preparedness Plan (DPP) Prepare a Disaster Preparedness Plan (DPP) with activities and responsibilities to minimize loss of life and property damage. Emergency Warning System Set up emergency warning system to inform people of likely dam failure and emergency actions to save lives and communities.
11.2.7.5 Waste Management Plan	The following tasks shall be done as daily basis. ▪ Waste shall be systematically collected and all types of waste will be separated for (kitchen waste, office's waste, etc.) proper handling and disposal. ▪ No waste shall be disposed of or buried on the site. Illegal dumping, either at the office compound, along public roads or in the surrounding areas, or into the river shall not be allowed. ▪ Domestic solid wastes will be collected and disposed properly by the nearest municipality to the designated disposal site after agreement with the municipality. ▪ Power house and reservoir workers will be instructed in proper solid waste storage and handling procedures.
11.2.7.6 Health and Safety Plan	Chipwi Nge Hydropower Company limited shall perform the following; OSH activities

	▪ Promoting health and safety awareness through training workers on health and safety regulations; ▪ Regular inspection of the workplace; ▪ Correcting unsafe work practices and conditions; ▪ Reporting and investigating all accidents or incidents so as to minimize or eliminate hazards; ▪ Post the safety sign such as "ENTRANCE", "EXIT", "DANGER", etc. in the workplace; ▪ Keep fire extinguishers, first-aid kits and PPEs adequately in the workplace; ▪ Keep the emergency contact numbers at the workplace where employees see it clearly. ▪ Main Diseases in the Project Affected Area ▪ The following measures shall be implemented by the Contractor to ensure an adequate Project Health Program: ▪ Screening of all workers on recruitment and annually ▪ Implementation of a comprehensive vaccination program ▪ Implementation of anti-malaria measures ▪ Storing sufficient medicines for malaria treatment ▪ Storing antibiotics for treatment of respiratory infections; ▪ Storing medicines and transfusion fluid to treat food poisoning and diarrhea ▪ Establishment of a medical center located at the main office in power house.
11.2.7.7 Environmental Management Plan for Aquatic Ecology (Mainly fish)	The Chipwi River upper catchment is identified as a key area for aquatic (mainly fish) habitat protection, to enhance the conservation of moderate priority fish in the project area, as well as to maintain vegetation and reduce soil loss, to prevent negative impacts on aquatic habitats. Action ▪ Identification of the most depleted areas in the upper catchment and preparation of suitable habitat improvement plans that include sediment erosion controls (watershed management). ▪ Implementing an afforestation program around the reservoir. ▪ Community awareness program Implementation Plan The Environmental Management Department will assign the

	aquatic specialist to monitor fish population in the dam area and downstream of dam. The duties of the aquatic specialist are as follows: Aquatic Specialist: ▪ Review all available data on aquatic (mainly fish) of the Chipwi Nge Hydropower Project and the project location and its characteristics. ▪ Obtain and review data from other studies, such as universities and government departments like environmental conservation department, etc., as appropriate; ▪ Annual monitoring of fish populations in dam area, and downstream of dam (especially 15.7km section). According to the annual monitoring results, if found abnormal condition of aquatic (mainly fish) habitat, monitoring frequency will be increase to two times per year. ▪ Prepare annual monitoring report and submit to Environmental Management Department
11.2.7.8 Environmental Management Plan for Flood Risk	Chipwi Nge Hydropower Co., Ltd. shall implement Environmental Management Plan for Flood Risk. To mitigate the deposition effects on the reservoir operation, one orifice with the size of 5m×6m is placed in the dam body to discharge flood and sediment. This orifice will be put into use for sediment flushing when the incoming sediment load is high.
11.2.7.9 Emergency Action Plan	A draft emergency preparedness/action plan has been prepared for the emergency situations that could occur in operation phases. All the activities that are performed during operation phases of the project are under the responsibility of the project owner (his representative).
11.2.7.10 Public Consultation and Stakeholder Engagement Plan (SEP) during Operation Period	Chipwi Nge Hydropower Company will keep ongoing consultations with all identified stakeholders. Chipwi Nge Hydropower Company will prepare information to be disclosed in advance and in a format adapted and suitable to the different public and groups. The documents and information that will be disclosed in the website include, but are not limited to, the following: ▪ The SEP, that will be disclosed in English and Burmese;

	▪ ESIA executive summary; ▪ Information on the construction schedule and services disruption; ▪ Stakeholders consultations time, venues and minutes; ▪ Grievance Procedure; ▪ Community development activities; and ▪ SEP Manager Contact. Monitoring and evaluation The Company SEP will be regularly updated, presenting changes in Project activities, stakeholders, as well as advice and inputs received, lessons learned and any change to the consultation process. The implementation of this SEP is responsibility of Chipwi Nge Hydropower Company during all over Project phases.

11.5.2 Monitoring scope	
Commitment Source	Commitment
11.5.2.1 Construction Phase	The monitoring scope is determined according to the characteristics of construction activities and local environment with the impacts of the project activities on the local environment taken into account, including: (1) Water quality monitoring (2) Ambient air quality (3) Noise (4) Terrestrial (5) Aquatic monitoring (6) Water and soil erosion monitoring (7) Population health monitoring
11.5.2.2 Operation Phase	Responsibility for the monitoring is assigned to Environmental Management Department of Chipwi Nge Hydropower Company as the constant party throughout these periods. Terrestrial Ecology Parameters Monitor: seedling deaths, indications and presence of pests and disease, invasive species, human encroachment, farming and other unauthorized activities

	Aquatic Fauna (Fish) Monitor: Fish species present and their distributions. Estimate population densities and record other features, such as breeding status Water Quality Monitor: Temperature, pH, DO, BOD5, Turbidity, Conductivity, Total Suspended Solids, Ammonia, Nitrate, Total phosphorus, PO4-P, Total nitrogen, Fecal Coliform bacteria, Total Coliform Bacteria) Hydrology (minimum flow) Conduct: Informant interviews to determine: a) whether daily changes in river flow and depth have been observed; and b) the nature and timing of any changes observed. Air Quality Monitor: CO_2, SO_2, $PM^{2.5}$, PM^{10}, NO_2 and Methane Noise Monitor noise level. Health and Safety Mainly focusing on malaria, dengue fever and other infectious diseases within the project area and Chipwi Town and downstream villages if access and required.
11.5.3 Implementation of monitoring works	The Environmental Management Department will submit environmental monitoring reports (including physical data) to the MONREC twice annually during operation period.

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန
ညွှန်ကြားရေးမှူးချုပ်ရုံး

စာအမှတ်၊EIA-၂/၉/အတည်ပြု(EIA-R)(၂၆၁၇(ရ) /၂၀၂၂)
ရက်စွဲ ၊ ၂၀၂၂ ခုနှစ် အောက်တိုဘာလ ၇ ရက်

သို့

အုပ်ချုပ်မှုဒါရိုက်တာ
CHIPWI NGE HYDROPOWER COMPANY LIMITED
အမှတ် (၂၁၇/၂၁၉) ၊ သပြေကုန်း၊ ဇမ္ဗူသီရိမြို့နယ်၊ နေပြည်တော်
ဖုန်း၊ ၀၆၇- ၈၁၀၈၃၅၅၊ ၀၆၇- ၈၁၀၈၃၉၉

အကြောင်းအရာ။ **လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာနနှင့် CPI Yunnan International Power Investment Co.,Ltd၊ Asia World Co.,Ltd. တို့ ပူးပေါင်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့် (၉၉) မဂ္ဂါဝပ် ချီဖွေငယ် ရေအားလျှပ်စစ်စီမံကိန်းဆိုင်ရာ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာအား အတည်ပြုပြန်ကြားခြင်း**

ရည်ညွှန်းချက်။ (၁) ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၏ ၁၈-၇-၂၀၂၂ ရက်စွဲပါ စာအမှတ်၊ အီးအိုင်အေ-၂/၉ (အတည်ပြု) (EIA-R) (၁၃၇၃/၂၀၂၂)

(၂) သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၏ ၃-၈-၂၀၂၂ ရက်စွဲပါ စာအမှတ်၊ (သစ်တော) ၃(၂)/ ၁၆(ဃ) (၂၅၄၆/ ၂၀၂၂)

၁။ အကြောင်းအရာပါကိစ္စနှင့်ပတ်သက်၍ လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာန (ယခင်လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန) နှင့် CPI Yunnan International Power Investment Co.,Ltd, Asia World Co.,Ltd တို့ စီမံကိန်းဆိုင်ရာ ဖက်စပ်သဘောတူစာချုပ် (JVA) လက်မှတ်ရေးထိုးထားသော ကချင်ပြည်နယ်၊ ချီဖွေမြို့နယ်ရှိ (၉၉) မဂ္ဂါဝပ် ချီဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာကို ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ စိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၊ စီမံကိန်းအဆိုပြုသူ (CPI Yunnan International Power Investment Co.,Ltd)၊ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာရေးသားပြုစုသည့်တတိယအဖွဲ့အစည်း (Changjiang Survey Planning Design and Research Limited Co.,Ltd. နှင့် Resource and Environment Myanmar Co., Ltd.) တို့ဖြင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့အစည်းအဝေး (၂) ကြိမ် ကျင်းပပြုလုပ်ခဲ့ပြီး စိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များ၏ သဘောထားမှတ်ချက်များကို ပြန်ကြားခဲ့ပါသည်။ ပြန်လည်ပြင်ဆင်တင်ပြလာသော EIA အစီရင်ခံစာတွင် အကျဉ်းချုပ်အစီရင်ခံစာ (မြန်မာဘာသာ)၊ စီမံကိန်း၏ Layout Planနှင့် Skeleton Map များ၊ အရင်းအမြစ်သုံးစွဲမှုပမာဏ၊ မြေယာသိမ်းယူခြင်း၊ လျော်ကြေးပေးခြင်းနှင့် ပြန်လည်နေရာချထားခြင်းအစီအစဉ်များ၊ Construction Wastewater Management Plan၊ လေအရည်အသွေးတိုင်းတာချက်များ၊ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်ခွဲများ၊ စောင့်ကြပ်ကြည့်ရှုခြင်းအစီအစဉ်များနှင့် စီမံကိန်းအဆိုပြုသူ

၏ ကတိကဝတ်ဖော်ပြချက်အခန်းများတွင် လိုအပ်ချက်များရှိနေသည့်အတွက် သဘောထား မှတ်ချက်ထပ်မံပြန်ကြားခဲ့ခြင်းအပေါ် ပြန်လည်ပြင်ဆင်တင်ပြလာသော အပြီးသတ်အစီရင်ခံစာ အား ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့ဝင်များထံ သဘောထား မှတ်ချက်များတောင်းခံရယူခဲ့ပါသည်။ အပြီးသတ်အစီရင်ခံစာမှာ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း ဆိုင်ရာ လုပ်ထုံးလုပ်နည်းပါ သတ်မှတ်ချက်များနှင့်အညီ ပြုစုထားကြောင်း စိစစ်သုံးသပ်ရသည့် အတွက် အတည်ပြုပြန်ကြားနိုင်ရေးအပေါ် ပြည်ထောင်စုဝန်ကြီးရုံးသို့ ရည်ညွှန်း (၁) ပါစာဖြင့် လမ်းညွှန်မှုခံယူတင်ပြခဲ့ခြင်းအပေါ် ပြည်ထောင်စုဝန်ကြီးရုံးက ဥပဒေ၊ လုပ်ထုံးလုပ်နည်းများနှင့် အညီ ပြန်ကြားခွင့်ပြုကြောင်း ရည်ညွှန်း (၂) ပါစာဖြင့် အကြောင်းကြားလာပါသည်။

၂။ ချီဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်းမှာ ကချင်ပြည်နယ် ချီဖွေမြို့နယ်တွင်တည်ရှိပါသည်။ ချီဖွေ ငယ်ရေအားလျှပ်စစ်စီမံကိန်း၏ တမံမှာ ချီဖွေမြို့မှ ၁၅ ကီလိုမီတာ အကွာအဝေးတွင်တည်ရှိပြီး ရေအားလျှပ်စစ်စက်ရုံမှာ ချီဖွေမြို့မှ (၉) ကီလိုမီတာ အကွာအဝေးတွင်တည်ရှိပါသည်။ Concrete Gravity Dam အမျိုးအစားဖြစ်ပြီး ဆည်အမြင့်မှာ ၄၇.၅ မီတာရှိပါသည်။ ပုံမှန် ရေအမှတ် ၇၄၀ မီတာ၊ စိုးရိမ်ရေ အမှတ် ၇၄၅.၉၉ မီတာ၊ ရေလျှောင်တမံဆန့်ဝင်နိုင်မှု ၇၈၉၀၀၀ ကုဗမီတာနှင့် ၁၂၃၄၀၀၀ ကုဗမီတာ အသီးသီးရှိပြီး တပ်ဆင်မှု ပမာဏ ၉၉ မဂ္ဂါဝပ်နှင့် နှစ်စဉ်ပျမ်းမျှ လျှပ်စစ်ဓာတ်အားထုတ် လုပ်မှုမှာ တစ်နာရီလျှင် ၅၉၉ မီလီယမ် ကီလိုဝပ်ရှိပါသည်။ စီမံကိန်းဧရိယာကို ဆည်၊ ရေလွှဲမြောင်း နှင့်လျှပ်စစ်ဓာတ်အားပေးရုံနယ်မြေများဟူ၍ စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့် နယ်မြေ (၃) ခု ပိုင်းခြားထားပါသည်။ ချီဖွေငယ်ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံသည် ရေလွှဲအမျိုးအစား ဖြစ်ပြီး အဓိကအားဖြင့် ဆည်၊ ရေလွှဲနှင့် လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ခြင်းစနစ်တို့ ပါဝင်ပါသည်။

၃။ စီမံကိန်းအဆိုပြုသူအနေဖြင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဥပဒေ၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး နည်းဥပဒေများ၊ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း၊ အမျိုးသားပတ်ဝန်း ကျင်ဆိုင်ရာအရည်အသွေး(ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များနှင့် စီမံကိန်းနှင့် သက်ဆိုင်သည့် အခြား ဥပဒေ၊ နည်းဥပဒေများ၊ မူဝါဒများကို တာဝန်ယူလိုက်နာဆောင်ရွက်မည်ဖြစ်ကြောင်း ဖော်ပြထားပါ သည်။

၄။ လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာနနှင့် CPI Yunnnan International Power Investment Co.,Ltd ၊ Asia World Co.,Ltd တို့ ပူးပေါင်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့် ၉၉ မဂ္ဂါဝပ် ချီဖွေငယ် ရေအားလျှပ်စစ်စီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာတွင် စီမံကိန်းတည် ဆောက်ခြင်းနှင့် လည်ပတ်ခြင်းတို့ကြောင့် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ထိခိုက်မှုများမရှိစေရေး အောက်ဖော်ပြပါအချက်များကို လိုက်နာဆောင်ရွက်မည်ဖြစ်ကြောင်း ကတိကဝတ်ပြုဖော်ပြထား ပါသည်-

(က) စီမံကိန်းအဆိုပြုသူအနေဖြင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ၏ အခန်း (၃) Laws and Regulations of Myanmar အခန်းတွင် မြန်မာ့အမျိုးသား ပတ်ဝန်းကျင်ဆိုင်ရာဥပဒေ (၁၉၉၄)၊ ၂၀၁၈ခုနှစ်ဖွဲ့စည်းပုံအခြေခံဥပဒေ၊ ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးဥပဒေ(၂၀၁၂)၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ(၂၀၁၄)၊ ပတ်ဝန်း ကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း(၂၀၁၅) ၊ အမျိုးသားပတ်ဝန်းကျင် ဆိုင်ရာအရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များ (၂၀၁၅)၊ သစ်တောဥပဒေ (၁၉၉၂)၊ တောရိုင်းတိရစ္ဆာန်နှင့် သဘာဝအပင်များကာကွယ်ရေးနှင့် သဘာဝနယ်မြေ များထိန်းသိမ်းရေးဥပဒေ(၁၉၉၄) ၊ ယဉ်ကျေးမှုအမွေအနှစ်နယ်မြေများ ကာကွယ်ရေး

နှင့်ထိန်းသိမ်းစောင့်ရှောက်ရေး ဥပဒေ(၁၉၉၈)၊ မြေယာသိမ်းယူမှုအက်ဥပဒေ (၁၈၉၄)၊ လယ်ယာမြေ ဥပဒေနှင့် နည်းဥပဒေများ (၂၀၁၂)၊ မြန်မာနိုင်ငံသားများ ရင်းနှီးမြှုပ်နှံမှု ဥပဒေ (၂၀၁၃)၊ လျှပ်စစ်ဥပဒေ (၂၀၁၅)၊ ရေအရင်းအမြစ်နှင့်မြစ်ချောင်းများ ကာကွယ် ထိန်းသိမ်းရေးဥပဒေ (၂၀၀၆)၊ ရှေးဟောင်းဝတ္ထုများ ကာကွယ်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၅) ၊ ရှေးဟောင်းအဆောက်အအုံများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ (၂၀၁၅) ၊ ဓာတုပစ္စည်းနှင့်ဆက်စပ်ပစ္စည်းများ အန္တရာယ်မှ တားဆီးကာကွယ်ရေး ဥပဒေ (၂၀၁၃) (အခန်း ၇၊၈၊၉)၊ လူမှုဖူလုံရေးဥပဒေ(၂၀၁၂)၊ အလုပ်သမားလျော်ကြေးအက်ဥပဒေ (၁၉၂၃)၊ အနည်းဆုံးအခကြေးငွေဥပဒေ (၂၀၁၃)၊ အလုပ်အကိုင်နှင့် ကျွမ်းကျင်မှု ဖွံ့ဖြိုးရေးဥပဒေ (၂၀၁၃)၊ ခွင့်ရက်နှင့်အလုပ်ပိတ်ရက်ဥပဒေ (၁၉၅၁)၊ အလုပ်သမား အဖွဲ့အစည်းဥပဒေ (၂၀၁၁)၊ အလုပ်သမားရေးရာအငြင်းပွားမှု ဖြေရှင်းရေးဥပဒေ (၂၀၁၂)၊ မော်တော်ယာဉ်ဥပဒေ (၂၀၁၅)၊ သွင်းကုန်ထုတ်ကုန်ဥပဒေ(၂၀၁၅) ၊ပေါက်ကွဲ စေတတ်သောပစ္စည်းများအက်ဥပဒေ (၁၉၀၈)၊ ကချင်ပြည်နယ်စည်ပင်သာယာ အက် ဥပဒေ (ကချင်ပြည်နယ်လွှတ်တော်ဥပဒေ အမှတ်၁၀/၂၀၁၃) စသည်တို့ကို လိုက်နာ ဆောင်ရွက်မည်ဖြစ်ကြောင်း၊

(ခ) လေထုဝန်းကျင်အပေါ် ထိခိုက်မှုလျော့ပါးစေရေးနှင့်စပ်လျဉ်း၍ အောက်ပါအတိုင်း လိုက်နာဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း-

(၁) မြေတူးဖော်ခြင်းနှင့် မိုင်းခွဲခြင်းအတွက် ဖုန်များ လျော့ချခြင်းနှင့် ထိန်းချုပ်ခြင်း များ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၂) ကွန်ကရစ်စနစ်အတွက် ဖုန်လျှော့ချခြင်းနှင့် ထိန်းချုပ်ခြင်းများ ဆောင်ရွက် သွားမည်ဖြစ်ကြောင်း၊

(၃) လောင်စာဓာတ်ငွေ့လျှော့ချခြင်းနှင့် ထိန်းချုပ်ခြင်းများ ဆောင်ရွက်သွားမည် ဖြစ်ကြောင်း၊

(၄) ယာဉ်သွားလာမှုမှ ထွက်ရှိသော ဖုန်လျှော့ချခြင်းနှင့် ထိန်းချုပ်ခြင်းများ ဆောင် ရွက်သွားမည်ဖြစ်ကြောင်း။

(ဂ) ဇလဗေဒနှင့် ရေအရည်အသွေးအပေါ်သက်ရောက်မှုများကြောင့် ထိခိုက်မှုလျော့ပါးစေ ရေး ဆောင်ရွက်မည့်အစီအစဉ်နှင့် စပ်လျဉ်း၍ အောက်ပါအတိုင်း လိုက်နာဆောင်ရွက် သွားမည် ဖြစ်ကြောင်း-

(၁) Ecological Flow အနေဖြင့် 0.53m^3/s အား ရေလှောင်ကန်မှ ထုတ်လွှတ် သွားမည်ဖြစ်ကြောင်း၊

(၂) မြစ်အောက်ပိုင်း အခြေခံဂေဟစနစ်အား ထိန်းသိမ်းရန်အတွက် Ecological Flow ပမာဏအား တိုးမြှင့်ရန်လိုအပ်ပါက တိုးမြှင့်ထုတ်လွှတ်ပေးမည်ဖြစ် ကြောင်း၊

(၃) ရေလှောင်ကန်အတွင်းရှိ ရေအရည်အသွေးနှင့် မြစ်အောက်ပိုင်းရှိ ရေအရည် အသွေးအား စောင့်ကြပ်ကြည့်ရှုရန် ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှု မည့် ကန်ထရိုက်တာကို ၄ားရမ်းဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၄) ရေအရည်အသွေးအား နေရာ (၅) နေရာတွင် ၆ လ တစ်ကြိမ် ၅နှစ် တိတိ စောင့်ကြပ်ကြည့်ရှုသွားမည်ဖြစ်ကြောင်း။

(ဃ) ဆူညံသံအပေါ် ထိခိုက်မှုလျော့ပါးစေရေးနှင့်စပ်လျဉ်း၍ ဆူညံသံမြင့်မားသည့် သက်ရောက်မှုအောက်တွင် အလုပ်လုပ်နေသည့် ဆောက်လုပ်ရေးလုပ်သားများကို ဆူညံသံကာကွယ်သည့် နားကျပ်၊ နားကာ၊ ဦးထုပ်နှင့် အခြားကာကွယ်ရေးပစ္စည်း များအား ပံ့ပိုးပေးခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(င) စွန့်ပစ်ပစ္စည်းများ စွန့်ပစ်ခြင်းကြောင့် ထိခိုက်မှုလျော့ပါးစေရေးနှင့်စပ်လျဉ်း၍ အောက်ပါအတိုင်း လိုက်နာဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း-

(၁) အမှိုက်ပုံးများကို အရောင်ဖြင့် ခွဲခြားကာ ဆောက်လုပ်ရေးနှင့် နေထိုင်ရာနေရာတွင် ထားရှိမည်ဖြစ်ရာ organic နှင့် inorganic စွန့်ပစ်ပစ္စည်းများစသည်ဖြင့် ခွဲခြားသိမ်းဆည်းရန် အသုံးပြုသွားမည်ဖြစ်ပြီး နေထိုင်ရာနေရာနှင့် ဆောက်လုပ်ရေးလုပ်ငန်းခွင်မှ စွန့်ပစ်ပစ္စည်းများကို နေ့စဉ်စွန့်ပစ်မည် ဖြစ်ပြီး ယင်းစွန့်ပစ်ပစ္စည်းများကို စွန့်ပစ်ရန် သတ်မှတ်ထားသည့် အမှိုက်ပုံး ၊ အမှိုက်ကျင်းနေရာများသို့ ပို့ဆောင်ခြင်းများဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၂) ဆောက်လုပ်ရေးပစ္စည်းများ သယ်ယူပို့ဆောင်စဉ်အတွင်း သဲ၊ မြေကြီးများ ဖိတ်စင်မှုမရှိစေရန် ကောင်းမွန်စွာ ဖုံးအုပ်သယ်ဆောင်မည်ဖြစ်ပြီး အသုံးပြုသည့် အဓိကလမ်းများအား ပုံမှန်ရှင်းလင်းခြင်းများ ဆောင်ရွက်သွားမည် ဖြစ်ကြောင်း၊

(၃) မြစ်အတွင်းသို့အမှိုက်ပစ်ခြင်းစွန့်ပစ်ခြင်းများအားရှောင်ကြဉ်သွားဖြစ်ကြောင်း။

(စ) ဇီဝမျိုးစုံမျိုးကွဲများအပေါ် ထိခိုက်မှုလျော့ပါစေရေးနှင့်စပ်လျဉ်း၍ အောက်ပါအတိုင်း လိုက်နာဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း-

(၁) ဆောက်လုပ်ရေး အလုပ်သမားများအား ကာကွယ်ရေးဆိုင်ရာ အသိပညာများ မြှင့်တင်ခြင်းနှင့် တောရိုင်းတိရိစ္ဆာန်များအား အမဲလိုက်ခြင်းမှ တားမြစ်ခြင်း အတွက် အသိပညာပေးခြင်းများဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၂) ဆောက်လုပ်ရေးဧရိယာအတွင်း တိရိစ္ဆာန်ကာကွယ်ရေး သတိပေးဆိုင်းဘုတ်များ စိုက်ထူခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၃) ဆောက်လုပ်ရေးစက်ပစ္စည်းများ၏ လုပ်ငန်းလည်ပတ်ချိန်အတွင်း တိရိစ္ဆာန်များကို အနှောင့်အယှက်ဖြစ်စေမှုအား ရှောင်ရှားရန်အတွက် သင့်လျော်သော အစီအစဉ်များ ထားရှိခြင်းနှင့် မိုင်းဖောက်ခွဲခြင်းကဲ့သို့သော ဆူညံသံမြင့်မားသည့် ဆောက်လုပ်ရေးလုပ်ငန်းများအား တိရိစ္ဆာန်များ၏ သားပေါက်ရာသီတွင် ဆောင်ရွက်ခြင်းများအား ရှောင်ရှားခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၄) ဆောက်လုပ်ရေးဧရိယာတွင် မီးဘေးကာကွယ်ရေးနှင့် မီးဘေးအချက်ပေးစနစ်အကောင်ထည်ဖော်ဆောင်ခြင်းအားဖြင့် သဘာဝပေါက်ပင်များအား မီးဘေးကြောင့် ထိခိုက်မှုဖြစ်ခြင်းမှ ရှောင်ရှားကာကွယ်ခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၅) လုပ်ငန်းခွင်နေရာတွင် မူရင်းအခြေအနေသို့ရောက်အောင် ပြန်လည်ဖြည့်တင်းခြင်းနှင့် စိမ်းလန်းစိုပြေရေးကဲ့သို့သော ဂေဟစနစ်ဝန်းကျင်တည်ထောင်ခြင်း လုပ်ငန်းများအား ဆောင်ရွက်ခြင်းများဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၆) အဓိကအဆောက်အဦးများ၊ ဆောက်လုပ်ရေးတန်းလျားများ၊ အပျက်အစီး သိုလှောင်ရာနေရာများ၊ မြေတူးဖော်ထားသည့် နေရာများ၏ ပတ်ဝန်းကျင်နှင့် လမ်းဘေးဝဲယာအနီးတဝိုက်တို့ရှိ ရှင်းလင်းထားသည့် သဘာဝပေါက်ပင်များ အား ပြန်လည်ဖြည့်တင်းပြီး ယင်းဧရိယာ၏ မူရင်းဂေဟစနစ် ဖြစ်စေရန် ပြန် လည်ဖြည့်တင်းခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၇) နို့တိုက်သတ္တဝါများ၊ ငှက်များ၊ တွားသွားသတ္တဝါများနှင့် ကုန်းနေရေနေ သတ္တဝါများ၏ စားကျက်နေရာ လက္ခဏာရပ်များနှင့် မျိုးစိပ်ပေါက်ဖွား ပျံ့နှံ့မှု များ ပြောင်းလဲမှု ရှိ/မရှိကို သင့်လျော်သည့် စောင့်ကြပ်ကြည့်ရှုခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၈) ရေဝေရေလဲဒေသဆိုင်ရာ စီမံခန့်ခွဲမှုအစီအစဉ် အကောင်ထည်ဖော်ဆောင် ခြင်းတွင် ပူးပေါင်းပါဝင်ခြင်းများဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၉) လိုအပ်သည့် ဂေဟစနစ် အခြေခံအချက်အလက်များ ထပ်မံလေ့လာခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၁၀) ထိန်းချုပ်ရေးစင်များ၊ ဂိတ်တံခါးများ၊ ဝန်ထမ်းအိမ်ရာ၊ လမ်းကြောင်း စသည့် လိုအပ်သော အခြေခံအဆောက်အဦးများ အကောင်ထည်ဖော်ခြင်းတွင် ပူး ပေါင်းပါဝင်ခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၁၁) အမဲလိုက်ခြင်း၊ ငါးဖမ်းခြင်း၊ စားသုံးရန်အတွက် တောရိုင်း တိရိစ္ဆာန်များ ထိန်းသိမ်းထားခြင်း (အသား) စသည်တို့အား တားမြစ်ရန် အလုပ်သမား ကျင့်ဝတ်စည်းမျဉ်းများ အကောင်ထည်ဖော်ခြင်းများ ဆောင်ရွက်သွားမည် ဖြစ်ကြောင်း၊

(၁၂) ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် တောမီးကာကွယ်ရေး စာသား များပါဝင်သည့် ပညာပေး ဆိုင်းဘုတ်များ စိုက်ထူခြင်းများဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၁၃) သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးစာများ ပါဝင်သည့် ပိုစတာများ၊ လက် ကမ်းစာစောင်များအား လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ၊ ရေလှောင်ကန်နေရာနှင့် စီမံကိန်းဧရိယာအတွင်းရှိ ရွာများတွင် ရှိသော အလုပ်သမား တန်းလျားများ၊ ဝန်ဆောင်မှုများ (ဆိုင်များ၊ စားသောက် ဆိုင်များ၊ ရုံးများ စသည်) သို့ ဖြန့် ဝေခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၁၄) စီမံကိန်းဧရိယာ (လျှပ်စစ်ဓာတ်အားပေးစက်ရုံ၊ ရေလှောင်ကန်ဧရိယာ၊ ရေဝေ ရေလဲဒေသ) တွင်ရှိသော မျိုးသုန်းအန္တရာယ်ရှိသည့် တောရိုင်းတိရိစ္ဆာန်မျိုး စိတ်များအပေါ် သက်ရောက်မှုများအတွက် စောင့်ကြပ်ကြည့်ရှုခြင်း အစီအစဉ်များ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၁၅) လျှပ်စစ်ဓာတ်အားပေး စက်ရုံဧရိယာတွင် သဘာဝပေါက်ပင်များ ပြန်လည် ထိန်းသိမ်းခြင်း (ဧရိယာ၊ အရေအတွက်နှင့် အမျိုးအစား) အား ဆောင်ရွက် သွားမည်ဖြစ်ကြောင်း။

(ဆ) ငါးအပါအဝင် ရေနေသတ္တဝါများအပေါ် ထိခိုက်မှုလျော့ပါစေရေးနှင့်စပ်လျဉ်း၍ အောက်ပါအတိုင်း လိုက်နာဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း-

(၁) Chipwi Nge Hydropower Co., Ltd. သည် ရေနေသတ္တဝါများဆိုင်ရာ စီမံခန့်ခွဲမှုအစီအစဉ် (အထူးသဖြင့် ငါးများ) တွင်ပါရှိသော အစီအမံများအား အကောင်ထည်ဖော်ဆောင်ရွက်မည်ဖြစ်ပြီး Aquatic specialist ဖြင့် နှစ်စဉ် စောင့်ကြည့်စစ်ဆေးသွားမည်ဖြစ်ကြောင်း၊

(၂) Chipwi Nge Hydropower Company ၏ ပတ်ဝန်းကျင်စီမံခံခွဲမှုဌာနသည် ရေနေသတ္တဝါပညာရှင်များအား ခေါ်ယူ၍ ဆည်နှင့် ဆည်အောက်ပိုင်းဒေသများရှိ ငါးအရေအတွက် စောင့်ကြပ်ကြည့်ရှု ဖွဖြိုးတိုးတက်စေခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၃) ရေနေသတ္တဝါ ပညာရှင်သည် ချီဗွေရေအားလျှပ်စစ်စီမံကိန်းဝန်းကျင်ရှိ ရေနေသတ္တဝါ (အထူးသဖြင့် ငါးများ) ၏ အချက်အလက်များအား ပြန်လည်သုံးသပ်ခြင်းနှင့် ၎င်းတို့၏ သွင်ပြင်များအား ဆန်းစစ်ဖွံ့ဖြိုးတိုးတက်စေခြင်းများ ဆောင်ရွက်သွားမည် ဖြစ်ကြောင်း၊

(၄) ဆည်နှင့် ဆည်အောက်ပိုင်းဒေသများ (အထူးသဖြင့် ၁၅.၇ ကီလိုမီတာအပိုင်း) မှ ငါးအရေတွက်ကောက်ယူခြင်းကို နှစ်စဉ်ဆောင်ရွက်သွားမည် ဖြစ်ကြောင်း၊

(၅) နှစ်စဉ်ငါးအရေအတွက် ကောက်ယူဆန်းစစ်ခြင်းအရ ပုံမှန်မဟုတ်သော အခြေအနေမျိုး ကြုံတွေ့လာပါက ငါးအရေတွက် ကောက်ယူဆန်းစစ်ခြင်းကို တစ်နှစ်နှစ်ကြိမ် တိုးမြင့်ဆောင်ရွက်ခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၆) နှစ်စဉ်စောင့်ကြပ်ကြည့်ရှုခြင်းအစီရင်ခံစာကို ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုဌာနသို့ တင်ပြခြင်းများဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း။

(ဇ) ရေကာတာလုံခြုံရေး၊ရေကြီးရေလျှံမှုထိန်းချုပ်ရေးနှင့် အရေးပေါ်အခြေအနေ စီမံခန့်ခွဲရေးနှင့်စပ်လျဉ်း၍ အောက်ပါအတိုင်း လိုက်နာဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း-

(၁) ရေလှောင်ကန် ဘေးအန္တရာယ်ကင်းရှင်းမှုဆိုင်ရာ စီမံခန့်ခွဲမှုအစီအစဉ်တွင် ပါရှိသော အကောင်အထည်ဖော်ဆောင်ရွက်မှုအစီအစဉ် (implementation plan) အတိုင်း ဆောင်ရွက်ခြင်းများ ဆောင်ရွက်သွားမည် ဖြစ်ကြောင်း၊

(၂) ဆည်ဘေးန္တရာယ်ကင်းရှင်းရေး ကနဦးစီစစ်ချက်များကို တည်ဆောက်ရေးလုပ်ငန်းများ ပြီးမြောက်ပြီးနောက် နှစ်နှစ်အကြာတွင် စတင်လုပ်ဆောင်ပြီး ငါးနှစ်တစ်ကြိမ် ဆက်လက်လုပ်ဆောင်ခြင်းများဆောင်ရွက်သွားမည် ဖြစ်ကြောင်း၊

(၃) ဆည်ပျက်ဆီးမှုဖြစ်ပေါ်ခြင်းနှင့် အရေးပေါ်အခြေအနေများတွင် အသက်ဆုံးရှုံးမှုများ မဖြစ်ပွားစေရေးအတွက် ရည်ရွယ်၍ လူများအလျင်အမြန် သိစေရန် အရေးပေါ်အချက်ပေးသည့်စနစ်များ တပ်ဆင်ခြင်းများ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၄) ရေကြီးရေလျှံမှုဆိုင်ရာ စီမံခန့်ခွဲမှုအစီအစဉ်ပါ အစီအမံများကို အကောင်အထည်ဖော်ဆောင်ရွက်သွားမည် ဖြစ်ကြောင်း၊

(၅) အနည်ကျရောက်မှုများအား လျော့ချနိုင်ရန် 5m×6m ရှိသော ရေပိုနှင့် အနည်များအား စွန့်ထုတ်ရန် ရေထုတ်ပေါက်အားထားရှိပြီး အနည်ကျနုန်းများမြင့်တက်လာပါက အဆိုပါ ရေထုတ်ပေါက်မှ ထပ်ဆင့်အနည်များ စွန့်ထုတ်ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း၊

(၆) အရေးပေါ်ဆောင်ရွက်မှုအစီအစဉ် အစီအမံများကို အကောင်ထည်ဖော်ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း။

၅။ လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာနနှင့် Cpi Yunnnan International Power Investment Co.,Ltd၊ Asia World Co.,Ltd တို့ ပူးပေါင်းအကောင် အထည်ဖော်ဆောင်ရွက်မည့် ၉၉ မဂ္ဂါဝပ် ချီဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာသည် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်းအပိုဒ် ၅၅၊ ၅၆ ၊ ၅၇ ၊ ၅၈၊ ၅၉၊ ၆၀ နှင့် ၆၁ တို့တွင် သတ်မှတ်ဖော်ပြထားသော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအတွက် လိုအပ်သော စုံစမ်းစစ်ဆေးခြင်းများအား ဆောင်ရွက်ထားပြီး ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာကိုလည်း လုပ်ထုံးလုပ်နည်းအပိုဒ် ၆၂နှင့် ၆၃ပါ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာတွင် ပါဝင်ရမည့် အချက်များနှင့်အညီပြုစုထားသဖြင့် အစီရင်ခံစာပါ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ထိခိုက်မှုလျော့ချရေးအစီအစဉ်များကို တိကျစွာအကောင်အထည်ဖော်ဆောင်ရွက်ခြင်းဖြင့် ဖြစ်ပေါ်လာနိုင်သော ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာသက်ရောက်မှုများကို အနည်းဆုံးဖြစ်စေရေး လျော့ချနိုင်မည်ဖြစ်သဖြင့် အတည်ပြုထုတ်ပြန်နိုင်သည့် အစီရင်ခံစာဖြစ်ကြောင်း စိစစ်သုံးသပ်ရပါသည်။

၆။ သို့ဖြစ်ပါ၍ လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာနနှင့် CPI Yunnnan International Power Investment Co.,Ltd နှင့် Asia World Co.,Ltd တို့ ပူးပေါင်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့် ၉၉ မဂ္ဂါဝပ် ချီဖွေငယ်ရေအားလျှပ်စစ်စီမံကိန်း၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာသည် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်းပါ အချက်များနှင့် ကိုက်ညီမှုရှိကြောင်း စိစစ်တွေ့ရှိရပါသဖြင့် အတည်ပြုပါကြောင်း၊ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်းအရ ထုတ်ပေးရမည့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ လိုက်နာဆောင်ရွက်မှုသက်သေခံလက်မှတ်ကဲ့သို့ အာဏာသက်ရောက်သော ဤအတည်ပြုစာအား ထုတ်ပေးပါကြောင်း၊ လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာနမှ ထုတ်ပြန်ထားသည့် ဥပဒေ၊ နည်းဥပဒေများ၊ လုပ်ထုံးလုပ်နည်း၊ အမိန့်၊ ညွှန်ကြားချက်များ၊ နောက်ဆုံးသတ်မှတ်ထားသည့်မူများကို စီမံကိန်းအဆိုပြုသူမှ လိုက်နာဆောင်ရွက်ရန်လိုအပ်ကြောင်း၊ ဤအတည်ပြုကြောင်းစာသည် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးကဏ္ဍဆိုင်ရာ လိုက်နာဆောင်ရွက်ရန်ဖြစ်ပြီး လုပ်ငန်းဆောင်ရွက်ခွင့်မှာ သက်ဆိုင်ရာဌာန၏ မူဝါဒ၊ ဥပဒေ၊ နည်းဥပဒေများ၊ လုပ်ထုံးလုပ်နည်းများနှင့်အညီ လိုက်နာဆောင်ရွက်ရန်ဖြစ်ပါကြောင်းနှင့် စီမံကိန်းအဆိုပြုသူအနေဖြင့် အပိုဒ် (၄) ပါ လိုက်နာဆောင်ရွက်ရမည့်ကတိကဝတ်များအပြင် တစ်ဖက်ဖော်ပြပါအချက်များကို အလေးထား လိုက်နာအကောင်အထည်ဖော်ဆောင်ရွက်ရန်နှင့် လိုက်နာဆောင်ရွက်ခြင်းမရှိပါက ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ၊ နည်းဥပဒေများနှင့် လုပ်ထုံးလုပ်နည်းပါ ပြဋ္ဌာန်းချက်များနှင့်အညီ အရေးယူဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း အကြောင်းကြားအပ်ပါသည်-

(က) မူဝါဒ၊ ဥပဒေ၊ အဖွဲ့အစည်းဆိုင်ရာ မူဘောင်နှင့် စံချိန်စံညွှန်းနှင့်စပ်လျဉ်း၍ အောက်ပါအတိုင်း လိုက်နာဆောင်ရွက်ရန်-

(၁) စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် ၊ စီမံကိန်းကတိကဝတ်အားလုံးနှင့် စည်းကမ်းချက်များကို အပြည့်အဝ အကောင်အထည်ဖော်ရမည့်အပြင် ယင်း၏ကိုယ်စားစီမံကိန်းကို ဆောင်ရွက်ပေးသူ ကန်ထရိုက်တာ နှင့်လက်ခွဲဆောင်ရွက်ပေးသူ ဆပ်ကန်ထရိုက်တာများအားလုံးသည် စီမံကိန်း အတွက်လုပ်ငန်းများဆောင်ရွက်ရာတွင် သက်ဆိုင်ရာဥပဒေ၊ နည်းဥပဒေများ ၊ ဤလုပ်ထုံးလုပ်နည်း ၊ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်နှင့် စည်းကမ်းချက်များအားလုံးကို အပြည့်အဝလိုက်နာဆောင်ရွက်ရန်၊

(၂) အစီရင်ခံစာတွင် ဖော်ပြထားသော ကတိကဝတ်များအား အပြည့်အဝ လိုက်နာဆောင်ရွက်ရန်နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ ၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေများ၊ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း၊ အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များ၊ ကုမ္ပဏီ၏ မူဝါဒများ၊ စီမံကိန်းနှင့် သက်ဆိုင်သော မူဝါဒ၊ ဥပဒေ၊ နည်းဥပဒေတို့ကို လိုက်နာဆောင်ရွက်ရန်၊

(၃) သစ်တောဥပဒေ (၂၀၁၈) နှင့် ဇီဝမျိုးစုံမျိုးကွဲနှင့် သဘာဝထိန်းသိမ်းရေးနယ်မြေများ ကာကွယ်စောင့်ရှောက်ခြင်းဆိုင်ရာ ဥပဒေ (၂၀၁၈) ပါ စီမံကိန်းနှင့် ဆက်စပ်သည့် ပြဋ္ဌာန်းချက်များအား လိုက်နာဆောင်ရွက်ရန်၊

(၄) လေအရည်အသွေး၊ ဆူညံသံ၊ အလုပ်စခန်းများ၊ မိလ္လာစနစ်များ၊ အိမ်တွင်းရေဆိုးများနှင့်စပ်လျဉ်း၍ အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်၊ အထွေထွေလမ်းညွှန်ချက်ပါ သတ်မှတ်ချက်နှင့်အညီ လိုက်နာဆောင်ရွက်ရန်၊

(၅) ဆူညံသံအတွက် စီမံကိန်းဧရိယာပြင်ပရှိ အနီးဆုံးလက်ခံသည့်နေရာတွင် အခြေခံအဆင့်မှ အများဆုံးမြင့်တက်မှု 3 dBA ထက် မကျော်လွန်စေရေး လိုက်နာဆောင်ရွက်ရန်၊

(၆) စွန့်ထုတ်အရည်အသွေးနှင့်စပ်လျဉ်း၍ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ၏ ဇယား ၁၁-၆-၂ တွင် ရေအရည်အသွေးစောင့်ကြည့်တိုင်းတာမည့် Parameter များအား ဖော်ပြမှုမရှိသောကြောင့် အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်အပိုဒ် ၁.၂ ပါ Parameter များတိုင်းတာ၍ သတ်မှတ်ချက်နှင့်အညီ သန့်စင်ပြီးမှ စွန့်ထုတ်ရန်၊

(၇) ထိတွေ့ဝန်းကျင်လေထုအရည်အသွေး (Air Quality Ambient) နှင့်ပတ်သက်၍ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ၏ ဇယား ၁၁-၆-၂ တွင် စောင့်ကြည့်တိုင်းတာမည့် Parameter များအပြင် စောင့်ကြည့်လေ့လာရာ၌ အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု)လမ်းညွှန်ချက်၁.၁ထုတ်လွှတ်အခိုးအငွေ့ (Air Emissions) ပါ Parameters များအားလုံးအား တိုင်းတာရန်။

(ခ) မြန်မာနိုင်ငံအမျိုးသားအဆင့် စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု မဟာဗျူဟာနှင့် ပင်မလုပ်ငန်းအစီအစဉ် (၂၀၂၀) အရ စွန့်ပစ်ပစ္စည်းနှင့်ပတ်သက်၍ အောက်ပါအတိုင်း ဆောင်ရွက်ထားရှိရန်-

(၁) စီမံကိန်းမှထွက်ရှိလာမည့် ပလပ်စတစ်စွန့်ပစ္စည်းများ၊ မိလ္လာအညစ်အကြေးများ၊ ဓာတုဗေဒစွန့်ပစ်ပစ္စည်းများ၊ စက်မှုလုပ်ငန်းများမှ ထွက်ရှိလာသော စွန့်ပစ်ပစ္စည်းများအား စနစ်တကျစွန့်ပစ်ရန်နှင့် လေဟာပြင်မီးရှို့ခြင်း လုပ်ငန်းများ ပပျောက်ရေး ဆောင်ရွက်ရန်၊

(၂) စွန့်ပစ်ပစ္စည်းများအား သက်ဆိုင်ရာက စွန့်ပစ်ပစ္စည်းစုပုံစွန့်ပစ်ရန် သတ်မှတ်ထားသောနေရာများတွင် ဘေးအန္တရာယ်ကင်းရှင်းစွာ စွန့်ပစ်ဆောင်ရွက်ရန်၊

(၃) စွန့်ပစ်ပစ္စည်းများအား သိမ်းဆည်းခြင်း၊ သယ်ယူပို့ဆောင်ခြင်း၊ စွန့်ပစ်ခြင်းတို့နှင့်ပတ်သက်၍ ပြန့်ကျဲထွက်ကျမှု၊ အနံ့အသက်ဆိုးများ ထွက်ရှိမှု၊ ဆူညံမှု၊ တုန်ခါမှုတို့မရှိစေရေး လိုက်နာဆောင်ရွက်ရန်၊

(၄) စီမံကိန်းမှ ထွက်ရှိသော စွန့်ပစ်ပစ္စည်းနှင့် ဘေးအန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများအားစီမံဆောင်ရွက်ထားရှိမှုကို စောင့်ကြပ်ကြည့်ရှုစစ်ဆေးနိုင်ရေးအတွက် စွန့်ပစ်ပစ္စည်းဆိုင်ရာ မှတ်တမ်းပုံစံထားရှိဆောင်ရွက်ရန်၊

(၅) ဘေးအန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်များနှင့် စက်မှုလုပ်ငန်းများမှ ထွက်ရှိလာသော စွန့်ပစ်ပစ္စည်းများအတွက် ပတ်ဝန်းကျင်နှင့် သဟဇာတဖြစ်စေသော စီမံခန့်ခွဲမှုစနစ်ကို တိုးမြှင့်ဆောင်ရွက်ရန်၊

(၆) စီမံကိန်းမှ ထွက်ရှိလာမည့် စွန့်ပစ်ပစ္စည်းများနှင့်ပတ်သက်၍ ထွက်ရှိမှု လျော့ချခြင်း၊ ပြန်လည်သုံးစွဲခြင်း၊ ပြန်လည်ပြုပြင်ထုတ်လုပ်ခြင်းဖြင့် စွန့်ပစ်ပစ္စည်းထွက်ရှိမှုများကို ကာကွယ်ဆောင်ရွက်ရန်၊

(၇) စီမံကိန်းမှ ထွက်ရှိလာမည့် စွန့်ပစ်ပစ္စည်းများ စီမံခန့်ခွဲမှုအတွက် အစဉ်လည်ပတ်နေသည့် ရန်ပုံငွေထားရှိဆောင်ရွက်ရန်။

(ဂ) အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာမူဝါဒ၊ မြန်မာနိုင်ငံရာသီဥတုပြောင်းလဲမှုဆိုင်ရာ မူဝါဒ၊ မြန်မာနိုင်ငံရာသီဥတုပြောင်းလဲမှုဆိုင်ရာ မဟာဗျူဟာ၊ မြန်မာနိုင်ငံရာသီဥတု ပြောင်းလဲမှုဆိုင်ရာ ပင်မလုပ်ငန်းစဉ် (၂၀၁၈-၂၀၃၀) တို့နှင့်ပတ်သက်၍ အောက်ဖော်ပြပါအတိုင်း ဆောင်ရွက်ထားရှိရန်-

(၁) စီမံကိန်းဆောင်ရွက်ခြင်းကြောင့် ပတ်ဝန်းကျင်ကို ခြိမ်းခြောက်နေသည့် ပြုမူလုပ်ဆောင်ချက်များကို ရှောင်ရှားခြင်း၊ တားမြစ်ခြင်းနှင့် ထိန်းချုပ်ခြင်းဖြင့် ပတ်ဝန်းကျင်ပျက်စီးမှုများမဖြစ်မီ ကာကွယ်တားဆီးရန် သို့မဟုတ် အနည်းဆုံးဖြစ်စေရန် ကြိုတင်ပြင်ဆင်ဆောင်ရွက်ထားရန်၊

(၂) ရာသီဥတုပြောင်းလဲမှု လျော့ချရေးနှင့် လိုက်လျောညီထွေဖြစ်စေရေးအတွက် ရေရှည်တည်တံ့သော သဘာဝသယံဇာတစီမံအုပ်ချုပ်ခြင်း၊ ဇီဝမျိုးစုံမျိုးကွဲများနှင့် သဘာဝဂေဟစနစ်များကို ထိန်းသိမ်းကာကွယ်ခြင်းနှင့် ပြန်လည်ပြုံ့ပျိုးထောင်ခြင်းတို့ကို မြှင့်တင်ဆောင်ရွက်ရန်၊

(၃) လတ်တလောနှင့် ရေရှည်တွင် ဖြစ်ပေါ်လာနိုင်သည့် ရာသီဥတုပြောင်းလဲမှု၏သက်ရောက်မှုများမှ ကြိုတင်ကာကွယ်ရန်၊ ပြန်လည်ထူထောင်ရန်နှင့် လူမှု

ကာကွယ်စောင့်ရှောက်မှုများကို ခိုင်မာအားကောင်းစေမည့် လုပ်ငန်းစဉ်များ အားဆောင်ရွက်ထားရှိရန်၊

(၄) ရာသီဥတုကြောင့် ဖြစ်ပေါ်လာနိုင်မည့် ဘေးအန္တရာယ်များအတွက် ကြိုတင်ပြင်ဆင်ရန်နှင့် ပြန်လည်ထူထောင်လာနိုင်စေရန်အတွက် ရင်းမြစ်များအား စုစည်းခြင်းနှင့် ခွဲဝေသုံးစွဲခြင်းတို့ဖြင့် ဘဏ္ဍာရေးလုပ်ငန်းလည်ပတ်မှုကို မြှင့်တင်ပေးပြီး အရပ်ဘက်လူ့အဖွဲ့အစည်းများနှင့် ပေါင်းစပ်ဆောင်ရွက်ရန်။

(ဃ) စီမံကိန်းအဆိုပြုသူသည် ဒေသခံများနှင့် ဆက်သွယ်ပြန်ကြားရေးလုပ်ငန်းစဉ်များ၊ တိုင်ပင်ဆွေးနွေးရေးလုပ်ငန်းစဉ်များ (Community Engagement Plan) နှင့်စပ်လျဉ်း၍ အောက်ပါအချက်များကို လိုက်နာဆောင်ရွက်ရန် -

(၁) တည်ဆောက်ရေးလုပ်ငန်းများနှင့် ဆောင်ရွက်မည့်လုပ်ငန်းများကို ဒေသခံပြည်သူများသို့ ကြိုတင်အသိပေးရန်၊

(၂) တည်ဆောက်ရေးကာလအတွင်း ယာဉ်သွားလာမှုလမ်းကြောင်းများ၊ ယာဉ်သွားလာမှုကြောင့် ဖြစ်နိုင်သောအနှောက်အယှက်များ၊ ပတ်ဝန်းကျင်သာယာမှုအပေါ် ထိခိုက်မှုများနှင့်စပ်လျဉ်း၍ သက်ဆိုင်ရာဒေသခံများသို့ ကြိုတင်အသိပေးရန်၊

(၃) ဒေသခံပြည်သူများနှင့်တိုင်ပင်ဆွေးနွေးခြင်း၊ ပူးပေါင်းပါဝင်စေခြင်း၊ နစ်နာမှုဖြေရှင်းရေးလုပ်ငန်းစဉ်များကို လုပ်ငန်းဆောင်ရွက်နေစဉ်အတွင်း အကောင်အထည်ဖော်ဆောင်ရွက်သွားရန်။

(င) ပတ်ဝန်းကျင်နှင့် လူမှုဆိုင်ရာစီမံခန့်ခွဲမှုအစီအစဉ်များ၊ စောင့်ကြပ်ကြည့်ရှုရေးအစီအစဉ်များ အကောင်အထည်ဖော်ဆောင်ရွက်ခြင်းနှင့်စပ်လျဉ်း၍ အောက်ဖော်ပြပါကိစ္စရပ်များဖြစ်ပွားပါက ဝန်ကြီးဌာနသို့ နှောင့်နှေးမှုမရှိစေဘဲ အစီရင်ခံတင်ပြရန်-

(၁) ပစ္စည်းကိရိယာများ သို့မဟုတ် နည်းစနစ်များ မှားယွင်းအလုပ်လုပ်ခြင်း၊ ပျက်စီးခြင်း သို့မဟုတ် အလုပ်မလုပ်တော့ခြင်း၊

(၂) သိသာထင်ရှားသော ညစ်ညမ်းမှုဖြစ်ပေါ်စေခဲ့သော (သို့မဟုတ်) ဖြစ်ပေါ်နေစေသော (သို့မဟုတ်) ဖြစ်ပေါ်စေနိုင်သော မတော်တဆမှုတစ်ခု ဖြစ်ပွားခြင်း (သို့မဟုတ်) ထုတ်လွှတ်မှုကန့်သတ်တန်ဖိုးဖြင့် ထိန်းချုပ်ထားခြင်း မရှိသည့် အရာဝတ္ထုတစ်ခုထုတ်လွှတ်ခြင်း၊

(၃) သတ်မှတ်ဖော်ပြထားသည့် ကန့်သတ်တန်ဖိုး တစ်ခုခုကို ကျော်လွန်ခြင်း၊

(၄) ပတ်ဝန်းကျင်နှင့်သက်ရှိတို့၏ ကျန်းမာရေးတို့အပေါ် သိသာထင်ရှားသော ဆိုးကျိုးသက်ရောက်မှုများ ဖြစ်ပေါ်ခြင်း။

(စ) စီမံကိန်းအဆိုပြုသူသည် ယင်း၏တာဝန်များ ပျက်ကွက်မှု သို့မဟုတ် အခြား လုပ်ငန်းများဆောင်ရွက်ရန် ပျက်ကွက်မှု သို့မဟုတ် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ လိုက်နာဆောင်ရွက်မှု သက်သေခံလက်မှတ်နှင့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်အား လိုက်နာဆောင်ရွက်ရန် ပျက်ကွက်မှုများကို ဖြစ်နိုင်သမျှ ဆောလျင်စွာစာဖြင့် အသိပေးရမည်။ ပျက်ကွက်မှုတစ်ခုခုကြောင့် အန္တရာယ်ဖြစ်စေနိုင်သော ပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှု ဖြစ်လာနိုင်သည့်ကိစ္စ သို့မဟုတ် ဝန်ကြီးဌာနက အမြန်သိရှိရန် လိုအပ်သည့်ကိစ္စကို (၂၄) နာရီအတွင်း လည်းကောင်း၊ အခြားကိစ္စများအားလုံးတွင်

စီမံကိန်းအဆိုပြုသူက ယင်းဖြစ်စဉ်ဖြစ်ရပ်ကို စတင်သိရှိသည့်အချိန်မှ (၇) ရက် အတွင်းလည်းကောင်း ဝန်ကြီးဌာနသို့ အသိပေးတင်ပြရန်၊

(ဆ) စီမံကိန်း၏ အရွယ်အစား၊ နယ်ပယ်အတိုင်းအတာ၊ တည်နေရာ၊ အခင်းအကျင်း၊ နည်းပညာ၊ ကြုံတင်မျှော်မှန်းနိုင်သော ဆိုးကျိုးသက်ရောက်မှုကြောင့် ဖြစ်လာသည့် အန္တရာယ်၊ ထုတ်လုပ်မှုနည်းလမ်း သို့မဟုတ် ညစ်ညမ်းမှုတားဆီးရန် သို့မဟုတ် လျှော့ချရန် ဆောင်ရွက်မှုတို့တွင် အဓိကပြောင်းလဲခြင်း သို့မဟုတ် တိုးချဲ့ခြင်း သို့မဟုတ် ဒုတိယတိုးချဲ့ဆောင်ရွက်ရန် အဆိုပြုခြင်းဖြစ်ပါက စီမံကိန်းအဆိုပြုသူသည် သတ်မှတ်ထားသော အချိန်ဇယားအတွင်း ပြောင်းလဲမှုများ၏ သတင်းအချက်အလက်များနှင့်အတူ ဝန်ကြီးဌာနသို့ တင်ပြရန်၊

(ဇ) စီမံကိန်းဇရိယာအတွင်း မမျှော်လင့်သော ဘေးအန္တရာယ်များကြောင့်လည်း ကောင်း ၊ ပတ်ဝန်းကျင်နှင့် လူမှုရေးအခြေအနေ ပြောင်းလဲမှုများကြောင့်လည်းကောင်း၊ ဖြစ်ပေါ်လာနိုင်သည့် ထိခိုက်မှုများအပေါ်မူတည်၍ သက်ဆိုင်ရာ ကဏ္ဍအလိုက် စီမံခန့်ခွဲမှုအစီအစဉ်များအား ပြန်လည်သုံးသပ်ဆောင်ရွက်ရန်၊

(စျ) တရားမဝင်တောခုတ်ခြင်း၊ တောမီးရှို့ခြင်း၊ စည်းကမ်းမဲ့ခုတ်လှဲခြင်း၊ တောရိုင်းတိရစ္ဆာန်များအား အမဲလိုက်ခြင်းမှ တားမြစ်ခြင်းအတွက် သစ်တောသစ်ပင်နှင့် ဇီဝမျိုးစုံမျိုးကွဲ ကာကွယ်ရေးဆိုင်ရာ သတိပေးဆိုင်းဘုတ်များစိုက်ထူခြင်းနှင့် စီမံကိန်းအလုပ်သမားများအား အသိပညာပေးခြင်းများဆောင်ရွက်ရန်၊

(ည) ယဉ်ကျေးမှုအမွေအနှစ်နှင့်စပ်လျဉ်း၍ စီမံကိန်းပိုင်ရှင်သည် လုပ်ငန်းများဆောင်ရွက်နေစဉ် စီမံကိန်းဇရိယာအတွင်း ယဉ်ကျေးမှုအမွေအနှစ်များဆိုင်ရာ အမှတ်အသားများ/ အထိမ်းအမှတ်များ ရှေးဟောင်းဝတ္ထုပစ္စည်းတွေ့ရှိပါက အနီးဆုံးရပ်ကွက်သို့မဟုတ်ကျေးရွာအုပ်ချုပ်ရေးမှူးထံမှတစ်ဆင့် ရှေးဟောင်းသုတေသနနှင့် အမျိုးသားပြတိုက်ဦးစီးဌာနသို့ ဆက်သွယ်အကြောင်းကြားရန်၊

(ဋ) ရွှေ့ပြောင်းလုပ်သားများ လာရောက်အလုပ်လုပ်ကိုင်မှုကြောင့် သက်ရောက်မှုရှိနိုင်သော ကျန်းမာရေးပြဿနာများ (အသက်ရှူလမ်းကြောင်းဆိုင်ရာရောဂါများ၊ အမျိုးသမီးနှင့်ကလေးငယ်များအတွက် ကျန်းမာရေးစောင့်ရှောက်မှုလိုအပ်ချက်များ၊ အလုပ်သမားများအတွက် ကိုဗစ်ရောဂါကာကွယ်ဆေးထိုးနှံပေးနိုင်ရန် လိုအပ်ချက်များ၊ ရေနှင့်နှီးနွယ် ပတ်သက်သော ဝမ်းပျက်ဝမ်းလျှော၊ ငှက်ဖျား၊ သွေးလွန်တုပ်ကွေး၊ အရေပြားရောဂါ အစရှိသော ကျန်းမာရေးပြဿနာများအား စီမံကိန်းဇရိယာရှိ ကျေးလက်ကျန်းမာရေးဌာနရှိ အချက်အလက်များမှထုတ်နုတ်ကာ ဆန်းစစ်ဖော်ထုတ်၍ အလုပ်သမားများအား ပံ့မှန်ကျန်းမာရေးစောင့်ရှောက်မှု အစီအမံများ ဆောင်ရွက်သွားရန်၊

(ဌ) လူမှုတာဝန်သိအစီအစဉ် (CSR Activities) နှင့်စပ်လျဉ်း၍ အောက်ပါအတိုင်း လိုက်နာဆောင်ရွက်ရန်-

(၁) လူမှုတာဝန်သိအစီအစဉ်အနေဖြင့် ဒေသဖွံ့ဖြိုးရေးလုပ်ငန်းများ (Community Development Plan) ဆောင်ရွက်ရာတွင် သက်ဆိုင်ရာဒေသရှိ ဌာနဆိုင်ရာများနှင့် ပူးပေါင်းဆောင်ရွက်ရန်၊

(၂) မြို့နယ်ဖွံ့ဖြိုးတိုးတက်ရေး စီမံကိန်း (Township Development Plans) များနှင့် ချိတ်ဆက်ဆောင်ရွက်ရန်နှင့် စီမံကိန်းအနီးရှိ ဒေသခံပြည်သူများ၊ ဆက်စပ်ပတ်သက်သူများ (Stakeholders)များနှင့် စဉ်ဆက်မပြတ် တွေ့ဆုံဆွေးနွေးပြီး ၎င်းတို့၏ အကြံပြုချက်နှင့် လိုအပ်ချက်များအား အလေးထားပေါင်းစပ်ဆောင်ရွက်ရန်၊စီမံကိန်းနှင့်ပတ်သက်သောသတင်းအချက်အလက်များကို တင်ပြခြင်းများနှင့် နစ်နာဖြေရှင်းရေးလုပ်ငန်းများကို လုပ်ငန်းဆောင်ရွက်နေစဉ်အတွင်း အကောင်အထည်ဖော်ဆောင်ရွက်သွားရန်။

(၃) တမံတည်ဆောက်ရာတွင် မြန်မာနိုင်ငံတမံကြီးများဆိုင်ရာ အမျိုးသားကော်မတီမှ ထုတ်ပြန်ထားသော နည်းပညာဆိုင်ရာလမ်းညွှန်ချက်များ၊ လျှပ်စစ်စွမ်းအား ဝန်ကြီးဌာနမှ ထုတ်ပြန်ထားသော မြန်မာ့ရေအားလျှပ်စစ်နည်းပညာဆိုင်ရာ စံသတ်မှတ်ချက်နှင့် ကမ္ဘာ့ဘဏ်၏ လုပ်ငန်းလည်ပတ်မှုမူဝါဒ (World Bank Opertional Policy- Od/Gp 4.37) တို့ကို တိကျစွာ လိုက်နာဆောင်ရွက်ရန်၊

(၄) စီမံကိန်းအဆိုပြုသည် ဆည်၏ဒီဇိုင်းပုံစံရေးဆွဲခြင်း၊ တည်ဆောက်ခြင်းနှင့် တည်ဆောက်ပြီး ဆည်အား ထိန်းသိမ်းပြုပြင်ရေးများ ဆောင်ရွက်ခြင်းနှင့် လုပ်ငန်းလည်ပတ်၍ လျှပ်စစ်ထုတ်လုပ်ခြင်းကို ဆည် (ရေလှောင်ကန်) ဘေးကင်းလုံခြုံစိတ်ချစေရေး (Dam Safety) ကို သေချာစေလျက်ဆောင်ရွက်ရန်၊

(၅) ရေကာတာလုံခြုံရေးဆန်းစစ်ခြင်း (Dam Safety Review And Dam Failure Modes Assessment) ကို ၅နှစ် တစ်ကြိမ် တတိယအဖွဲ့အစည်း (Independent Third Party) ဖြင့်လုပ်ဆောင်ရန်နှင့် ၎င်းရေကာတာလုံခြုံရေး ဆန်းစစ်ချက်ကို သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ တင်ပြခြင်းနှင့် အများပြည်သူသိရှိစေရန် စီမံကိန်းအဆိုပြုသူ၏ Website တွင် လွှင့်တင်ခြင်းများ ဆောင်ရွက်ပေးရန်၊

(တ) စီမံကိန်းအဆိုပြုသူသည် ဆည်ကျိုးခြင်းအပါအဝင် အဆိုပြုစီမံကိန်းကြောင့် ပတ်ဝန်းကျင်နှင့် လူမှုဆိုင်ရာထိခိုက်ပျက်စီးခြင်းများ အားလုံးအတွက် တာဝန်ရှိပြီးထိခိုက်မှုများအတွက် လျော်ကြေးပေးဆောင်ခြင်း၊ ပြန်လည်ထူထောင်ခြင်းလုပ်ငန်းများ ဆောင်ရွက်ပေးရန်၊

(ထ) Environmental Flow Assessment ပြုလုပ်ချက်ရလဒ်ကို အခြေခံ၍ ချီဖွေမြစ်၏ အနည်းဆုံးရေစီးဆင်းမှု လိုအပ်ချက်ပမာဏကို ဆည်မှထုတ်လွှတ်ပေးရန်၊

(ဒ) အဆိုပြုရေအားလျှပ်စစ်တည်ဆောက်ခြင်း၊ လည်ပတ်ခြင်းနှင့် ဖျက်သိမ်းခြင်းနှင့်သက်ဆိုင်သော တည်ဆဲပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေနှင့် နည်းဥပဒေများ၊ အပြည်ပြည်ဆိုင်ရာ ကွန်ဗင်းရှင်းများ၊ စာချုပ်များနှင့် သဘောတူညီချက်များ၊ အမျိုးသားနှင့် အပြည်ပြည်ဆိုင်ရာ စံချိန်စံညွှန်းများနှင့် လမ်းညွှန်ချက်များအားလုံးကို လိုက်နာဆောင်ရွက်ရန်၊

(ဓ) စီမံကိန်းနှင့် ဆက်စပ်အခြေခံအဆောက်အဦများဖြစ်သော ဓာတ်အားလိုင်းနှင့် ဓာတ်အားခွဲရုံများ တည်ဆောက်လည်ပတ်ခြင်းအား အပြည်ပြည်ဆိုင်ရာ ငွေကြေးရန်ပုံငွေအဖွဲ့၏ Environmental, Health, And Safety Guidelines For Electric Power Transmission And Distribution (2007) အတိုင်း လိုက်နာဆောင်ရွက်ရန်၊

(န) စီမံကိန်းအတွက်ရှင်းလင်းခဲ့သော Vegetation Cover 12.2 Square Hectometre အတွက် ၎င်းဧရိယာထက်မနည်းသော ဧရိယာတွင် အပင်ပြန်လည်အစားထိုး စိုက်ပျိုးပေးရန်၊

(ပ) အစီရင်ခံစာတွင် ဖော်ပြထားသည့် ကတိကဝတ်များအား အပြည့်အဝလိုက်နာဆောင်ရွက်ရန်၊

(ဖ) Project Design နှင့် Operation များ ပြောင်းလဲမှုရှိပါက ချီဖွေငယ်ရေအား လျှပ်စစ်ကုမ္ပဏီလိမိတက်သည်ပူးပေါင်းဆောင်ရွက်သူများကိုယ်စား ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနသို့ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်းအပိုဒ် (၉၆) အရ အကြောင်းကြားတင်ပြရန်၊

(ဗ) ဒေသခံပြည်သူများ၊ ဆက်စပ်ပတ်သက်သူများ (Stakeholders) နှင့်စဉ်ဆက်မပြတ်တွေ့ဆုံဆွေးနွေးပြီး ၎င်းတို့၏အကြံပြုချက်နှင့် လိုလားချက်များအား အလေးထားပေါင်းစပ်ဆောင်ရွက်ရန်၊

(ဘ) ပတ်ဝန်းကျင်နှင့်လူမှုရေးဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှုအစီရင်ခံစာကို သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ သတ်မှတ်ထားသည့်အချိန်အတွင်း တင်ပြရန်၊

(မ) ချီဖွေငယ်ရေအားလျှပ်စစ်ကုမ္ပဏီလိမိတက်သည် မြန်မာဘာသာပြန်ထားသော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာအကျဉ်းချုပ်နှင့် စီမံကိန်းမှ လိုက်နာဆောင်ရွက်မည့် ပတ်ဝန်းကျင်နှင့်လူမှုရေးဆိုင်ရာ ကတိကဝတ်များအား စီမံကိန်းနှင့် ဆက်စပ်ပတ်သက်သူများသို့ စီမံကိန်း၏ ပတ်ဝန်းကျင် ထိခိုက် မှုဆန်းစစ်ခြင်း အစီရင်ခံစာအား အတည်ပြုပြီး နောက် (၁) လ အတွင်း ဖြန့်ဝေ အသိပေးရန်၊

(ယ) စီမံကိန်းပိုင်ရှင်သည် အတည်ပြုထားသည့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာကို အများပြည်သူသိရှိနိုင်စေရေး ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာအား အတည်ပြုပြီး နောက် (၁) လအတွင်း ထုတ်ဖော်ကြေညာရန်၊

(ရ) စီမံကိန်းပိုင်ရှင်အနေဖြင့် ဒေသအကျိုးပြုလုပ်ငန်းများ၊ ဒေသခံပြည်သူများ၏ လူမှုစီးပွားဆိုင်ရာ ဖွံ့ဖြိုးရေးလုပ်ငန်းများကို တတ်နိုင်သမျှဆောင်ရွက်ပေးရန်၊

(လ) စီမံကိန်းပိုင်ရှင်အနေဖြင့် အများပြည်သူနှင့်တိုင်ပင်ဆွေးနွေးခြင်း၊ စီမံကိန်းအကြောင်းအရာများနှင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာကို အများပြည်သူသိရှိနိုင်စေရေး ထုတ်ဖော်ကြော်ငြာခြင်းများ ဆောင်ရွက်ရာတွင် သက်ဆိုင်ရာအစိုးရအဖွဲ့အစည်းများ၊ အခြားအဖွဲ့အစည်းများ၊ လူမှုအဖွဲ့အစည်းများနှင့် စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသူများအပါအဝင် ဆက်စပ်ပတ်သက်သူများ၏ တောင်းဆိုအကြံပြုသည့်အချက်များကို အလေးထားဆောင်ရွက်ပေးရန်နှင့် ညှိနှိုင်းဖြည့်ဆည်းပေးရန်၊

(ဝ) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် စောင့်ကြပ်ကြည့်ရှုမှုအစီအစဉ်များနှင့် စပ်လျဉ်း၍ အောက်ပါအတိုင်း လိုက်နာဆောင်ရွက်ရန်-

(၁) ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာပါ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်၊ ပတ်ဝန်းကျင်စောင့်ကြပ်ကြည့်ရှုရေးအစီအစဉ်နှင့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုနှင့် စောင့်ကြပ်ကြည့်ရှုစစ်ဆေးမှုအစီအစဉ်ခွဲများအား ပတ်ဝန်းကျင်

ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာအား အတည်ပြုပြီး သည်နှင့်တစ်ပြိုင်နက် ချက်ချင်းအကောင်အထည်ဖော်ဆောင်ရွက်ရန်၊

(၂) စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေးဆိုင်ရာ ထိခိုက်နိုင်မှုများကို လျော့ချမည့်နည်းလမ်းများ၊ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်များ၊ ၎င်းနှင့်ဆက်စပ်သည့် အစီအစဉ်ခွဲများ၊ စောင့်ကြပ်ကြည့်ရှု မည့် နည်းလမ်းများအပါအဝင် ဆောင်ရွက်ရမည့် ကိစ္စရပ်များအားလုံးကို အတည်ပြု ထားသည့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာတွင် ဖော်ပြထားသည့် အတိုင်း လိုက်နာအကောင်အထည်ဖော် ဆောင်ရွက်ရန်၊

(၃) စောင့်ကြပ်ကြည့်ရှုမည့်နယ်ပယ် (ရေ၊ လေ၊ ဆူညံသံ) များ၊ နည်းစနစ်များ၊ နမူနာစုဆောင်းခြင်းနှင့် ခါတ်ခွဲစမ်းသပ်ခြင်း၊ စောင့်ကြပ်တိုင်းတာမည့် နေရာ၊ အကြိမ်အရေအတွက်၊ အချိန်ဇယားနှင့်မှတ်တမ်းတင်ခြင်းနှင့် အစီရင်ခံခြင်း စသည်တို့ကိုရေးဆွဲ၍ အကောင်အထည်ဖော်ဆောင်ရွက်ပြီး သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ (၆)လ တစ်ကြိမ်တင်ပြရန် နှင့် အများပြည်သူသိရှိစေရန် ဝန်ကြီးဌာနသို့ တင်ပြသည့်နေ့ရက်မှ (၁၀) ရက် အတွင်း ထုတ်ဖော်ကြေညာရန်၊

(၄) အစီရင်ခံစာတွင် သတ်မှတ်ဖော်ပြထားသော ကန်ထရိုက်တာနှင့်သက်ဆိုင် သည့် စည်းကမ်းချက်များကို လည်းကောင်း၊ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီ အစဉ်တွင် ဖော်ပြထားသည့် ကုစားပြင်ဆင်ရေးလုပ်ငန်းများ၊ ကြိုတင် ကာကွယ်ရေးလုပ်ငန်းများ လိုက်နာဆောင်ရွက်ရန်နှင့် စောင့်ကြပ်ကြည့်ရှု ရေး အစီအစဉ်တွင် ဖော်ပြထားသည့် ကတိကဝတ်အတိုင်း လိုက်နာ အကောင်အထည်ဖော်ဆောင်ရွက်ရန်၊

(၅) အစီရင်ခံစာတွင် ဖော်ပြထားသော ပတ်ဝန်းကျင်ထိခိုက်မှု အနည်းဆုံးဖြစ် စေရေးဆောင်ရွက်မည့်လုပ်ငန်း အစီအစဉ်များအတိုင်း အလေးထားလိုက် နာဆောင်ရွက်ရန်၊

(၆) စီမံကိန်း၏ ကြွင်းကျန်သက်ရောက်မှုများနှင့် ဘေးအန္တရာယ်ရှိမှုများအား တည်ဆဲစည်းမျဉ်းစည်းကမ်း၊ စံချိန်စံညွှန်းများ၊ လမ်းညွှန်ချက်များနှင့် အညီ ဖြစ်စေရေး စီမံဆောင်ရွက်ရန်နှင့် စောင့်ကြပ်ကြည့်ရှုရန်၊

(၇) ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) တွင် ဖော်ပြထားသော အခန်း (၉) စောင့်ကြပ်ကြည့်ရှုခြင်း (အပိုဒ် ၁၁၁ မှ အပိုဒ် ၁၂၂) အား လိုက်နာဆောင်ရွက်ရန်၊

(၈) စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် အစီ အစဉ်ခွဲများ၊ စောင့်ကြပ်ကြည့်ရှုမည့် အစီအစဉ်များအတွက် လုံလောက် သည့် ရန်ပုံငွေထားရှိသုံးစွဲရန်နှင့် ၎င်းအစီအစဉ်များကို အကောင်အထည် ဖော်ဆောင်ရွက်မည့် အဖွဲ့အစည်းများ ဖွဲ့စည်းဆောင်ရွက်ရန်၊

(၉) ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် ပတ်ဝန်းကျင်စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ်များ အကောင်အထည်ဖော်မှုအတွက် စာရွက်စာတမ်းများ မှတ်တမ်း ထားရှိရန်၊

(၁၀) ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနမှ ထိတွေ့ဝန်းကျင်ဆိုင်ရာ စံချိန်စံညွှန်းရေးဆွဲလျက်ရှိရာ ၎င်းစံချိန်စံညွှန်းအား အတည်ပြုထုတ်ပြန်ပြီးပါက ချီဖွေမြစ် ၏ ရေအရည်အသွေးကို ထပ်မံနမူနာကောက်ယူတိုင်းတာ၍ မြန်မာနိုင်ငံထိတွေ့ဝန်းကျင်ဆိုင်ရာရေအရည်အသွေးစံချိန်စံညွှန်းပါ မြစ်ရေအရည်အသွေးနှင့်စွန့်ပစ်မည့် Pararmeter များနှင့်နှိုင်းယှဉ်ဖော် ပြရန်။

(သ) ရေနေသတ္တဝါများ (အထူးသဖြင့် ငါးများ) အပေါ် ထိခိုက်မှု ရှိ/မရှိကို ရေနေသတ္တဝါများ (အထူးသဖြင့် ငါးများ) ၏ မျိုးစိတ်များ (Species Diversity)နှင့် အကောင် အရေအတွက် (Population) တို့ လျော့နည်းသွားခြင်းရှိ/မရှိ၊ မျိုးစိတ် အသစ်များ ဝင်ရောက်လာခြင်း ရှိ/ မရှိကို စဉ်ဆက်မပြတ်စောင့်ကြပ်ကြည့်ရှုခြင်း (Continuous Monitoriong) ကို ဆောင်ရွက်ရန်နှင့် Monitoring Report တွင် ထည့်သွင်းတင်ပြရန်၊

(ဟ) စီမံကိန်းသက်တမ်းတစ်လျှောက် ဓာတ်အားလိုင်းနှင့် ဓာတ်အားခွဲရုံများတွင် အများပြည်သူ လျှပ်စစ်ဘေးအန္တရာယ် ကာကွယ်ရေးအတွက် ဆိုင်းဘုတ်များ၊ ဓာတ်အားလိုင်းနှင့် ဓာတ်အားခွဲရုံများရှိ အန္တရာယ်ရှိပစ္စည်းများနှင့် အလွယ်တကူ မထိတွေ့နိုင်စေရန် အတားအဆီးများ၊ လျှပ်ကာပစ္စည်းများထားရှိခြင်း၊ အများပြည်သူအား လျှပ်စစ်ဘေးအန္တရာယ်ဆိုင်ရာ အသိပညာမြှင့်တင်ပေးခြင်း၊ သင်တန်းများပို့ချခြင်းများ ဆောင်ရွက်ရန်နှင့် ဆောင်ရွက်မှု မှတ်တမ်းများ၏ Monitoring Report တွင် ထည့်သွင်းတင်ပြရန်၊ ဓာတ်အားလိုင်းနှင့် ဓာတ်အားခွဲရုံများအား ပုံမှန်ပြုပြင်ထိန်းသိမ်းခြင်းများ ဆောင်ရွက်ရန်နှင့် ဆောင်ရွက်မှုမှတ်တမ်းများအား Monitoring Report တွင် ထည့်သွင်းတင်ပြရန်၊

(ဠ) စီမံကိန်းလည်ပတ်သည့်ကာလ မကုန်ဆုံးမီ စီမံကိန်းပိုင်ရှင်သည် သက်ဆိုင်ရာ ဝန်ကြီး ဌာနများနှင့်တိုင်ပင်ဆွေးနွေး၍ စီမံကိန်းဖျက်သိမ်းမည့် ကာလတွင် ပတ်ဝန်းကျင် ထိခိုက်မှုမရှိစေရေး ဆောင်ရွက်မည့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ် (Decom-missioning Phase EMP) ကို ရေးဆွဲကာ တင်ပြအတည်ပြုချက်ရယူရန်၊

(အ) စီမံကိန်းသက်တမ်းတစ်လျှောက် စီမံကိန်းပတ်ဝန်းကျင်ရှိ ဒေသခံပြည်သူများ၏ လမ်းပန်းဆက်သွယ်ရေး ၊ ကျန်းမာရေး၊ ပညာရေး၊ ဘာသာရေး၊ လူမှုရေး စသည့်တို့ ဖွံ့ဖြိုးတိုးတက်စေရေးအတွက် ဒေသဖွံ့ဖြိုးရေးလုပ်ငန်းများကို ဒေသခံပြည်သူများနှင့် တိုင်ပင်ဆွေးနွေး၍ ဆောင်ရွက်ပေးရန်နှင့် ဆောင်ရွက်ထားရှိမှုအား မှတ်တမ်းများနှင့် တကွ Monitoring Report တွင် ထည့်သွင်းတင်ပြရန်၊

(ကက) လျှပ်စစ်စွမ်းအားဝန်ကြီးဌာန (ယခင်လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန)နှင့် CPI Yunnan International Power Investment Co.,Ltd (Chipwi Nge Hydropower Co., Ltd), Asia World Co.,Ltd တို့သည် ဧရာဝတီမြစ်၏ အထက်ပိုင်း မေခမြစ်၊ မလိခမြစ်နှင့် ချီဖွေငယ်မြစ်တို့တွင် ဆောင်ရွက်မည့် ရေအားလျှပ်စစ်စီမံကိန်း (၈) ခုတို့အတွက် ၂၀၀၆ ခုနှစ် ဒီဇင်ဘာလတွင် နားလည်မှုစာချွန်လွှာရေးထိုးခဲ့ပြီး အဆိုပါ စီမံကိန်းများအား ၁၅ နှစ်အတွင်းပြီး စီးအောင် အကောင်အထည်ဖော်ဆောင်ရွက်ရန်ဖြစ်ပြီး ဧရာဝတီမြစ်အထက်ပိုင်း ရေအားလျှပ်စစ်စီမံကိန်းများအားလုံး၏ပိုင်ရှင်မှာ

CPI Yunnan International Power Investment Co.,Ltd သာလျှင်ဖြစ်သဖြင့် ရောဝတီမြစ်ဝှမ်းအထက် ပိုင်းအတွက် (Upper Ayeyarwaddy Basin) တစ်ခုလုံး အတွက် အဆိုပြုရေအား လျှပ်စစ်စီမံကိန်း(၈)ခု အကောင်အထည်ဖော်ခြင်း ဖြစ်ပေါ်လာနိုင်သည့် Cumulative Impact များအတွက် CPI Yunnan International Power Investment Co.,Ltd မှ ရောဝတီမြစ်ဝှမ်းအထက်ပိုင်းအတွက် (Upper Ayeyarwaddy Basin) တစ်ခုလုံး အတွက် Cumulative Impact Assessment For Upper Ayeyarwaddy Basinကို မေခမြစ်၊ မလိခမြစ်ပေါ်ရှိ ရေအားလျှပ်စစ်စီမံကိန်း (၇) ခု၏ တည်ဆောက်ရေး လုပ်ငန်းများ မစတင်မီ ပြုလုပ်တင်ပြရန်၊

(က၁) စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေးဆိုင်ရာ ထိခိုက်နိုင်မှုများကို လျော့ချမည့်နည်းလမ်းများ၊ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်များ၊ ၎င်းနှင့် ဆက်စပ်သည့် အစီအစဉ်ခွဲများ၊ စောင့်ကြပ်ကြည့်ရှုမည့် နည်းလမ်းများ အပါအဝင် ဆောင်ရွက်ရမည့် ကိစ္စရပ်များအားလုံးကို အတည်ပြုထားသည့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာတွင် ဖော်ပြထားသည့်အတိုင်း လိုက်နာအကောင်အထည်ဖော်ဆောင်ရွက်ရန်၊

(က၇) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် ပတ်ဝန်းကျင်စောင့်ကြပ်ကြည့်ရှုမှုအစီအစဉ်များ အကောင်အထည်ဖော်မှုအတွက် စာရွက်စာတမ်းများ မှတ်တမ်းထားရှိရန်၊

(ကဃ) ဝန်ကြီးဌာနသည် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး နည်းဥပဒေများ၊ နည်းဥပဒေ ၃၀ အရ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုရန်ပုံငွေတစ်ရပ် ထူထောင်ရန် ဆောင်ရွက်လျက်ရှိရာ ရန်ပုံငွေထူထောင်ပြီးနောက် စီမံကိန်းပိုင်ရှင်သည် ဝန်ကြီးဌာနမှ သတ်မှတ်သည့် ငွေကြေးပမာဏကို ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုရန်ပုံငွေတွင် ထည့် ဝင်ရန်၊

(က၈) စီမံကိန်းပိုင်ရှင်သည် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာပါ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် ပတ်ဝန်းကျင်စောင့်ကြပ်ကြည့်ရှုခြင်းအစီအစဉ်များကို အကောင်အထည်ဖော်ရာတွင် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာတွင် ဖော်ပြထားသော ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် ပတ်ဝန်းကျင်စောင့်ကြပ်ကြည့်ရှုခြင်းအစီအစဉ်များကို အကောင်အထည်ဖော်ရန်အတွက် ရန်ပုံငွေလျာထားချက်နှင့် လုံလောက်မှုမရှိပါက ရန်ပုံငွေ ထပ်မံဖြည့်သွင်းဆောင်ရွက်ရန်၊

(က၉) စီမံကိန်းအဆိုပြုသူသည် အတည်ပြုထားသည့် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း အစီရင်ခံစာကို အများပြည်သူသိရှိနိုင်စေရေး ထုတ်ဖော်ကြေညာရန်၊ မြန်မာဘာသာဖြင့်ရေးသားဖော်ပြထားသော အကျဉ်းချုပ်အစီရင်ခံစာနှင့် လိုက်နာ ဆောင်ရွက်မည့် ပတ်ဝန်းကျင်နှင့်လူမှုဆိုင်ရာကတိကဝတ်များအား စီမံကိန်းနှင့် ဆက်စပ်ပတ်သက်သူများနှင့် အများပြည်သူများသိရှိနိုင်ရေး ဖြန့်ဝေအသိပေး ထုတ်ဖော်ကြေညာရန်နှင့် ထုတ်ဖော်ကြေညာထားသည့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာနှင့် ပတ်သက်၍ အစိုးရအဖွဲ့အစည်းများ၊ အခြားအဖွဲ့အစည်းများ၊ လူမှုအဖွဲ့အစည်းများနှင့် စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသူများ အပါအဝင် ဆက်စပ်ပတ်သက်သူများ၏ တောင်းဆိုအကြံပြုသည့်အချက်များကို အလေးထားဆောင်ရွက်ပေးရန်နှင့် ညှိနှိုင်းဖြည့်ဆည်းပေးရန်၊

(ကဆ) အတည်ပြုထားသော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ (ဖ) စုံ ကို Soft Copy ပူးတွဲ၍ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနသို့ ပေးပို့သည့်အခါ အောက်ပါ အချက်များကို ပြင်ဆင်၍ ဤအတည်ပြုစာထုတ်ပြန်ပြီး (၄၅) ရက်အတွင်း ပြန်လည် ပေးပို့ရန်-

(၁) မြန်မာနိုင်ငံသား ရင်းနှီးမြှုပ်နှံမှုဥပဒေ (၂၀၁၃) အစား မြန်မာနိုင်ငံရင်းနှီး မြှုပ်နှံမှုဥပဒေ (၂၀၁၆) နှင့် မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှု နည်းဥပဒေများ (၂၀၁၇) ဟုပြင်ဆင်၍ စီမံကိန်းနှင့်ဆက်စပ်သည့် ပြဋ္ဌာန်းချက်များအား ပြင်ဆင် ဖြည့်စွက်ရန်၊

(၂) မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုဥပဒေအရ ခွင့်ပြုမိန့်ရရှိထားသည့်လုပ်ငန်း တစ်ခု ဖြစ်သည့်အတွက် မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုကော်မရှင်၏ ခွင့်ပြုမိန့်နှင့် ဆုံးဖြတ်ချက်မိတ္တူ တို့ကို ထည့်သွင်းဖော်ပြရန်၊

(၃) မြန်မာ့အာမခံလုပ်ငန်းဥပဒေ (၁၉၉၃) ပုဒ်မ ၁၅၊ ၁၆ ပါ ပြဋ္ဌာန်းချက်များ အား ဖြည့်စွက်ဖော်ပြရန်နှင့် Motor Vehicles Law (2015) အစား ယာဉ်အန္တရာယ် ကင်းရှင်းရေးနှင့် မော်တော်ယာဉ်စီမံခန့်ခွဲမှုဥပဒေ (၂၀၂၀) ဟုပြင်ဆင်ဖော်ပြ ရန်၊

(၄) ဇယား ၁၁-ဖ-၂ တွင် ဌာနသို့ (ဖ) လတစ်ကြိမ်တင်ပြရမည့် Environmental Monitoring Plan တွင် တိုင်းတာမည့် Parameter များသည် Annually ဟု ဖော်ပြထားသည့်အတွက် Air ၊ Water ၊ Terrestrial Ecology များအား ၆လ တစ်ကြိမ်တိုင်းတာပေးရန်၊

(၅) စောင့်ကြပ်ကြည့်ရှုခြင်း ဆောင်ရွက်မည့် Environmental Management Department ၏ Institutional Structure နှင့် Related works များ အား ဇယား ၁၁-၄-၁-၁ နှင့် စာမျက်နှာ ၂၃၄ ၊၂၃၅ ဖော်ပြထားသော်လည်း တစ်ဦးချင်း၏ Roles and Responsiblitiesများကို(ဥပမာ- ဇယား ၁၁-၂-၇-၁၀ တွင် Reporting Mechanisms Responsiblities ဇယား ကဲ့သို့) သီးခြားဖော်ပြထားခြင်းမရှိသောကြောင့် Environmental Management Departmentပါ ဝန်ထမ်းတစ်ဦးချင်းစီ၏ Roles and responsiblities များအား ပြင်ဆင်ဖော်ပြရန်၊

(၆) Emergency Response Planနှင့်ပတ်သက်၍ 8.4 Risk Accident Emergency Plan တွင် ဖော်ပြထားသော်လည်း Emergency Response Planအား လက်တွေ့စမ်းသပ်အသုံးပြုရခြင်းနှင့် စမ်းသပ်မှုရလဒ်အပေါ် အခြေခံ၍ ပြန်လည်ဆန်းစစ်ပြုပြင်ခြင်းအား ထည့်သွင်းပေးရန်နှင့် Institutional Structure For Emergency Response Plan အား ဖော်ပြ ရန်၊

(၇) စီမံကိန်းရေယာရှိ ကျန်းမာရေးစောင့်ရှောက်မှုနှင့်ပတ်သက်၍ စီမံကိန်းမှ ဆောင်ရွက်ပေးနိုင်မည့် ကျေးလက်ကျန်းမာရေးဌာနများအတွက် ကူညီ ထောက်ပံ့ပေးခြင်း၊ ကျန်းမာရေးဆိုင်ရာ အထောက်အပံ့များပံ့ပိုးခြင်း ၊ အလုပ်သမားများအတွက် နှစ်စဉ် ကျန်းမာရေးဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှု စစ်ဆေးခြင်းနှင့် On site Clinic များထားရှိဆောင်ရွက်ခြင်းတို့အတွက်

အစီအမံများနှင့် ကျန်းမာရေးဆိုင်ရာ အချက်အလက်များ ကောက်ယူရာတွင် ကိုးကားရည်ညွှန်းသည့် Reference များအား ထည့်သွင်းဖော်ပြရန်၊

(က၉) Dam Break Analysis ဆောင်ရွက်ခြင်းနှင့် Emergency Preparedness Plan ရေးဆွဲခြင်းအား JV Company ထူထောင်ပြီး စီးပွားဖြစ်လည်ပတ်မှု စတင် ချိန်တွင် ဆောင်ရွက်ပေးမည်ဟု ကတိကဝတ်ပြုဖော်ပြထားသဖြင့် Dam Failure နှင့် Flood Risk ကြောင့်ဖြစ်ပေါ်လာမည့် ရေလွှမ်းရေိယာ (Flood Impact Zone) ၊ ရေလွှမ်း ရေိယာအတွင်းကျရောက်မည့်ကျေးရွာများ၊ အခြေခံအဆောက်အဦးများ ၊ ထိခိုက်မှု၏ ပြင်းထန်နိုင်မှုများအား သင့်လျော်သော ဆန်းစစ်သည့် နည်းလမ်း (Modeling/ Mapping) တစ်ခုခုဖြင့် တွက်ချက်ဖော်ပြခြင်း၊ Dam Break Analysis ဆောင်ရွက် ခြင်းနှင့် Dam Break Analysis အပေါ် အခြေခံ၍ Emergency Preparedness Plan အသစ်ပြန်လည်ရေးဆွဲခြင်းအား သယံဇာတနှင့်သဘာဝ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဝန်ကြီးဌာနသို့ ဤအတည်ပြုစာထုတ်ပြန်ပြီး နောက် (၆)လအတွင်း ပြန်လည် တင်ပြရန်၊

(က၁၀) အရေးပေါ်အခြေအနေ ဖြစ်ပေါ်လာပါက ကယ်ဆယ်ရေးလုပ်ငန်းများ ဆောင် ရွက်ရန်၊အသက်အိုးအိမ်ဆုံးရှုံးမှုများအတွက် လျော်ကြေးပေးခြင်းများ၊ ပြန်လည် ထူထောင်ရေးလုပ်ငန်းများ ဆောင်ရွက်ရန်နှင့် Emergency Preparedness Planပါ လုပ်ငန်းတစ်ခုချင်းစီ အကောင်အထည်ဖော်ခြင်းအတွက် သုံးစွဲမည့် ရန်ပုံ ငွေအသေးစိတ်အား Emergency Preparedness Planတွင် ဖြည့်စွက်ရေးဆွဲ၍ သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ ဤအတည်ပြု စာထုတ်ပြန်ပြီး နောက် (၆) လ အတွင်း ပြန်လည်တင်ပြရန်၊

(က၁၁) Dam Safety နှင့်ပတ်သက်၍ စီမံကိန်းလည်ပတ်သည့် သက်တမ်းတစ်လျှောက် ပြုပြင်ထိန်းသိမ်းမည့်အစီအစဉ် Operation And Maintenance Plan ၊ စောင့် ကြပ်ကြည့်ရှုမည့်အစီအစဉ် (Dam Safety Monitoring Programme) ကို ရေးဆွဲ၍ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ ဤ အတည်ပြု စာထုတ်ပြန်ပြီး နောက် (၆) လ အတွင်း ပြန်လည်တင်ပြရန်၊

(က၁၂) ဆည်မှထုတ်လွှတ်ပေးမည့် ရေပမာဏမှာ မြစ်၏ ဂေဟစနစ်ကျန်းမာရေးနှင့် ဂေဟစနစ်ဝန်ဆောင်မှုများ ယခင်ကအတိုင်း ဆက်လက်ထောက်ပံ့နိုင်ရေး၊ မြစ် တိမ်ကောပျက်စီးသွားခြင်းနှင့် မြစ်ကမ်းပါးနှင့် မြစ်အောက်ခြေတိုက်စားမှုများမှ ရှောင်ရှားနိုင်ရေး၊ ငါးများရွှေ့ပြောင်းသွားလာနိုင်ရေး၊ ဆည်၏အောက်ဖက် နေထိုင်သူများမှ ရေအသုံးပြုနိုင်ရေးတို့အတွက် လုံလောက်သောရေပမာဏနှင့် ရေအရည်အသွေးဖြစ်ကြောင်း သေချာစေရန်နှင့် ဆည်၏အောက်ဖက် ချီဖွေမြစ်၏ အနည်းဆုံးရေ စီးဆင်းမှုပမာဏလိုအပ်ချက်များ သိရှိရန် ချီဖွေမြစ်အတွက် Environmental Flow Assessment ကို IFC'S (2016) International Good Practice Note: Eflows For Hydropower Projects ကို အခြေခံ၍ သင့်လျော် သော Modeling နှင့် Mapping နည်းလမ်းများဖြင့် ဆောင်ရွက်၍ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ ဤအတည်ပြုစာထုတ်ပြန် ပြီးနောက် (၆) လ အတွင်း ပြန်လည်တင်ပြရန်၊

(က၅) ငွေကြေးဆိုင်ရာအာမခံမှုထားရှိမည့်အစီအစဉ် (အာမခံမှုအမျိုးအစား၊ ပမာဏ၊ အချိန်သတ်မှတ်ချက်၊ လျှောက်ထားမှု၊ အာမခံသူ၏အမျိုးအစားနှင့် ငွေကြေး ပမာဏ) အသေးစိတ်နှင့် ဝန်ကြီးဌာန၏စစ်ဆေးမှုခံရန် ရန်ပုံငွေထားရှိမည့် အစီအစဉ် (ပမာဏ၊ ပေးချေသည့် လုပ်ထုံးလုပ်နည်း ၊ အချိန်သတ်မှတ်ချက်နှင့် အကြိမ်) အသေးစိတ်ကို သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ ဤအတည်ပြုစာထုတ်ပြန်ပြီး နောက် (၆) လ အတွင်း ပြန်လည်တင်ပြရန်၊

(က၆) ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာတွင် ဖော်ပြထားသော ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် ပတ်ဝန်းကျင်စောင့်ကြပ်ကြည့်ရှုမှုအစီအစဉ်များ အကောင်အထည်ဖော်မှုအတွက် သုံးစွဲမည့်ရန်ပုံငွေကို ဘဏ်တစ်ခုခုတွင် ထည့်သွင်းထားသော Bank Statement အား သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ ဤအတည်ပြုစာထုတ်ပြန်ပြီးနောက် (၆) လအတွင်း ပြန်လည်တင်ပြရန်။

(လှမောင်သိန်း)
ညွှန်ကြားရေးမှူးချုပ်

မိတ္တူကို
ပြည်ထောင်စုဝန်ကြီးရုံး၊ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၊ ရုံးအမှတ် (၂၈)
ညွှန်ကြားရေးမှူးချုပ်ရုံး၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန
ညွှန်ကြားရေးမှူးရုံး၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၊ ကချင်ပြည်နယ်
ညွှန်ကြားးရေးမှူး၊ ပတ်ဝန်းကျင်ညစ်ညမ်းမှုထိန်းချုပ်ရေးဌာန
ညွှန်ကြားရေးမှူး၊ ပတ်ဝန်းကျင်အရည်အသွေးနှင့် စံချိန်စံညွှန်းဌာန
ရုံးလက်ခံ၊ မျှောစာတွဲ။

အတည်ပြု EIA ပါ ကတိကဝတ်များ၊ လိုက်နာဆောင်ရွက်ရမည့်အချက်များ အားအကောင်အထည်ဖော်ဆောင်ရွက်ရေးအတွက် ကြပ်မတ်ပေးပါရန်။

References for Health Impact Assessment

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ECD Comments အား ဖြည့်စွက်တင်ပြခြင်း

(၁) မြန်မာနိုင်ငံသား ရင်းနှီးမြှုပ်နှံမှုဥပဒေ (၂၀၁၃ အစား မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုဥပဒေ ၂၀၁၆) နှင့် (မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုနည်းဥပဒေများ ၂၀၁၇) ဟု ပြင်ဆင်၍ စီမံကိန်းနှင့် ဆက်စပ်သည့် ပြဋ္ဌာန်းချက်များအား ပြင်ဆင်ဖြည့်စွက် ရန် ပါသည်။

(၃) မြန်မာ့အာမခံလုပ်ငန်းဥပဒေ (၁၉၉၃ ပုဒ်မ ၁၅၊ ၁၆ပါ ပြဋ္ဌာန်းချက်များအား ဖြည့်စွက်ဖော်ပြရန်နှင့် Motor Vehicles Law (2015) အစား ယာဉ်အန္တရာယ်ကင်းရှင်းရေးနှင့် မော်တော်ယာဉ် စီမံခန့်ခွဲမှုဥပဒေ (၂၀၂၀) ဟု ပြင်ဆင်ဖော်ပြရန်၊

- (၁ နှင့် ၃) ကို စာမျက်နှာ ၁၃၃ နောက်တွင် နောက်ဆက်တွဲ -(က)ဖြင့် ဖြည့်စွက်ထားပါသည်။

(၂) မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုဥပဒေအရ ခွင့်ပြုမိန့်ရရှိထားသည့် လုပ်ငန်းတစ်ခုဖြစ်သည့်အတွက် မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုကော်မရှင်၏ ခွင့်ပြုမိန့်နှင့် ဆုံးဖြတ်ချက်မိတ္တူတို့ကို ထည့်သွင်းဖော်ပြရန်၊

- (၂) ကို Commitment စာမျက်နှာနောက်တွင် ဖြည့်စွက်ထားပါသည်။

(၄) ဇယား ၁၁-၆-၂ တွင် ဌာနသို့ (၆)လ တစ်ကြိမ်တင်ပြရမည်။ Environmental Monitoring Plan တွင် တိုင်းတာမည့် Parameter များသည် Annually ဟုဖော်ပြထားသည့်အတွက် Air ၊ Water ၊ Terrestrial Ecology များအား ၆လတစ်ကြိမ်တိုင်းတာပေးရန်၊

(၅) စောင့်ကြပ်ကြည့်ရှုခြင်းဆောင်ရွက်မည့် Environmental Management Department ၏ Institution Structure နှင့် Related works ဇယား ၁၁-၄-၁၁ နှင့် စာမျက်နှာ ၂၃၄-၂၃၅ ဖော်ပြထားသော်လည်း တစ်ဦးချင်း၏ Roles and Responsiblities များကို (ဥပမာ - ဇယား ၁၁-၂-၇-၁၀ တွင် Reporting Mechanisms Responsiblities ဇယားကဲ့သို့ သီးခြားဖော်ပြထားခြင်းမရှိသောကြောင့် Environmental Management Department ပါ ဝန်ထမ်းတစ်ဦးချင်းစီ၏ Roles and Responsiblities များအားပြင်ဆင်ဖော်ပြရန်၊

(၆) Emergency Respond Plan နှင့် ပတ်သက်၍ 8.4 Risk Accident Emergency Plan တွင် ဖော်ပြထားသော်လည်း Emergency Respond Plan အား လက်တွေ့စမ်းသပ် အသုံးပြုရခြင်းနှင့် စမ်းသပ်မှုရလဒ်အပေါ်အခြေခံ၍ ပြန်လည်ဆန်းစစ်ပြုပြင်ခြင်းအား ထည့်သွင်းပေးရန်နှင့် Institutional Structure for Emergency Respond Plan အားဖော်ပြရန်၊

- (၅ နှင့် ၆) ကို စာမျက်နှာ ၃၄၃နောက် နောက်ဆက်တွဲ (ခ)တွင် ဖြည့်စွက်ထားပါသည်။

(၇) ကျန်းမာရေးဆိုင်ရာအချက်အလက်များကောက်ယူရာတွင် ကိုးကားရည်ညွှန်းသည့် Reference များအားထည့်သွင်းဖော်ပြရန် အစီရင်ခံစာတွင်ဖော်ပြပါသည်။

- (၇) Reference ကို အစီရင်ခံစာနောက်ဆုံးတွင် ဖြည့်ပါသည်။