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TA – 8758
Preparing Third Great Mekong Sub-region Corridor Towns Development Project

Final Report

Summary Report

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Abbreviations & Acronyms

3Rs	Reduce, Reuse, Recycle
AAGR	Annual Average Growth Rates (Population)
ADB	Asian Development Bank
AH 1	Asian Highway 1
APCF	Asia Pacific Carbon Fund
BATNEEC	Best Available Techniques Not Entailing Excessive Costs
BOI	Thai Board of Investment
BOI	Thai Board of Investment
BOO	Build - Own - Operate
BOOT	Build–Operate–Own–Transfer
C:N	Carbon-Nitrogen (ratio)
cap	Capita (= 1 person)
CBO	Community-Based Organization
CBP	Capacity Building Program
CC	Climate Change
CDIA	Cities Development Initiative for Asia
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH_4	Methane
CO_2	Carbon Dioxide
CPCS	Centre for Peace and Conflict Studies
DDI	Domestic Direct Investment
DFR	Draft Final Report
DHSHD	Department for Human Settlement Housing Development (DUHD)
DMF	Design and Monitoring Framework
DUHD	Department of Urban Housing Development (MOC)

EA	Executing Agency
EA	Environmental Assessment
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
EIA	Environmental Impact Assessment
EWEC	East – West Economic Corridor
FDI	Foreign Direct Investment
GAD	General Administration Department
GHG	Greenhouse Gas
GMS	Greater Mekong Sub-Region
GNP	Gross National Product
GoM	Government of Myanmar
HDPE	High Density Polyethylene
HIZ	Hpa-An Industrial Zone
HTDC	Hpa-An Town Development Committee
IA	Implementing Agency
IEE	Initial Environmental Examination
IFI	International Finance Institution
INC	Initial National Communication
IPNS	Integrated Plant Nutrient System
ISWM	Integrated Sustainable Waste Management
JICA	Japan International Cooperation Agency
KNU	Karen National Union
KS-DAC	Kayin State Development Affairs Development Committee
KS-DAO	Kayin State Development Affairs Office
KSG	Kayin State Government
m^3	cubic meter
MaT-DAC	Mawlamyine Township Development Affairs Committee
MaT-DAO	Mawlamyine Township Development Affairs Office
MCDC	Mandalay City Development Committee

MDDC	Myawaddy District Development Committee
MoECAF	Ministry of Environment Conservation and Forests
MHA	Ministry of Home Affairs
MMK	Myanmar Kyat
MOA	Ministry of Agriculture
MOC	Ministry of Construction
MOE	Ministry of Energy
MOSB	Myanmar Offshore Supply Base
MRF	Material Recovery Facility
MS-DA	Mon State Development Affairs
MS-DAC	Mon State Development Affairs Committee
MS-DAO	Mon State Development Affairs Office
MSE	Micro- and Small enterprises
MSG	Mon State Government
MS-GAD	Mon State General Affairs Department
MST-DAC	Mon-State Township-level Development Affairs Committees
MSW	Municipal Solid Waste
MTDC	Mawlamyine Town Development Committee
MW	Megawatt
NAPA	National Adaptation Programs of Actions
NECC	National Environmental Conservation Committee
NEDA	Neighbouring Countries Economic Development Cooperation Agency, Ministry of Finance, Thailand
NGO	Non Government Organization
NMSP	New Mon State Party
NPK	Nitrogen, Phosphorous, And Potassium
NSAG	Non-State Armed Groups
ODA	Overseas Development Assistance
PCU	Project Coordination Unit
PET	Poly-ethylene Terephthalate
PIU	Project Implementation Units

PPP	Public–Private Partnership
PPTA	Project Preparatory Technical Assistance
SEZ	Special Economic Zone
SLEDP	Strategic Local Economic Development Plans
SPC	Special Purpose Company
SPS	Safeguard Policy Statement
TA	Technical Assistance
TAO	Township Administration Office
THa-DAC	Township Hpa-An Development Affairs Committee
THa-DAO	Township Hpa-An Development Affairs Office
TMy-DA	Myawaddy Township Development Affairs
TMy-DAO	Myawaddy Township Development Office
TMy-DC	Myawaddy Township Development Committee
TZM	Myawaddy Township Trade Zone
UMTA	Union of Myanmar Travel Association
UNDP	United Nations Development Programme
WOP	Water Operator Partnership (WOP)
WWTP	Waste Water Treatment Plant
YCDC	Yangon City Development Committee
YHT	Yangon Heritage Trust

EXECUTIVE SUMMARY (ENGLISH)

This Final Report (FR) is one of a series of "milestone" reports produced by the Consultant for this assignment. This report continues the analysis and outline proposals which were contained in the draft final report which was published in early December 2015.

Consultant Activities

During the FR period there have been a number of Project Coordination Committee (PCC) meetings involving both the Mon and Kayin State Governments (MSG and KSG) as well as several informal meetings and visits within the two States to potential project sites and with potentially affected persons.

The consultants held a presentation of the project to the new government in May 2016.

The consultants accompanied the ADB and NEDA / TICA representatives during the LFF mission in June 2016 and the follow-up LFF mission in September.

The consultants took in account the comments from ADB raised during the LFF mission and implemented a social survey focusing on wastepickers resettlement and updated the draft final report.

The PCC meetings have involved the more technical members of the authorities in conceptualizing and progressing the actual projects as well as ensuring that data and analysis is shared between the PPTA and the PCC members. The PCCs are important focal points as they will also provide the basis of the expected future Project Management/ Implementation Units (PMU and PIUs) in due course.

Analysis of The Present Situation

Data collection shortcomings have been mentioned as a major issue throughout this PPTA. Limited local office facilities (especially of computers and internet access) means that much of the data collected is only in hard copy and is usually transcribed by hand (with attendant likelihood of errors) to the few computers available. In some instances data may be limited: however, this has provided an opportunity to highlight the issues and has determined where the project can assist in the collection, collation and/or updating process, either as part of the PPTA or as part of later capacity building.

Security issues on the road between Kawkareik and Myawaddy which previously severely constrained project activities, have eased in recent months although there are still lengthy processes to be undertaken to gain access to sensitive areas along the river border with Thailand and where future potential water intakes have been considered.

More urgency amongst the State Governments has been engendered in recent months in identifying and confirming locations for new/improved water and solid waste disposal facilities in all 3 towns.

After the national elections in November 2015, new chief ministers have been elected in both States and have taken post in April 2016.

Reporting Formats

The FR is split into this Summary Report for both States as well as separate reports for both MSG and KSG. Relevant Appendices are provided for all 3 reports.

Project Selection

Based upon its focus on the Greater Mekong Sub-Region (GMS) East – West Economic Corridor (EWEC) the project needs to be considered from a strategic viewpoint as to what is the current situation in terms of issues and opportunities in the region, what is planned in terms of policies and projects by the Union government (and by Thailand, particularly in the case of Kayin State) and what is likely to happen which has relevance for potential projects under this PPTA. This strategic analysis provides the framework within which individual projects can be identified, discussed and developed (Chapter 2).

The broad process of project identification has also been guided by the constraints or boundaries inherent in the project make-up such as the ToR, budget guidelines and required team composition. During the project itself further refinements have been made, through the institutional and financial analyses, based on the assumed capacity of the agencies (both executing and implementing) to undertake potential projects. Some potential projects may have impacts which have to be addressed, by including appropriate safeguards (e.g. environmental, social) or by modifying the original project details. In some cases initially identified projects may not proceed due to impacts, uncertainties or complications which make final inclusion unlikely or impossible in the time available.

The processes as to how the proposed projects were generated are part of the overall justification to both ADB and intended executing and implementing agencies. They are described in Chapter 3.

Project Proposals

The expected impact of the project is that economic activities along the GMS EWEC will be increased. The outcome will be improved access to sustainable urban services in Mawlamyine, Hpa-An and Myawaddy. The indicative project cost was originally estimated at $116.9 million with ADB providing a loan of $80.00 million from the Asian Development Fund (ADF) and the remainder being financed by co-financing sources and the government.

On the basis of investigations and discussions with a wide range of key stakeholders, the following list of project components, with preliminary basic costs, is proposed for further consideration and additional investigation.

Town	Sector	Details	USD million
Mawlamyine	Water Supply	Rehabilitation of the existing dams and reinforcement of the water transfers, rehabilitation, reinforcement and extension of the existing networks, improved operational and financial management, plus Attran River Treatment Project	22.6
	Solid Waste	Improved collection, recycling, composting & upgrading of existing landfill	14
	Built Heritage	Proposed renovation and upgrading of the existing GAD building adjoining the courthouse	1.6
		TA for setting up of National Restoration Fund to renovate and/or convert heritage buildings to more productive uses.	0.9
		Total Mon State	**39.1**
Hpa-An	Water Supply	Development of a new long-term intake and an additional treatment facility, rehabilitation, reinforcement and extension of the existing networks and improved operational and financial management	16.2
	Solid Waste	A new landfill site is proposed at the existing Industrial Zone. Also improved operations.	8.6
Myawaddy	Water Supply	A new river intake is proposed to the south and upstream of the town.	11.3
	Solid Waste	Proposed new landfill at the existing Industrial Zone. The proposal includes closure of the two existing dumpsites. Also improved operations.	7.6
	Development Plan	Joint Spatial Development Plan for Myawaddy and Mae Sot. The output would be a formal legal document detailing the future development strategy for the 2 linked towns.	0.9
		Total Kayin State	**44.6**
Total			**83.7**

In terms of the 3 Outputs associated with the project, proposed costs are as follows. They are higher than the costs given above as they also include Capacity Building (Output 3) and some incidental costs associated with Outputs 1 and 2.

Project Outputs	USD million
Output 1: Enhanced city competitiveness to help vitalize the economic activities that will contribute to development not only within the project cities but also of the GMS region	20.47
Output 2: Improved basic urban services to address the local needs for basic urban services in each project city	66.71
Output 3: Strengthened urban management capacity of the State Governments	9.78
Contingencies	15.26
Financing charges during implementation	4.71
Total	**116.93**

Safeguards

On the basis of the project components anticipated and of the screening exercise presented above, it seems reasonable to classify the present project, which main objective is to improve the urban environment of the towns of Mawlamyine, Hpa-An and Myawaddy, as a Category B project, and subsequently to consider the preparation of an Initial Environmental Evaluation.

As the Project covers two states with different administrative arrangements for resettlement planning and implementation - separate resettlement investigations have been prepared. However, land acquisition is be minor as most of the land required for both water supply and solid waste proposals is already owned by the government.

Financial and Economic Aspects

Since improving public sector capacity and governance for policy-making, coordination, and service delivery are the main objectives of fiscal decentralization process as contemplated by the Union Government, the report provides an updated description of the fiscal decentralization system as implemented presently in the two States. The financial analyses for the 2 States includes: (i) a fiscal analysis of the State, (ii) a fiscal analysis of the 3 specific townships, (iii) a financial performance analysis of the water supply and the sanitation departments and (iv) the Financial Management Assessment (FMA) of the States which are identified as the Implementing Agencies (IA) of the project.

Major Implementation Issues

It is clear from work undertaken so far that successful implementation of any of the finalized projects will not be possible without major, intensive and sustained capacity building of both State and Township level staff who will be involved. This capacity building is required for a wide range of technical, administrative and financial aspects within many government departments and also within the private sector in some cases. It will require significant investment of time and money for training and equipment as well as long-term operational support. It is also proposed that a number of long term young international professionals will supplement this process: they would support the States through on-the-job training and at the same time develop their own experience.

The organization of the project, from central government to township level will be crucial in determining its success. The proposed set-up involves the States as IAs setting up Project Management Offices (PMO) as well as the appropriate Project Implementation Units (PIU) in the towns to deal with individual projects. Support from the national Ministry of Construction (MoC) as the Executing Agency and in particular from its DUHD, will be crucial to monitor and direct the loan activities.

EXECUTIVE SUMMARY (MYANMAR)

အစီရင်ခံစာအကျဉ်းချုပ်

ဤနောက်ဆုံးအစီရင်ခံစာသည် ဤစီမံကိန်းအတွက်တိုင်ပင်ခံများရေးသားသော အစီရင်ခံစာ မိုင်တိုင်များထဲမှ တခုအပါအဝင်ဖြစ်ပါသည်။ ဤအစီရင်ခံစာသည် ၂၀၁၅ ဒီဇင်ဘာတွင် တင်ပြထားသော နောက်ဆုံးအစီရင်ခံစာမူကြမ်းတွင် ပါဝင်သောစီမံကိန်းများနှင့် ပတ်သက်သည့်အချက်အလက်များ ခွဲခြမ်းလေ့လာခြင်း နှင့် သုံးသပ်လေ့လာချက်များကို ဆက်လက်ဖော်ပြထားပါသည်။

အတိုင်ပင်ခံအဖွဲ့၏ လုပ်ငန်းဆောင်ရွက်နေမှုများ

နောက်ဆုံးအစီရင်ခံစာပြင်ဆင်ချိန်ကာလအတွင်းတွင် မွန်နှင့်ကရင်ပြည်နယ် အစိုးရနှင့်တကွ စီမံကိန်း ညှိနှိုင်းဆောင်ရွက်ရေးကော်မတီ PCCအစည်းအဝေးများသာမက အခြားသောတွေ့စုံမှုများနှင့် ပြည်နယ်နှစ်ခုလုံး၏ ဖြစ်နိုင်ချေရှိသောစီမံကိန်းနေရာများသို့ ကွင်းဆင်းလေ့လာခြင်း၊ စီမံကိန်း သက်ရောက်မှု ခံရမည့် ပုဂ္ဂိုလ်များနှင့် တွေ့ဆုံခြင်းများ ပြုလုပ်ခဲ့ပါသည်။ မေလ ၂၀၁၆ဝတွင် တိုင်ပင်ခံအဖွဲ့သည် အစိုးရသစ်ကို စီမံကိန်းအကြောင်းရှင်းလင်းတင်ပြခဲ့သည်။ တိုင်ပင်ခံအဖွဲ့သည် ဇွန်လ ၂၀၁၆ဝတွင် ADB,NEDAနှင့် TICA အဖွဲ့တို့မှ တာဝန်ရှိသူများနှင့်အတူ ချေးငွေအချက်အလက်ဆိုင်ရာ အစည်းအဝေးနှင့် စက်တင်ဘာတွင် ချေးငွေအချက်အလက်ဆိုင်ရာ နောက်ဆက်တွဲအစည်းအဝေးတို့တွင် ပူးပေါင်းပါဝင်ဆောင်ရွက်ခဲ့သည်။ တိုင်ပင်ခံအဖွဲ့သည် ချေးငွေအချက်အလက်ဆိုင်ရာ အစည်းအဝေးတွင် ADBမှ တင်ပြလာသည်များကို ထည့်သွင်းစဉ်းစား၍ အမှိုက်ကောက်လုပ်သားများ၏ ပြန်လည်နေရာချထားရေးဆိုင်ရာ ကိစ္စရပ်များ ပါဝင်သော လူမှုစီပွားစစ်တမ်းကိုကောက်ခံ၍ နောက်ဆုံးအစီရင်ခံစာကို ထပ်မံဖြည့်စွက်ခဲ့သည်။

PCCအစည်းအဝေးများတွင် သက်ဆိုင်ရာနယ်ပယ်များမှ နည်းပညာရှင်များ ပိုမိုပါဝင်ခဲ့ကြပြီး နည်းပညာရပ်များနှင့် PPTAနှင့် PCC အဖွဲ့ဝင်များအကြားအချက်အလက်များနှင့် လေ့လာသုံးသပ်ချက်များ မျှဝေမှုနှင့် စီမံကိန်းအမှန်တကယ်ဆောင်ရွက်ပြင်မှုများကို ဆွေးနွေးခဲ့ကြသည်။ PCC အဖွဲ့ဝင်များသည် နောင်တစ်ချိန်တွင် ဖွဲ့စည်းရမည့် စီမံကိန်းစီမံခန့်ခွဲမှု/အကောင်အထည် ဖော်ဆောင်ရွက်မှုအဖွဲ့များ (PMU နှင့် PIU) ဖြစ်လာမည့် အဓိကအဖွဲ့ဝင်များ ဖြစ်ပါသည်။

လက်ရှိဖြစ်နေသောအခြေအနေများကိုလေ့လာသုံးသပ်ခြင်း

တိုးတက်မှု တွင် ရင်ဆိုင်နေရသောအကြောင်းအရာများ

PPTA ကာလတစ်လျှောက်တွင် ဖော်ပြချက်များအတိုင်းအချက်အလက်စုဆောင်းမှုနှင့် ပတ်သက်၍ အခက်အခဲများရှိနေဆဲဖြစ်သည်။ကွန်ပြူတာ နှင့် အင်တာနက် အစရှိသည့် ရုံးသုံးအထောက်အကူပြု ပစ္စည်းများအသုံးပြုနိုင်မှု ကန့်သတ်ချက် ရှိသည့်အတွက် ရရှိသောအချက်အလက်အများစုမှာလက်ရေးနှင့် ပြုစုထားသည့် စာရွက်စာတန်းများသာဖြစ်ပြီး ဖြစ်တတ်သောအမှားအယွင်းများလည်း ပါဝင်မှု ရှိနိုင်သည်။ အချို့သောအခြေအနေများတွင် အချက်အလက်များသည်လည်းအကန့်အသတ်ဖြစ်သာရှိသည်။ သို့သော်ငင်းမှာ PPTAဏ၏ အစိတ်အပိုင်းအဖြစ်သော်လည်းကောင်း၊ နောင်တချိန်တွင် အရည်အသွေးတိုးမြင့်ပေါ်ရေး အစီအမံများ၏ တစိတ်တပိုင်းအဖြစ်သော်လည်းကောင်း ဤစီမံကိန်းမှ အချက်အလက်များ စုဆောင်း မွမ်းမံခြင်းနှင့် ပတ်သက်ပြီးမည်သို့ကူညီဆောင်ရွက်နိုင်မည်ကိုစဉ်းစားရာတွင် အထောက်အကူ ဖြစ်စေခဲ့သည်။

ယခင်ကစီမံကိန်းဆောင်ရွက်မှုများကို နောက်နေးစေခဲ့သောကော့ကရိတ်နှင့် မြဝတီလမ်းကြား လုံခြုံရေးပြဿနာမှာ လွန်ခဲ့သောလအနည်းငယ်ခန့်က လွယ်ကူလာပြီးဖြစ်သော်လည်း ရေထွက်အသစ် ဆောက်လုပ်ရန် ရာထားသောထိုင်းနယ်စပ် မြစ်တစ်လျှောက်နေရာကို သွားရောက်ရန်မှာမူ ဆောက်ရွက်ရမည့် အဆင့်များစွာဖြင့် ခက်ခဲနေဆဲဖြစ်သည်။

လွန်ခဲ့သောလအနည်းငယ်က ပြည်နယ်အစိုးရများအတွက် အရေးပေါ်ဆုံးဖြတ်ရမည့် ကိစ္စရပ်များမှာ ရေနှင့် အညစ်အကြေးစွန့်ပစ်မှုဆောက်ရွက်ချက်များအတွက် နေရာများသတ်မှတ် အတည်ပြုခြင်း ဖြစ်သည်။

နိုဝင်ဘာလတွင် ကျင်းပပြုလုပ်ခဲ့သောရွေးကောက်ပွဲပြီးနောက် ပြည်နယ်နှစ်ခုလုံးတွင် သက်ဆိုင်ရာ ဝန်ကြီးချုပ်များနှင့် ဝန်ကြီးများသည် ဇန်နဝါရီ ၂၀၁၆တွင် စတင်၍ တာဝန်ထမ်းဆောင်ခဲ့ကြသည်။

အစီရင်ခံစာပုံစံ

နောက်ဆုံးအစီရင်ခံစာကို ပြည်နယ်နှစ်ခုလုံးအတွက် အနှစ်ချုပ်နှင့် မွန်နှင့် ကရင်အတွက် သီးခြားအစီရင်ခံစာဟူ၍ ခွဲခြားထားပါသည်။ သက်ဆိုင်ရာနောက်ဆက်တွဲများကိုအစီရင်ခံစာသုံးခုလုံးအတွက် ပြုလုပ်ထားပါသည်။

စီမံကိန်းရွေးချယ်မှု

မဟာမဲခေါင်ဒေသအရှေ့၊ အနောက် စီးပွားရေးစင်္ကြန် (GMS East-West Economic Corridor – EWEC)အပေါ်မူတည်၍ စီမံကိန်းကိုဒေသတွင်းဖြစ်ပေါ်နေသောအခြေအနေများ၊ အခွင့်အလမ်းများ၊ ပြည်ထောင်စုအစိုးရ (ကရင်ပြည်နယ်နှင့်ပက်သတ်၍ ထိုင်းနိုင်ငံဘက်မှအစီအစဉ်များ)၏ ဆောက်ရွက်သွားမည့် လမ်းစဉ်များနှင့် အစီအစဉ်များ၊ PPTA ၏ စီမံကိန်းကြောင့် ဖြစ်ပေါ်လာမည်များကိုထည့်သွင်းစဉ်းစားသည့် ပဏ္ဍာဖြင့် စဉ်းစားရန်လိုအပ်ပါသည်။ ဤပဏ္ဍာကျလေ့လာမှုသည် စီမံကိန်းတစ်ခုစီအတွက် လေ့လာမှု၊ ဆွေးနွေးမှု၊ ရှေ့ဆက်ဆောင်ရွက်ချက်များအတွက် ဖွဲ့စည်းမှုဘောင်တစ်ခုကိုပေးစွမ်းပါသည်။

စီမံကိန်းသတ်မှတ်ခြင်းဆောင်ရွက်ရာတွင် ကျယ်ပြန့်လှသောကြောင့် စီမံကိန်း၏ ကနဦး TOR မှ ကန့်သတ်ချက်များ၊နယ်ပယ်များကိုလည်းကောင်း ၊ ဘဏ္ဍာရေးလမ်းညွှန်ချက်များကိုလည်းကောင်းလိုအပ်သည့် ဖွဲ့စည်းပုံစည်းမျဉ်းစည်းကမ်းများကိုလည်းကောင်းထည့်သွင်းစဉ်းစားခဲ့သည်။ဆက်လက်၍လည်းစီမံကိန်းတာဝန်ခံ ကိုယ်စားလှယ်နှင့် စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့် ကိုယ်စားလှယ် တို့၏ လုပ်ဆောင်နိုင်မှုအင်အား၊ ဖွဲ့စည်းပုံ နှင့် ဘဏ္ဍာရေးလေ့လာသုံးသပ်မှုများအပေါ်လေ့လာသုံးသပ်ကာ ဖြစ်နိုင်ချေရှိသော စီမံကိန်းများကို စီစစ်ရွေးချယ်ရမည်ဖြစ်သည်။ အချို့သော ဖြစ်နိုင်ချေရှိသောစီမံကိန်းများသည် သင့်လျော်သော ဘေးကင်းလုံခြုံမှု အကာအကွယ်များ (ဥပမာ- သဘာဝပတ်ဝန်းကျင် နှင့် လူမှု ပတ်ဝန်းကျင်) ထည့်သွင်းစဉ်းစားခြင်းဖြင့်သော်လည်းကောင်းမူလစီမံကိန်းအသေးစိတ်အားပြုပြင်ပြောင်းလဲခြင်းအားဖြင့်လည်းကောင်းစီမံကိန်းအကျိုးသက် ရောက်မှုများရှိနိုင်ကာထည့်သွင်းစဉ်းစားရန် လိုအပ်ပေသည်။ အချို့. အခြေအနေများတွင် ဖြစ်လာနိုင်သည့် အကျိုးသက်ရောက်မှုများ ၊မရေရာမှုများ (သို့) ရရှိသော အချိန်အတိုင်းအတာအတွင်း ဆုံးဖြတ်ချက်ချနိုင်ရန် မလွယ်ကူသောရှုပ်ထွေးမှုများကြောင့် ကနဦး ဆုံးဖြတ်ထားသော စီမံကိန်းများမှာဆက်လက်လုပ်ဆောင်နိုင်ရန် မဖြစ်နိုင်ပေ။

ကနဦးအစီအရင်ခံစာတွင် အဆိုပြုဖော်ပြထားသောစီမံကိန်းများကို ဖော်ထုတ်သောလုပ်ငန်းစဉ် အဆင့်များတွင် ADB နှင့် Executing and implementing Agencies တို့၏ ခြုံငုံသုံးသပ် ဆုံးဖြတ်မှုများပါဝင်သည်။ ၎င်းတို့ကို အခန်း-၄ တွင် ဖော်ပြထားပါသည်။

စီမံကိန်းအဆိုပြုခြင်း

စီမံကိန်း၏ မျှော်မှန်းထားသောအကျိုးသက်ရောက်မှုများမှာ GMS EWEC တလျောက်ရှိစီးပွားရေးနှင့် ဖွံ့ဖြိုးတိုးတက်မှု များမှာ မြင့်မားလာမည်ဖြစ်ပါသည်။ ရလာဒ် အနေဖြင့် မော်လမြိုင်၊ ဘားအံ နှင့် မြဝတီမြို့များ၏ ရေရှည်သုံးစွဲနိုင်မည့် Urban Serivesများကိုတိုးမြင့် ဆောင်ရွက်နိုင်မည်ဖြစ်သည်။ ရည်မှန်းထားသောစီမံကိန်းမှာခန့်မှန်းခြေအားဖြင့် အမေရိကန်ဒေါ်လာသန်းတရာ့တစ်ဆယ့်ခြောက်သန်း ကုန်ကျနိုင်မည်ဖြစ်သည်။ ADBမှ ချေးငွေအားဖြင့် Asia Development Fund (ADF)မှ အမေရိကန်ဒေါ်လာသန်းရှစ်ဆယ်ကို ချေးမည်ဖြစ်ပြီး တစ်ဆယ်ငါးသန်းကိုအခြားပူးတွဲချေးယူနိုင်မည့် အရင်းအမြစ်များထံမှလည်းကောင်း၊ ငါးသန်းကိုအစိုးရထံမှ လည်းကောင်းရရှိနိုင်မည်ဖြစ်သည်။

ကွင်းဆင်းလေ့လာသုံးသပ်ခြင်းများနှင့်အဓိကသက်ဆိုင်သူများနှင့် ဆွေးနွေးခြင်းတို့ကိုအခြေခံ၍ အောက်ဖော်ပြပါ စီမံကိန်း ပါဂင်မှုအစိတ်အပိုင်း (tentative)ကို ဖြစ်နိုင်ချေရှိသော ခန့်မှန်းကုန်ကျစရိတ်များနှင့် တကွ အသေးစိတ်စဉ်းစားရန်နှင့် ထပ်ပေါင်းလေ့လာနိုင်ရန် အတွက် အဆိုပြုထားသည်။

မြို့အမည်	ကဏ္ဍ	အချက်အလက်	USD (သန်း)
မော်လမြိုင်	ရေပေးဝေရေး	လက်ရှိရေလှောင်ကန်များပြုပြင်မွန်းမံခြင်း ၊ Water Transfers line များကိုပိုမိုကောင်းမွန်အောင်ဆောင်ရွက်ခြင်း ၊ လက်ရှိရေပေးရေး Networks များကိုတိုးချဲ့ခြင်း၊ ပိုမိုကောင်းမွန်အောင် ပြုပြင်ခြင်း ၊ ဘဏ္ဍာရေးနှင့် လုပ်ငန်းဆောင်ရွက်မှု၊ စီမံခန့်ခွဲမှုများကိုတိုးမြင့်ခြင်း၊ အထွေထွေမြေရေကို ပြုပြင်သန့်စင်သည့် စီမံကိန်း	၂၂.၆
	စွန့်ပစ်အမှိုက်	အမှိုက်သိမ်းဆည်းမှု စနစ်တိုးမြင့်ခြင်း၊ ပြန်လည်အသုံးချခြင်း အမှိုက်များကိုခြေဖျက်ခြင်း၊ လက်ရှိအမှိုက်ပုံအားအဆင့်မြင့်တင်ခြင်း	၁၄
	ရှေးဟောင်းအဆောက်အဦးများ ပြုပြင်ထိန်းသိမ်းခြင်း	တရားရုံးနှင့် ဆက်စပ်နေသောလက်ရှိအထွေထွေအုပ်ချုပ်ရေးရုံးကိုအဆင့်မြှင့်တင်ခြင်းအဆိုပြုချက် အဆောက်အဦးများကို ပြုပြင်မွမ်းမံထိန်းသိမ်းရန် (သို့) ဂင်ငွေကောင်းစေဂုန် အသုံးပြုနိုင်မည့် အဆောက်အဦးအဖြစ် ရှေးဟောင်းအဆောက်အဦးများကိုပြောင်းလဲရန် အတွက် မူရင်းအတိုင်းမွမ်းမံခြင်းရံပုံငွေမတည်ခြင်း။	၁.၆ ၀.၉
		မွန်ပြည်နယ် စုစုပေါင်း	၃၉.၁
ဘားအံ	ရေပေးဝေရေး	အဓိက မြို့ပြရေယာဇ၏ အထက်ဘက်တွင် ရေရှည်အသုံးပြုနိုင်မည့် ရေထွက်အသစ်တည်ဆောက်ခြင်း နှင့် ရေသန့်စင်စနစ် ထပ်ပေါင်းတည်ဆောက်ခြင်း၊လက်ရှိရေဖြန့်ဝေမှုစနစ်များကိုပိုမိုကောင်းမွန် အောင် ပြုပြင်ခြင်း၊ ဘဏ္ဍာရေးနှင့် လုပ်ငန်းဆောင်ရွက်မှု၊ စီမံခန့်ခွဲမှုများကိုတိုးမြင့်ခြင်း	၁၆.၂
	စွန့်ပစ်အမှိုက်	လက်ရှိစက်မှုဇုန်တွင် အမှိုက်စွန့်ပစ်သည့်နေရာအဆိုပြုချက်။	၈.၆

မြို့အမည်	ကဏ္ဍ	အချက်အလက်	USD (သန်း)
မြဝတီ	ရေပေးဝေရေး	မြို့၏တောင်ဘက်နှင့် ရေဆန်တွင် ရေထွက်အသစ် အဆိုပြုချက်။	၁၁.၃
	စွန့်ပစ်အမှိုက်	ပိုမိုအားသာသည့် ရွေးချယ်ချက်မှာလက်ရှိစက်မှုဇုန်တွင် အမှိုက်စွန့်ပစ်သည့်နေရာအသစ်တစ်ခုတည်ဆောက်ခြင်းဖြစ်သည်။ အဆိုပြုချက်တွင် လက်ရှိအသုံးပြုနေသောအမှိုက်စွန့်ပစ်သည့်နေရာကိုပိတ်သိမ်းခြင်းများပါဝင်ပါသည်။	၇.၆
	ဖွံ့ဖြိုးမှု အစီအစဉ်	မြဝတီနှင့် မဲဆောက် စပ်ဆက်နယ်နိမိတ် ဖွံ့ဖြိုးမှု အစီအစဉ်ဖြစ်သည်။ ရလာဒ်အနေဖြင့် စပ်ဆက်နေသည့် မြို့နှစ်မြို့၏ အနာဂတ်ဖွံ့ဖြိုးရေးပုံစံဟာ (အစီအစဉ်များ၊ စီမံကိန်းများ၊ အဆင့်များ၊ ကုန်ကျစရိတ်) အသေးစိတ်ကိုရေးဆွဲနိုင်မည့် တရားဝင် အချက်အလက်မှတ်တမ်းများရရှိမည်ဖြစ်ပါသည်။	၀.၉
		ကရင်ပြည်နယ် စုစုပေါင်း	၄၄.၆
	စုစုပေါင်း		၈၃.၇

စီမံကိန်းနှင့်ဆက်စပ်သောအကျိုးသက်ရောက်မှု(၃)ခုအရကုန်ကျစရိတ်များကိုအောက်ပါအတိုင်းခန့်မှန်းထားပါသည်။ ၎င်းတို့သည် အရည်အသွေးမြှင့်တင်ခြင်းဆိုင်ရာ (အကျိုးသက်ရောက်မှု၃)နှင့် အခြားသော အကျိုးသက်ရောက်မှု ၁နှင့်၂ ဆိုင်ရာကုန်ကျစရိတ်များပါဝင်သောကြောင့် အထက်ဖော်ပြပါ ကုန်ကျစရိတ်ထက်ကို ပိုများနေပါသည်။

စီမံကိန်းအကျိုးသက်ရောက်မှု	USD (သန်း)
အကျိုးသက်ရောက်မှု၁။စီမံကိန်းမြို့များတွင်းသာမကGMS ဒေသများပါဖွံ့ဖြိုးတိုးတက်နိုင်မည့်စီးပွားရေးလုပ်ဆောင်ချက်များဖြစ်ပေါ် လာနိုင်ရန်ကူညီမည့်မြို့ပြပြို့ငဆိုင်မှုမြင့်တတ်လာခြင်း။	၂၀.၄၇
အကျိုးသက်ရောက်မှု၂။စီမံကိန်းတစ်မြို့ဆီ၏ဒေသတွင်းလိုအပ်သောအခြေခံမြို့ပြဝန်ဆောင်မှုများ တိုးတတ်လာခြင်း။	၆၆.၇၁
အကျိုးသက်ရောက်မှု၃။ပြည်နယ်အစိုးရများ၏မြို့ပြစီမံခန့်ခွဲခြင်းစွမ်းရည်မြင့်တတ်လာခြင်း။	၉.-၇၈

စီမံကိန်းအကျိုးသက်ရောက်မှု	USD (သန်း)
Contingencies	၁၅.၂၆
လုပ်ငန်းအကောင်အထည်ဖော်ဆောင်ရွက်စဉ်အတွင်း ငွေကြေးပြောင်းလဲမှုများ	၄.၇၁
စုစုပေါင်း	၁၁၆.၉

ဘေးကင်းလုံခြုံမှု အစီအမံများ

အဆိုပြုထားသော စီမံကိန်းပါဂင်သည့် အစိတ်အပိုင်းအများစုမှာ ကနဦးအမြင်သဘောထားပေါ်မူတည်သော အဆင့်တွင်သာရှိသေးသော်လည်း စီမံကိန်းသည် သက်ဆိုင်ရာဘေးကင်းလုံခြုံ စိတ်ချရမှု ဘောင ်များကိုသုံးသပ်တင်ပြ နိုင်ခဲ့ပြီး သဘာဂပတ်ဂန်းကျင် နှင့် လူမှု အခြေအနေများအပေါ် ကျရောက်နိုင်သောအကျိုးသက်ရောက်မှု များကို လေ့လာသုံးသပ်ရန် စတင်နိုင်ခဲ့ပြီဖြစ်သည်။

ပါဂင်သည့် အစိတ်အပိုင်းများ နှင့် ၎င်းတို့အပေါ်အကြမ်းဖျင်းလေ့လာသုံးသပ်ခြင်း (အခန်း -၉) ကိုအခြေခံ၍လက်ရှိလုပ်ဆောင်မည့် စီမံကိန်းသည် အဓိကအားဖြင့် မော်လမြိုင်၊ ဘားအံ နှင့် မြဂတီမြို့ များ၏ မြို့ပြပတ်ဂန်းကျင်ကို အဆင့်မြင့် တင်စေမည်ဖြစ်ပြီးစီမံကိန်းအမျိုးအစား "ခ" အဖြစ်သတ်မှတ်နိုင်ကာကနဦး ပတ်ဂန်းကျင်လေ့လာဆန်းစစ်မှု (IEE) ကိုဆက်လက်လုပ်ဆောင်ရန် လိုအပ်သည်။

စီမံကိန်းသည် ပြန်လည်နေရာချထားခြင်းနှင့် စီမံကိန်းအကောင်အထည်ဖော်ခြင်းဆိုင်ရာစီမံခန့်ခွဲမှု ဖွဲ့စည်းပုံခြင်းမတူညီသော ပြည်နယ်နှစ်ခုအတွင်း ကျရောက်နေသောကြောင့် ပြန်လည်နေရာချထားခြင်း အစီအစဉ် နှစ်ခုကို ပြင်ဆင်မည်ဖြစ်ပါသည်။ သို့သော်လည်း ထပ်မံလိုအပ်သောမြေယာများမှာ အစိုးရပိုင်မြေနေရာများဖြစ်သောကြောင့် မြေယာသုံးစွဲမှုအပိုင်းကိုမူ အဓိကမကျသောကိစ္စရပ်ဟု မျှော်လင့်ထားပါသည်။

ဘက္ကာရေး နှင့် စီးပွားရေးဆိုင်ရာ ရှုထောင့်များ

ပြည်ထောင်စုအစိုးရ၏ ချမှတ်ထားသောဗဟိုချုပ်ကိုင်မှုမဟုတ်သည့် ဘက္ကာရေးမူဂါဒများတွင် အရေးပါသော မူဂါဒလမ်းစဉ်ချမှတ်ခြင်း၊ ပူးပေါင်းဆောင်ရွက်ခြင်း နှင့် ဂန်ဆောင်မှုပေးနိုင်ခြင်းတို့အတွက် လူထု နှင့် အုပ်ချုပ်မှု ကဏ္ဍစွမ်းရည်တိုးမြင့်ခြင်းတို့မှာအရေးပါသောအချက်များဖြစ်ပြီး ဤအစီအရင်ခံစာသည် လက်ရှိပြည်နယ်နှစ်ခုတွင် လက်တွေ့.ကျင့်သုံးနေသောဗဟိုချုပ်ကိုင်မှု မဟုတ်သည့် ဘက္ကာရေးစနစ်ကို ဖော်ပြထားသည်။ ပြည်နယ်နှစ်ခု၏ ဘက္ကာရေးဆိုင်ရာလေ့လာသုံးသပ်ချက်များတွင် (၁) ပြည်နယ်၏ ဘက္ကာရေးသုံးသပ်မှု (၂) သီးသန့်.မြို့နယ်သုံးခု၏ ဘက္ကာရေးလေ့လာသုံးသပ်မှု (၃) ရေပေးဝေရေး နှင့် သန့်.ရှင်းရေးဌာနများ၏ ဘက္ကာရေးဆောင်ရွက်မှု အခြေအနေလေ့လာသုံးသပ်မှု နှင့် (၄) ပြည်နယ်များ၏ ဖြစ်နိုင်ချေရှိသောစီမံကိန်းအကောင်အထည် ဖော်ဆောင်ရွက်မည့် ကိုယ်စားလှယ်များ၏ ဘက္ကာရေးစီမံခန့်ခွဲမှုများကို လေ့လာသုံးသပ်ခြင်းတို့ ပါဂင်သည်။

စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်ရာတွင် ကြုံတွေ့.ရမည့် အဓိကအကြောင်းအရာများ

စီမံကိန်းတွင်ပါဂင်မည့် ပြည်နယ်နှင့် မြို့နယ်အဆင့် ဂန်ထမ်းများကို ရေရှည်အကျိုးပြုမည့် စွမ်းရည် မြင့်တင်ပေးသည့် ကဏ္ဍကို ကြပ်ကြပ်မတ်တ်၊ ထဲထဲဂင်ဂင် ဆောင်ရွက်ပေးမှသာလျှင် နောက်ဆုံးအဆင့်

သတ်မှတ်လိုက်သောစီမံကိန်းများအကောင်အထည် ဖော်ဆောင်ရွက်ရာတွင် အောင်မြင်လွယ်ကူမည်ဖြစ်သည်။ ဤစွမ်းရည်မြှင့်တင်ပေးမည့် ကဏ္ဍသည် အစိုးရ ဌာနများအတွင်း (တခါတရံလူထုကဏ္ဍ ပါ ပါဝင်သည်) ကျယ်ပြန့်သောနည်းပညာပိုင်းဆိုင်ရာ၊ အုပ်ချုပ်မှုပိုင်းဆိုင်ရာ နှင့် ဘဏ္ဍာရေးပိုင်းဆိုင်ရာတို့အတွက် လိုအပ်သည်။ ဤသို့ဆောင်ရွက်ရာတွင် လိုအပ်သောသင်တန်း၊ အထောက်အကူပြု ပစ္စည်းများ နှင့် ရေရှည်လည်ပတ်ရန်အတွက် အကူအညီစသည်တို့အတွက် သိသာသောအချိန်နှင့် ငွေရင်းနှီးမြှုပ်နှံမှုတို့ လိုအပ်သည်။ ပြည်နယ်များကိုသူတို့၏ အလုပ်လုပ်ဆောင်ချက်များထောက်ပံ့၍ တပြိုင်နက်တည်းမှာပင်လျှင် သူတို့၏ ကိုယ်ပိုင် အတွေ့အကြုံများကို မြှင့်တင်ကြမည့် နိုင်ငံတကာမှ ငယ်ရွယ်သောပညာရှင်များကို ဤစီမံကိန်းတွင် ဖြည့်စွက်ရန် အဆိုပြုထားပါသည်။

စီမံကိန်းအောင်မြင်မှုကိုဆုံးဖြတ်ရာတွင် မြို့နယ်အဆင့်မှ ဗဟိုအစိုးရအဆင့်ထိ ပါဝင်သော စီမံကိန်းဖွဲ့စည်းပုံမှာအလွန်အရေးပါသည်။အဆိုပြုထားသောဖွဲ့စည်းပုံတွင် စီမံကိန်းတစ်ခုစီဆောင်ရွက်ရန် အတွက် မြို့တွင် စီမံကိန်းစီမံခန့်ခွဲမှုရုံးများ Project Management Offices (PMO) နှင့်သင့်တော်သော စီမံကိန်းအကောင်အထည် ဖော်ဆောင်ရွက်မှုအဖွဲ့များProject Implementation Units (PIU)ဖွဲ့စည်း၍ ပြည်နယ်များကိုစီမံကိန်းအကောင်အထည် ဖော်ဆောင်ရွက်မည့် ကိုယ်စားလှယ် IAအနေဖြင့် ထားရှိခြင်းဖြစ်သည်။ ဗဟိုဆောက်လုပ်ရေးဝန်ကြီးဌာနမှ Executing Agency အဖြစ်ဆောင်ရွက်၍ DUHD ချေးငွေကိစ္စရပ်များနှင့် ပက်သတ်၍ ဆောင်ရွက်ပါမည်။

1 INTRODUCTION

1.1 Project Context

Whereas economic growth is imperative if Myanmar is to alleviate poverty and improve living standards, growth alone is not sufficient for a successful transformation, and its contribution to poverty reduction depends on specific circumstances and policies. As identified in ADB's recent publication "Myanmar – Unlocking the Potential"[1], the country's ability to ensure that participation in the growth process, and that the sharing of its benefits will be as broad as possible, will be crucial for a successful program of reforms. It can achieve this by making social inclusion, environmentally sustainable growth, and balanced regional development central to that agenda. In particular, this means promoting greater participation in the economy of ethnic minorities through, for one thing, equitable sharing of natural resource revenues. In the context of this project the adoption of a conflict sensitive approach will be paramount to the achievement of this.

In addition to ensuring economic stability through good governance, the building of human capital and infrastructure in facilitating economic growth and development cannot be overemphasized. Effective transportation, reliable power supply, and state-of-the-art information and communication technology services enable businesses to thrive, people to become more productive and innovative, and growth to accelerate. Myanmar's infrastructure subsectors require integrated planning and appropriate investments to follow up those plans. The need to improve urban planning and sector master plans is a key objective of this project.

Furthermore, social inclusion, regional integration, and environmental sustainability will be key to achieving success in this project. A peaceful resolution of conflicting interests across ethnic and social groups during the transition will be critical, as is balancing regional development such that all ethnic groups have more economic opportunity and access to public services.

As part of the above quoted reference ADB identified 8 Strategic pillars and priority actions to support the development mission and vision.

- Accelerating governance and public sector reform
- Ensuring macroeconomic and financial stability
- Creating a business-enabling environment
- Leveraging rich endowments

[1] ADB Economics Working Paper Series, July 2015. A Strategy for High, Sustained, and Inclusive Growth.

- Fostering internationally competitive sectors—manufacturing and services
- Enhancing regional connectivity and integration
- Promoting human development and poverty reduction
- Pursuing environmentally sustainable growth

The proposed GMS Corridor Project has been clearly aligned to respond to the above challenges and to build upon these strategic pillars.

The GMS East-West Economic Corridor (EWEC) route as envisaged (**Figure 1-1**) will serve domestic and interstate trunk transport between Myanmar and Da Nang. The remaining link within Myanmar (from Myawaddy to the west) is currently being completed in stages as discussed in **Chapter 2**.

Figure 1-1: Extent of East – West Economic Corridor (EWEC)

It is within this context that the Union of Myanmar together with the ADB has placed the Third GMS Corridor Towns Development Project within the current lending program. The proposed project is in line with the ADB's medium-term goal in Myanmar as outlined in the interim country partnership strategy to promote sustainable and inclusive economic growth in support of the government's objectives of poverty reduction and national reconciliation.

As outlined in the Terms of References, the expected impact of the project is that economic activities along the GMS EWEC will be increased. The outcome will be improved access to sustainable urban services in Mawlamyine, Hpa-An, and Myawaddy and in connection with other Corridors.

It was envisioned in the original Concept Paper that the indicative outputs would include

(i) endorsement and implementation of strategic local economic development plans;

(ii) improvement of priority urban infrastructure including

a. water supply,

b. sanitation and wastewater management,

c. solid waste collection and disposal,

d. urban roads and drainage,

e. trans-shipment and immigration facilities;

(iii) institutional capacity strengthening and public awareness raising.

At that time the ADB produced a Problem Tree which outlined a series of issues and shortcomings which needed to be addressed to improve access to sustainable urban infrastructure and municipal services in the 3 towns. The PPTA has examined the Problem Tree and made a number of revisions to the original findings as shown in **Figure 1-2.** These are:

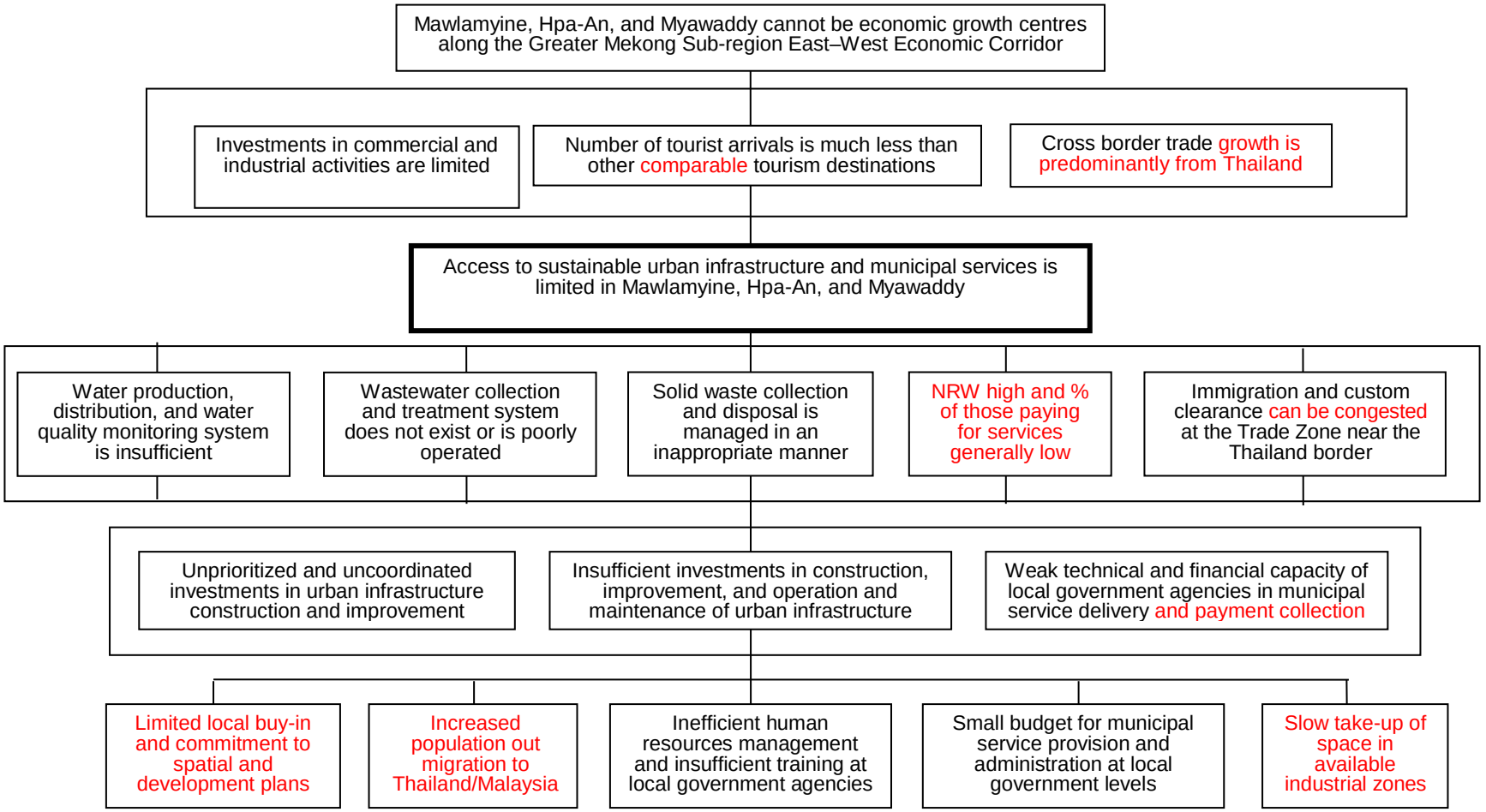
- Cross border trade is actually growing quickly although it is extremely one-sided, in favour of Thai exports[2];
- The proportion of the population actually paying for services, especially water and solid waste disposal, is low, with high rates for Non-Revenue Water (NRW);
- Customs clearance takes place at the Myawaddy Trade Zone some 11 km west of the town. An X-Ray machine was installed in April 2015 to help speed up processing;
- Spatial Plans were recently (2013 – 14) and rapidly prepared for the 3 towns by the Department of Urban Housing Development (DUHD), but with limited local involvement and capacity building of those responsible locally for plan implementation;
- Relevant migration issues are mainly due to the loss of those in the young, dynamic age groups (male and female) who seek work in neighbouring Thailand and Malaysia due to limited opportunities in the two States;

[2] Total trade through the border was US$290 million in the 2013-14 fiscal year (to April), up 9% on the previous year, but US$240 million of this was imports and mostly manufactured goods. Trade from Myanmar was mostly marine products (The Irrawaddy, 14th April 2014). In 2014-15 trade was up another 12.3% over the previous year (Bangkok Post 1st October 2015).

- Industrial Zones have been designated in all 3 towns but the take-up has been slow, due to security, access and power issues.

The project cost is estimated at $117.00 million with ADB providing a loan of $80.00 million from the Asian Development Fund (ADF) and a grant of $4.37 million. It is expected that NEDA (Neighbouring Countries Economic Development Cooperation Agency) would provide a loan of $24.33 million. $0.5 million would be financed by a grant from TICA (Thailand International Cooperation Agency) and $7.75 million by the Myanmar regional and national governments.

Figure 1-2: Problem Tree for the PPTA



Source: ADB as updated by the PPTA consultant (red)

1.2 Activities Undertaken

A diagram showing key project milestones is shown as **Figure 1-3** together with scheduled meetings and the respective tasks and responsibilities of both the PPTA and the Project Coordination Committees (PCC) set up in both States during the period to support and contribute to the process. These meetings are intended to involve the more technical members of the authorities in conceptualizing and progressing the actual projects as well as ensuring that data and analysis is shared between the PPTA and the PCC members.

The actual dates of all formal meetings held in both Mon and Kayin States, as well as in Naypyitaw, are shown in **Table** 1-1. Many other informal meetings have been held with key stakeholders within both Mon and Kayin States. Unfortunately, security concerns have affected the PPTA's ability to visit Myawaddy during part of the project period and also severe rainfall and flooding restricted the amount of consultation that could be accomplished immediately following the publication of the Interim Report.

Figure 1-3: Broad Roles and Responsibilities between PCC and PPTA

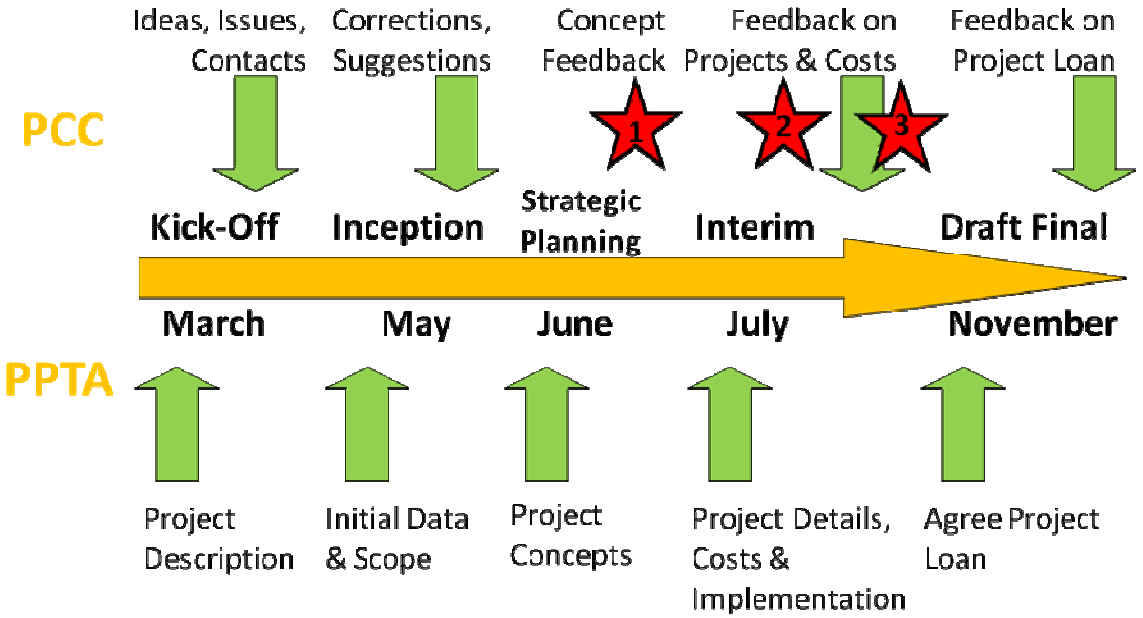


Table 1-1: Formal Meeting Schedule

Type	Mon State	Kayin State	Central Government
Kick – Off	17th March	18th March	
Inception	4th May	5th May	7th May (DUHD, MoF, FERD, MoCommerce)
Strategic Planning			19th June
PCC 1	26th June	2nd July	
Interim Report			17th August (DUHD)
PCC 2	9th September	22nd September	
PCC 3	6th October	7th October	
Draft Final Report	8th December	9th December	11th December

Type	Mon State	Kayin State	Central Government
ADB Pre loan fact finding mission	24th Feb 2016	25th Feb 2016	
ADB Loan Fact Finding mission	7th June 2016	6th June 2016	10th June 2016
ADB follow-up loan fact finding mission	8th Sept 2016	9th Sept 2016	
Final Report	Sept 2016	Sept 2016	September 2016

1.3 Organization of this Summary Report

This Final Report (FR) is one of a series of "milestone" reports provided by the Consultant for this assignment. The Summary Report covers both Mon and Kayin States and is organized within 10 additional main chapters as follows, with Appendices as referenced within the Chapters:

- Chapter 2: Strategic Local Development. This provides an analysis of the higher level strategies and policies which affect the 3 project towns and the wider EWEC.
- Chapter 3: Project Selection. This asks the questions "What we have chosen and why, but why not other projects". It examines whether projects have been identified due to strategic or local needs and opportunities.
- Chapter 4: Project Description. Provides an analysis of the current situation, proposed strategies and recommendations/options for the selected projects in each project town. It also details the proposed implementation arrangements as well as capacity building recommendations.
- Chapter 5: Environmental Safeguards. This chapter sets out the specific required of the government and ADB, considerations related to Climate Change as well as screening of projects (IEE) as far is feasible to date.
- Chapter 6: Summary of the Poverty and Social Assessment with the SPRSS, Gender Action Plan and Stakeholder Communication Strategy as appendices.
- Chapter 7: Social Safeguards. Provides details of the safeguard process undertaken as well as any Resettlement Plans (RP).
- Chapter 8: Project Implementation Plan (PIP)
- Chapter 9: Project Costs
- Chapter 10: Economic Justification. Summary of work undertaken with links to the appropriate Appendices.
- Chapter 11: Financial Analysis. Summary of work undertaken with links to the appropriate Appendices.

This Summary Report is also supported by separate standalone Volumes for each of the States. Each State Report has its own referenced Appendices.

2 STRATEGIC LOCAL DEVELOPMENT

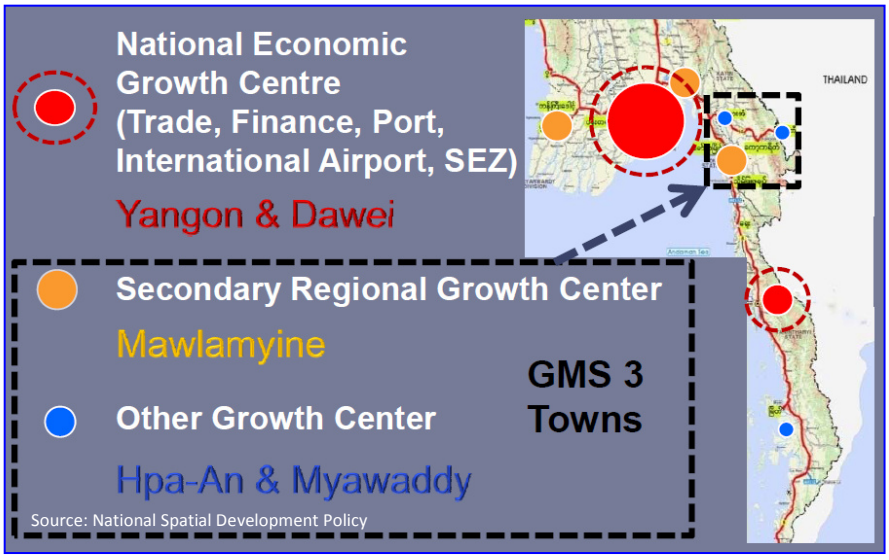
The PPTA has undertaken an analysis of the strategic factors which affect or may influence the future spatial and economic development of the 3 project towns in particular and for the EWEC in general. It should be noted that, given available resources, the analysis was not a full regional study or planning exercise: instead, it was designed to:

- Summarize the current assumed national priorities in regional infrastructure provision affecting Mon and Kayin States;
- Assess the various strategic issues which are likely to arise in conjunction with such priorities and other development factors;
- Develop an understanding of the implications of these priorities and factors for the Corridor Towns;
- Produce development strategies and other suggestions for the 3 towns.

2.1 National Strategies

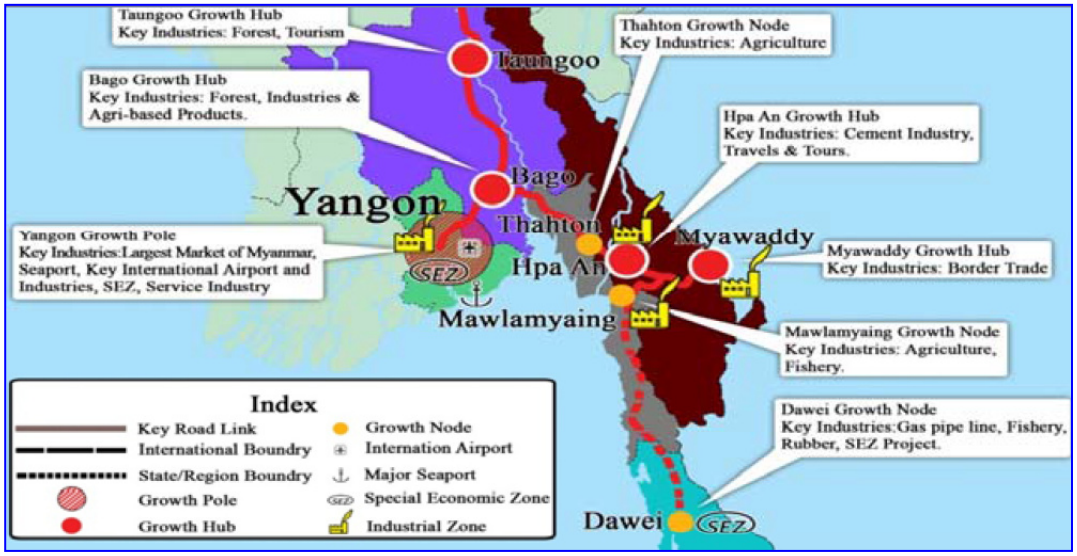
The analysis commences with the national government's Concentrated & Decentralized Development Strategy, which identifies both Yangon and Dawei in the region as National Economic Growth Centres (NEGC). This status could include use for Trade, Finance, Port, International Airport and/or Strategic Economic Zone (SEZ), of which there are only 3 of the latter approved and permitted in the country at present. Mawlamyine falls within the next category of Secondary Regional Growth Centre, while Hpa-An and Myawaddy are considered as "Other Growth Centres" as shown in **Figure 2-1**. Bago is the only other urban centre between Yangon and Dawei to be granted either of these growth titles. This thus confirms why the GMS 3 Corridor Towns were originally chosen in conformity with the national spatial development strategy.

Figure 2-1: Concentrated and Decentralized Development Strategy



Also at national level the Government has developed the Myanmar Comprehensive Development Vision (MCDV) which essentially applies a SWOT analysis to the various regions and towns and assesses the comparative advantage of each area for future consideration and investment opportunities. The vision in graphic form for the south of the country is shown in **Figure 2-2**. The vision sees Mawlamyine as a Growth Node and Hpa-An /Myawaddy as Growth Hubs. To the list of Key Industries given in the Figure we would also add Tourism to Mawlamyine and Agricultural Processing to Hpa-An. For both States, remittances from overseas workers also contribute significantly to the local income.

Figure 2-2: Myanmar Comprehensive Development Vision



Source: MCDV. Final Draft. November 2013.

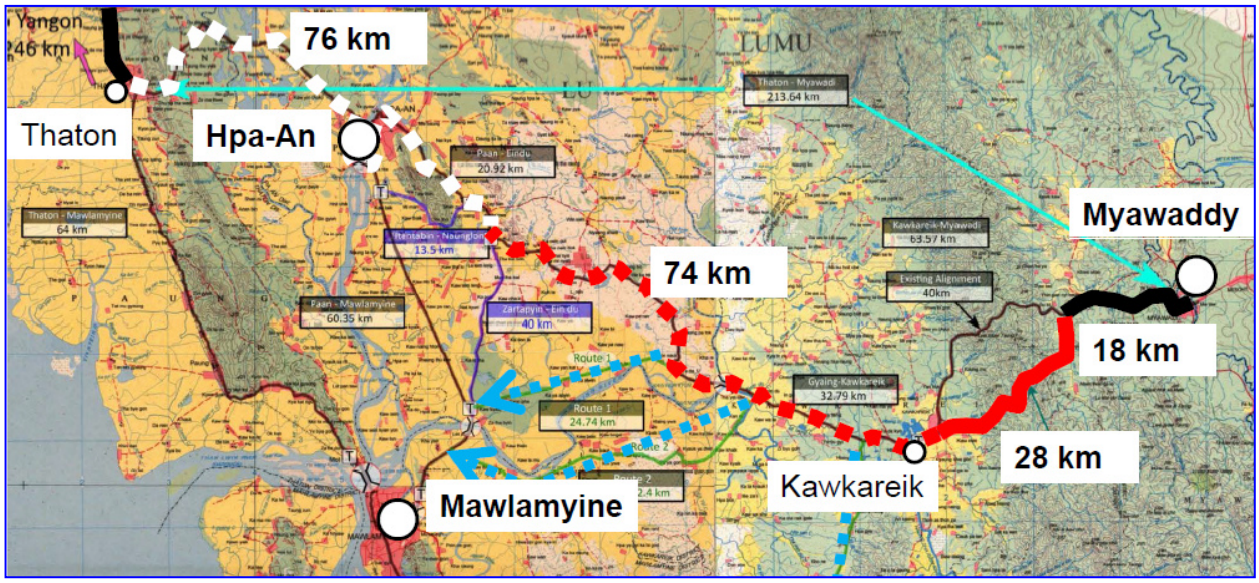
2.2 Strategic Infrastructure

2.2.1 ROADS

The Ministry of Construction (MoC) is currently inviting bids for the improvement of the GMS EWEC road between Eindu and Kawkareik. This section, of about 74 kilometres (km) and costing $100 million, will be improved to GMS road network standard, essentially 2 lanes with appropriate width shoulders, suitable for all standard highway traffic, and which will require complete reconstruction of the current road. Improvements to the GMS EWEC in Myanmar should dramatically improve connectivity within Kayin State, between the State and the economic hub of Yangon, regionally between Myanmar and Thailand, and onwards across the GMS region. The project is thus well aligned with the development agenda of ADB's Strategy 2020 to support regional trade and integration and inclusive development. The GMS EWEC extends from Da Nang on the coast of Viet Nam through the Lao PDR and Thailand to Mawlamyine. The road that forms the core of the corridor has been completed in Viet Nam, the Lao PDR, and Thailand. The section of the EWEC corridor in Myanmar will complete the EWEC corridor.

The current status of the EWEC roads, or more specifically Asian Highway 1 (AH 1) in relation to the GMS 3 Corridor Towns is shown on **Figure 2-3**. From the boundary with Thailand, the first 18 km within Myawaddy is complete and the next section to Kawkareik (28 km) was officially opened in September 2015. This latter section has significantly reduced travel times and inconvenience of the old road which operated a one-way policy on every other day. Travel times from Mawlamyine to Myawaddy are now about 4 hours. The next 74 km stretch was mentioned above. That leaves a 76 km piece of road from Eindu to Thaton via Hpa-An to be completed, although the road from Thaton west to Bago will also need to be improved for the EWEC to be considered a viable functioning reality.

Figure 2-3: Improvements to AH 1 and access to Mawlamyine



Source: Base Map and Routes Source: Khin Maung Kyaw, Chief Engineer (Roads). Public Works. Ministry of Construction. December 2013

However, AH 1 does not serve Mawlamyine directly. There are 3 possible alternative routes which are being considered by the government to link the town to AH 1, both north and south of the Attran River as shown on the Figure above. One major consideration will be the need for investment in a number of new major bridges across the Attran and Thanlwin rivers in both Mon and Kayin States, as well as checks on the viability of existing bridges to take the expected increases in EWEC traffic.

The PPTA assessed priorities for all road links in this region are therefore shown in **Figure 2-4**. The AH 1 is the main assessed priority and it is completely logical to follow the current route from Myawaddy – Hpa-An – Thaton as being the shortest link and one which minimizes a large number of bridge crossings which would be the case if the road went via Mawlamyine. Apart from AH 1, one other assumed high road priority in the region is the cross-border link east of Dawei to the south of Mawlamyine (shown green). The Myanmar, Thai and Japanese governments recently agreed to re-invigorate the Dawei SEZ and it is expected that this will lead to both direct and associated investments in road and other infrastructure in that

area. However, a road link from Mawlamyine to Dawei via Ye (shown orange) is not currently seen as a high priority and Dawei is likely, initially, to be a separate development enclave with national road access only to Thailand and links within Myanmar predominantly by air and sea. Links to the Southern Area Development Corridor (SADC) south of Dawei (shown in yellow), are also not considered to be of the highest priority at present.

Figure 2-4: PPTA Assessed Regional Road Priorities (1, 2 and 3)

2.2.2 RAIL

There is an existing single track railway from Yangon to Dawei via Mawlamyine. The section from Yangon to Mawlamyine is 281 km (176 miles) and the daily service takes approximately 9 - 10 hours (to Dawei is about 24 hours). Since 2006, when the Thanlwin Bridge opened, the only change of trains en route to Dawei is in Ye. Construction also recently started on a 213 km link from Dawei south to Myeik but its current status is unknown. The project is not aware of any concrete proposals to improve this part of the network.

There has been little investment in the rail system for many years. If it is to compete with roads in future there will need to be a complete assessment and improvement of the track (including several main bridges), progressive doubling of sections of the track to allow for increased frequencies, a major update of all rolling

stock, as well as constructing proper controlled level crossings at all of the many road/rail intersections.

It was reported in 2013[1] that Myanmar was considering rebuilding a stretch of railway from Thanbyuzayat, 64 km south of Mawlamyine, over the Three Pagodas Pass to link with the Thai border. The article mentioned that the town of Kanchanaburi, a popular destination about three hours drive from Bangkok, generated tourism revenue of over 2.4 billion baht (US$84 million) in 2012. Such a project might well inspire the Myanmar government to link Thanbyuzayat with Mawlamyine or perhaps Dawei, in an effort to stimulate tourism on the area.

2.2.3 AIRPORTS

From 2010 – 12, the number of domestic passengers within the country increased by 16% per annum, while the figure for international passengers was even greater at 31% per year[2]. In the period 2012 – 14[3], the overall growth for the two years was 26% for domestic to 2.02 million passengers and a staggering 62% for international to 3.19 million passengers. Of the 27 airports, numbers of domestic passengers for the regionally relevant towns are given for 2012 in **Table 2-1**.

Of the airports in the region, Mawlamyine had the least number of passengers: the other airports, except Yangon, all lie south of Mawlamyine along the western seaboard of Myanmar. There is also a small airstrip at Hpa-An.

Table 2-1: Domestic Passengers - Selection from 27 Airports

No.	Airport	Total
1.	Yangon	1,157,565
6.	Kawthoung	146,867
8.	Myeik	118,110
10.	Dawei	108,909
22.	Bokpyinn	12,120
25.	Mawlamyine	9,369

Source: Myanmar-Japan Working Group Meeting on Air Transport. 25th Jan 2013, Yangon

In future it is not expected that Mawlamyine will have more importance as shown in Table 2-2: in fact the airport has been closed for the past few months. However, it

[1] Source: Bangkok Post 23 April 2013
[2] Myanmar-Japan Working Group Meeting on Air Transport. 25th Jan 2013, Yangon
[3] ASEAN-JAPAN Transport Partnership Information Center.

is intended that Dawei will become an international airport in due course. For those that wish to connect with the GMS 3 towns the other option is to use Mae Sot, just over the Thai border from Myawaddy: it has 2 daily flights to Bangkok with Nok Air[4] and is now significantly closer than Yangon in terms of driving time.

Table 2-2: Future Airport Functions

Class	Main Function	Airports	Tentative List
I	Scheduled operations of large aircraft	3	Yangon, Mandalay, Naypyitaw
IIA	Capable of accommodating Code 4C	7	Includes Dawei, Myeik
IIB	Capable of accommodating Code 3C	10	Includes Kawthaung,
IIC	Capable of accommodating ATR 72	13	Includes Mawlamyine

Source: Myanmar-Japan Working Group Meeting on Air Transport. 25th Jan 2013, Yangon

2.2.4 WATER

There are still both passenger and cargo ships using the Thanlwin, Attran and Gyaing rivers with most routes based on Mawlamyine. The Gyaing is navigable for large boats up to Kyundo; the Thanlwin to Hpa-An and Swegon; and the Attran as far as Kyarinn. There are also passenger ferry services to Belu island (Kalwi and Natmaw) but these will be under severe competition once the new bridge to the island opens up, probably in late 2016 or 2017.

There are concrete plans to build dams on the Thanlwin (one of the longest free-flowing rivers in the world, which runs 2,800 kilometres from the mountains of the Tibetan plateau through China, Myanmar and Thailand before emptying into the Andaman Sea) and the Attran. A total of 31 dams are planned for the Thanlwin with 7 on the lower reaches within Myanmar. The first in Myanmar, a $6 billion hydropower project with a 241 meter high dam planned for a site in Myanmar's Shan state would produce more than 7,000 megawatts of electricity, nearly all of it for export to China and Thailand. It would be Myanmar's largest hydroelectric project and the tallest dam in Asia outside of China or India. The dam is expected to take 12 years to build. It is still uncertain as to the impact of this and other dams on river flows and salinity in the GMS 3 towns of Mawlamyine and Hpa-An.

Climate change is also a major issue with increased sea levels leading directly or indirectly to a possible impact on surface urban water supply systems (as intakes need to be moved further upstream) as well as livelihoods as farmers find plots close to the coast too saline to rely solely on rice and need to introduce a shrimp

[4] Nok Air also introduced a Mae Sot to Mawlamyine service in 2013 but it was discontinued a year later.

crop during the dry season. This can potentially increase incomes due to the higher value of shrimps but they need to learn the business and to avoid dangers from the spread of diseases between ponds.

2.3 Regional Context

2.3.1 POTENTIAL FOR DEVELOPMENT

A recent study[5] defined the physical, political and administrative problems which have afflicted Mon and Kayin States in the past and which need to be addressed in future. Identified deficiencies cover infrastructure (roads, water supply, power), political (migration, security, labour) and administration (government capacities, environmental management) which together have led to low economic growth rates, environmental degradation and weak management.

However, the EWEC generally and the GMS 3 Corridors Towns specifically have significant potential for development and improved economic activity in future. This is partly due to:

- Expected increases in trade with Thailand and beyond as a result of the improved AH 1 through the area and due to the expected increased efficiencies from a 2nd border crossing in Myawaddy;
- Improved access to Yangon, through expected road improvements and mooted rail upgrades;
- Its location (Mawlamyine especially) as a potential base for those working on offshore projects in the Bay of Bengal; and
- Expected increases in tourist numbers to Myanmar, to Mon and Kayin States as well as to the south, initially for diving and exclusive resort development, but also for heritage and natural attractions.
- A new international airport at Hanthawaddy (Bago) by 2020, closer to Mawlamyine than the existing Yangon airport;

In addition, there are expected peace dividends from agreements between the government and the New Mon State Party (NMSP) and Karen National Union (KNU) which should enable displaced residents to return and businesses to prosper.

The two States, with support from central government, have taken initial steps to take advantage of this expected interest in the area. There are a number of established Industrial Zones (IZ) and also a Trade Zone in Myawaddy which is essentially a check point for vehicles arriving from Thailand. To date, none of the IZ have been particularly successful:

[5] Preparatory Survey for the Integrated Regional Development for Ethnic Minorities in South-East Myanmar. Final Report. Ministry of Border Affairs/JICA. August 2013

- The IZ to the west of Myawaddy is large but essentially empty. It suffers because investors are wary of the ethnic tension in the area and not yet willing to invest until the security situation improves;
- Until recently, the IZ in Hpa-An did not have water or power. These still need to be improved and possibly linked to the rest of the town, but a few industries have located there and the KSG is a strong and vocal advocate for the area;
- In Mawlamyine the existing IZ on the other side of the Attran River has over 200 registered private companies, but these are mostly small businesses and the area suffers from power brown-outs.
- In addition to the under-used IZs there are several proposals for port related activities in Mawlamyine and Ye, as well as the main focus further south in Dawei in relation to the SEZ there[6]. In Mawlamyine, a bridge is now being constructed across to Belu Kyun which will improve the access of some 200,000 people who live on the island and should stimulate tourism development based on handicraft industries, when it is completed in 2016 – 17. An MoU has also been signed to set up a Marine Offshore Supply Base (MOSB) on 193 acres within the town.

The tourism sector also has potential to stimulate economic growth in and around all the GMS 3 towns. If the Mawlamyine and Hpa-An area is considered as one destination there are sufficient attractions for several days. These include several notable caves near Hpa-An, Mount ZweKabin (for which work has apparently started on a cable car to the summit) as well as to the south of Mawlamyine which include Thanbyuzayat (cemetery and railway), Kyaikkami (sea pagoda) and Win Sein Taw Ya (largest reclining Buddha). Mawlamyine is itself a major attraction to view its heritage and surrounding scenery.

However, there are still some security concerns, especially in the border areas near Thailand which may influence tourists' itineraries and possibly encourage them to travel to other parts of the country instead. There are also limited accommodation options in both Hpa-An and Mawlamyine, especially considering the latter should be the logical base for visits elsewhere. Although it is the fourth largest town in Myanmar, Mawlamyine ranks number 14 out of 59 locations in terms of number of hotel beds (19 hotels with 553 beds)[7]. There were some 3+ million visitors to the country in 2014. The 2013 – 20 Tourism Master Plan projects this number will rise to 7.5 million by 2020. It will be important for the region that it can attract a significant portion of this expected increase to ensure that tourism contributes an increasingly greater proportion of economic growth, in the absence of other

[6] In April 2015 it was agreed that the governments of Myanmar, Thailand and Japan would jointly re-launch this project with Special Purpose Vehicles (SPV) to manage parts of the project. A comprehensive master plan for the project includes an industrial estate covering 132 km^2, a deep-sea port to service 170 tonnes of goods and 5 million 20 feet containers (TEU) per year. A 132 kilometer road to the Thai border would also be included.
[7] Union of Myanmar Travel Association (UMTA)

generators. Unfortunately, in Mawlamyine especially, many of the heritage attractions are poorly cared for, and there are many "first impression" issues with uncontrolled disposal of solid waste in public areas, scavenging animals, erratic power supply and limited amount of information for tourist arrivals.

2.4 Urban Development

2.4.1 FUTURE EXPECTATIONS

In response to the future expected growth, ambitious development plans for their expansion have recently been produced for all 3 towns by the Department of Urban Housing Development) DUHD (previously DHSHD). However, current official population figures within Myanmar are known to be unreliable (and detailed results from the Census from May 2015 only provide detail down as far as the Township level); it is still uncertain as to the timing of expected dividends from peace in the area; and benefits from the major road reconstructions will take time to filter through the regional economy. Investors and visitors are obvious cagey: for example, Nok Air introduced a Mae Sot (Thailand) to Mawlamyine service in 2013 but it was discontinued a year later. So it is understandable that the DUHD has included a range of population projections for each of the Project Towns.

The DUHD has adopted the following 2011 populations for the Project Towns: Mawlamyine (200,000), Hpa-An (70,000) and Myawaddy (100,000). These are "urban" figures, which reflect the respective levels of urbanization between the 3 locations. The DUHD assumed a range of growth rates until 2040, namely 1.2, 2.5 and 3% Annual Average Growth Rates (AAGR) for Hpa-An and Myawaddy as well as 2.8% AAGR for Mawlamyine. These figures were adopted prior to the 2014 Census which shows slightly different population figures for all 3 towns. Grappling with actual population numbers is a major challenge in Myanmar at the moment, especially in terms of projecting service and infrastructure needs.

2.4.2 URBAN FUNCTIONS

In order to better understand the issue of future growth rates it is necessary to examine population trends and expectations but also the current and expected function of each urban area. Accordingly, a Scalogram (or Guttman Scaling) exercise was undertaken at the Interim Report stage to investigate current and expected urban functions. The other key corridor towns of Thaton and Kawkareik were included as they form an integral part of the EWEC and the AH 1 in particular, so they should also benefit from the expected increased trade and economic activity in the area.

The results (**Figure 2-5**) showed that Mawlamyine is the pre-eminent centre in the area: more interestingly, Hpa-An scores highly because of its government function (employment & economic boost) while Myawaddy has a higher population than Hpa-An, but does not possess any major functions (e.g. higher education) to support this number at present. The major omission of a supermarket for Mawlamyine is being addressed at present and an Ocean Supermarket has opened

in 2016. From the diagram it may be that an IZ in Thaton would benefit from the urban area's role as a centre for agricultural production.

If the projected 2040 Urban Population (see Section below) is inputted it can be seen that several of the towns might be expected to have rarer functions based on similar levels of 2014 populations in relation to functions as shown in Figure 2-6. So Hpa-An (and perhaps Myawaddy) might be expected to have a YKKO or similar restaurant chain by 2040. The projected high growth for Myawaddy suggests that it might become more than a border dormitory town and start to develop some of the higher level functions which are currently provided across the border in Thailand.

Figure 2-5: Centrality Index based on Scored Functions by Urban Area

	Centre	2014 Census Urban Population	1	2	3	4	5	6	7	8	9	10	CI
1	Mawlamyine	253,734	25	25	25	33.3	33.3	33.3	50		100	100	425.0
2	Hpa-An	75,141	25	25	25	33.3	33.3	33.3	50	100			325.0
3	Thaton	55,047	25	25	25	33.3	33.3						141.7
4	Myawaddy	113,155	25	25	25			33.3					108.3
5	Kawkareik	42,950											-
	Total	540,027	100	100	100	100	100	100	100	100	100	100	1,000

Figure 2-6: Indications for 2040 Functions

	Centre	2040 Projected Urban Population	1	2	3	4	5	6	7	8	9	10
1	Mawlamyine	426,788	25	25	25	33.3	33.3	33.3	50		100	100
2	Hpa-An	143,936	25	25	25	33.3	33.3	33.3	50	100	?	
3	Thaton	105,445	25	25	25	33.3	33.3	?				
4	Myawaddy	246,844	25	25	25	?	?	33.3		?	?	?
5	Kawkareik	82,272										
	Total	1,005,285	100	100	100	100	100	100	100	100	100	100

Sources: Project Surveys and Census 2014

2.4.3 URBAN POPULATION

There are major issues with using historic population data to project future trends or even a total at some time in the future, as discussed in the Interim Report.

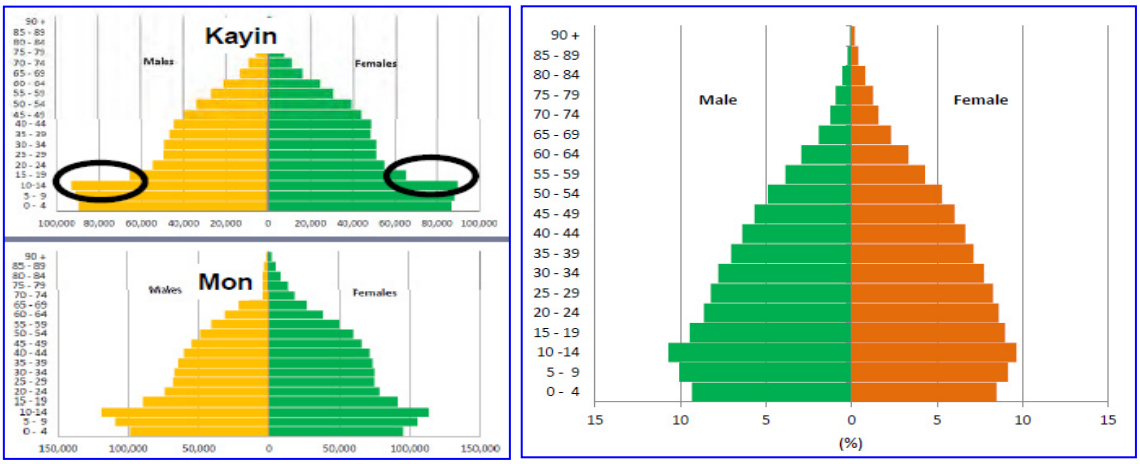
The DUHD assumed a range of AAGRs from 1.2 – 3.0% for the GMS 3 Corridor Towns in its 2013 – 14 Development Plans. Given the development potential as already mentioned, as well as the large numbers of children in the 0 – 14 age cohorts, particularly for Kayin State (as shown in Figure 2-7), it is likely that growth will be substantially higher than General Administration Department (GAD) trends, even without additional stimuli.

Age Structure

The age structure for both States is very different from the bell shape for the country as a whole. Notable differences are the significant relative shortage of elderly men, especially in Mon State and the significant drop in numbers of those

reaching working age in both States as both sexes move overseas or to other parts of Myanmar for work or study). In Mon State, there has also been a substantial decline in births for the past 10 years, which could be related to the lower numbers of marriages as either one or other of the potential partners is studying or seeking work elsewhere. Such factors, plus the large expected number of children in Kayin State, have significant relevance for the future provision of services, such as schools and health facilities.

Figure 2-7: Age/Sex Distribution for Mon and Kayin States



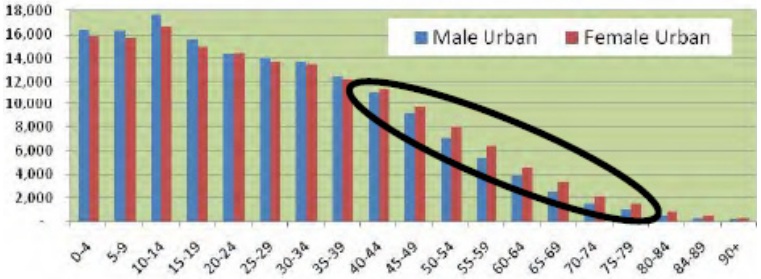
Source: Census 2014.

Sex

Populations in both States are significantly skewed by sex as shown in Figure 2-8. In both Mawlamyine and Hpa-An there are significantly more females within the Townships. The impact of this can be seen visually, with resident families often consisting of elderly parents being tended by unmarried daughters.

Figure 2-8: Population distribution by Sex, Townships & Urban Kayin State

Township	Male	%	Female	%
Mawlamyine	122,052	48.1%	131,682	51.9%
Hpa-An	36,921	49.1%	38,220	50.9%
Myawaddy	57,399	50.7%	55,756	49.3%



Source: Census 2014

The young males only usually return once a year at the time of the Water Festival in April. In Myawaddy, the reverse is true, probably because employment on the Thai side of the border is mainly in textile and other such factories as well as in service activities such as shop assistants and waitresses. But this case does not influence the overall distortion of sex distribution in urban Kayin State as shown in the same Figure. From the age of 40 until 79 there is a huge numerical advantage for females over males in urban areas.

Population Projections

In order to produce a meaningful analysis of population and likely development trends to the year 2040 the project has taken into account:

- the range of projections adopted by DUHD for their 2013 - 14 plans and discussions held with the Director and senior staff of the Department in June 2015;
- the analysis of urban functions detailed above;
- the distribution of Ward populations as contained in the GAD population figures from 2012 – 15 would be used for base figures in future;
- An assessment of the potential of the GMS 3 towns based upon expected future infrastructure and known investments, as described earlier in the chapter.

The result is a range of AAGRs for the GMS 3 Corridor Towns up to 2040 as follows and for the given reasons:

- Mawlamyine: 2%, which is based upon ongoing and expected increased private development in the town (catering largely for increased international and local tourism), but which is lower than the other 2 towns because of its location away from the main trade route of the AH 1;
- Hpa-An: 2.5%, due to its location on AH 1 and to its potential from development of its IZ as well as increased dividends from tourism, especially to the caves and ascent of Mt. ZweKabin by cable car[8];
- Myawaddy: 3%, due to the influence of the 2nd Bridge within 5 years and increasingly complementary growth of the town and Mae Sot on the Thai side of the border.

Rates of 2.5% AAGR were also assumed for both Kawkareik and Thaton which also lie along the AH 1 and have significant associated potential for development.

It is appreciated that these rates are based on a little guess work in the absence of other reliable data. However, these towns will reach the projected population at some stage. It may not be in 2040: it could be earlier or later. It is to be expected that data collection and associated projections will improve significantly in future based upon the capacity building undertaken as part of the 2014 Census collection

[8] Myanmar Business Today, 22nd June 2015.

and analysis processes. It will therefore be important that populations and hence demand for services are reviewed at least every 10 years in line with each Census but on a regular short-term basis and at a minimum every 5 years.

The result in terms of Urban Populations for 2040 is shown in **Figure 2-9**. The graphic also introduces an urban hierarchy related to expected functions. Assuming the proposed AAGRs the population of Myawaddy in 2040 would rival that of Mawlamyine today and together with Mae Sot could form a substantial metropolis. Mawlamyine would still be the main unchallenged centre in the region.

Figure 2-9: Urban Hierarchy in 2014 and 2040 and Projected Population

			2014			2040	
	Level of Hierarchy	Urban Population	Urban Centres in Region	Census Population	Assumed AAGR % 2014 – 40	Projected Population	Projected Urban Centres in Region
1	National Growth Centre	> 1 million					
2	Regional Growth Centre	500,000 – 1 million					
3	State Growth Centre	200,000 – 500,000	Mawlamyine	253,734	2.0	Mawlamyine Myawaddy	426,788 246,844
4	Major District Growth Centre	50,000 – 200,000	Myawaddy Hpa-An Thaton	113,155 75,141 55,047	3.0 2.5 2.5	Hpa-An Thaton Kawkareik	143,936 105,445 82,272
5	Minor District Centre	10,000 – 50,000	Kawkareik	42,950	2.5		

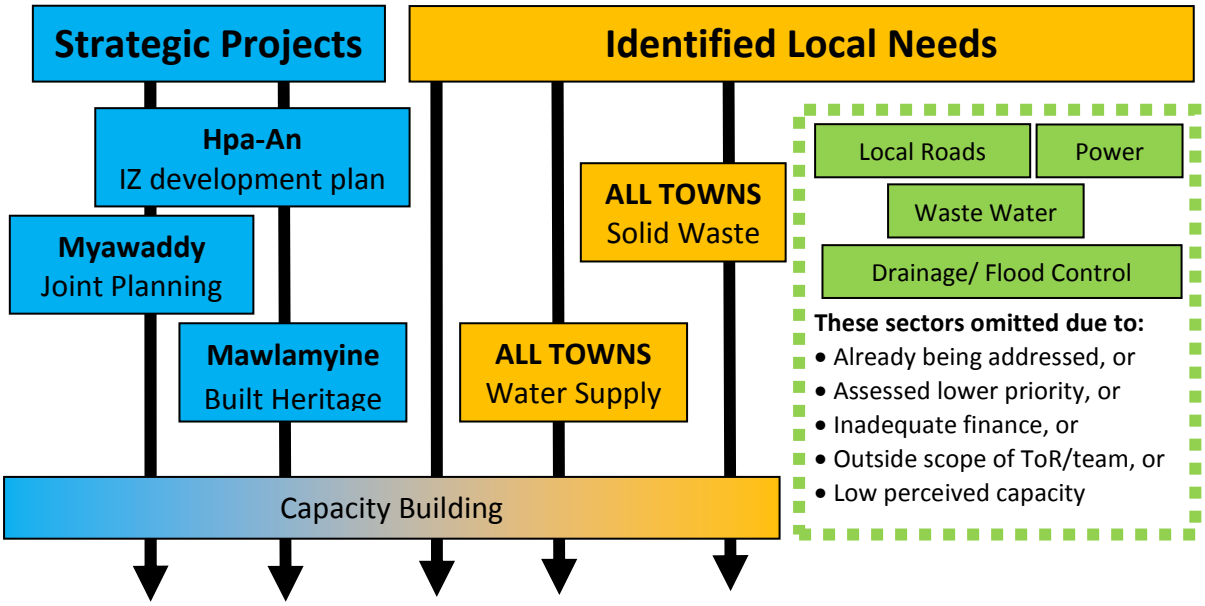
3 PROJECT IDENTIFICATION

This Final Report includes a wide range of collected data and analyses contained in a series of sections starting with the national and other strategic issues contained in the previous chapter, through to project proposals as detailed in the following chapters. In reality these investigations have been undertaken in parallel with each informing the other and projects being identified from top-down, bottom-up or a combination of these processes.

The broad process of project identification has also been guided by the constraints or boundaries inherent in the project make-up such as the ToR, budget guidelines and required team composition. During the project itself further refinements have been made, through the institutional and financial analyses, based on the assumed capacity of the agencies (both executing and implementing) to undertake potential projects. Some potential projects may have impacts which have to be addressed, by including appropriate safeguards (e.g. environmental, social) or by modifying the original project details. In some cases initially identified projects may not proceed due to impacts, uncertainties or complications which make final inclusion unlikely or impossible in the time available.

It is important to document the processes as to how the proposed Interim Report projects were generated as part of the overall justification to both ADB and intended executing and implementing agencies. The process adopted by the project is shown diagrammatically on **Figure 3-1** and described below.

Figure 3-1: Project Identification Process



The objective of the project as defined by ADB is to "strengthen competitiveness of the GMS economic corridors through investing in urban infrastructure in corridor

towns. Local economic development in corridor towns will contribute to broader regional economy through increased traffic and trade along the GMS economic corridors". The associated impact and outcome are "increased economic activities along the EWEC" and "improved access to sustainable urban services in Mawlamyine, Hpa-An, and Myawaddy".

3.1 Strategic Projects

Strategic planning thinking from the national government level down is thus clearly a key issue to try to determine exactly what is planned in the area in terms of supporting infrastructure and development policies. The main piece of infrastructure influencing development along the EWEC is AH 1 which currently runs from Danang to the Thai border at Mae Sot. And as discussed in the previous chapter, the route of AH 1 within Myanmar will significantly influence future trade routes by road and hence the economic fortunes of towns along the way.

3.1.1 MYAWADDY: JOINT PLANNING WITH MAE SOT

Both Myawaddy and Hpa-An are located on the AH 1 and can thus benefit from any improvements of the route. For Myawaddy the urban development plan is outdated since the alignment of the 2nd bridge crossing and access roads was recently agreed. On the Thai side the proposal for several new SEZs also means that the current Mae Sot spatial plan requires updating. This situation thus provides the opportunity for a joint strategic planning exercise between the two towns in order to plan future developments in a coordinated and integrated manner, while at the same time benefiting from international and central government support to ensure best planning practices are applied. The planning would focus on the as yet relatively undeveloped 2nd bridge access road in both Thailand and Myanmar in order to improve spatial planning and associated economic development opportunities.

3.1.2 MAWLAMYINE: BUILT HERITAGE CONSERVATION

Tourism is a major growth industry with international visitors increasing by one million each year for the past 3 years while local people are increasingly physically and financially able to travel in their own country. Along with Yangon, Mawlamyine has a large supply and variety of heritage buildings dating back to the 10th century which are an attraction to international and national visitors alike. It is a resource which needs to be conserved soon before it is lost if Mawlamyine is to have an attraction which has been lost in most other developing towns. The proposal is based on the principle that conserving the built heritage will encourage more visitors who will raise economic activity in the area and thus encourage more investment in such buildings.

3.1.3 HPA-AN: INDUSTRIAL ZONE DEVELOPMENT PLAN

Capacities in planning and management of IZ are virtually limited in Kayin State. So far, the DUHD and Ministry of Commerce in Naypyitaw assume tasks planning IZ / trade zones. There is a need to facilitate transfer, or at least sharing of this

competence, to State/Regional level. It is proposed to help the KSG, by closely interact with business community, defining and making officially approved promotion action plans for Hpa An. The plan would be based on an updated local industrial strategy/vision and would "prioritize" investors according to this strategy/vision (e.g. agro-business or labor intensive industries, or cluster-based or eco-park approach, etc.) and complementarities (and not competition) between the Hpa-An IZ and Mawlamyine, Myawaddy and Mae Sot IZ. The plan includes also a feasibility study for infrastructure services in Hpa-An IZ (particularly water and solid waste) and an assistance to establish a Hpa An IZ Investment Promotion Office.

3.2 Local Needs

There has been little investment in new infrastructure nor in maintenance of existing facilities in the past decades in the 3 GMS Corridor towns. There are major ongoing issues with inadequate and erratic provision of electricity and water supply, as well as both solid waste and waste water management.

3.2.1 DRAINAGE AND FLOOD CONTROL

With an average of 5 metres of rain per annum in much of the region, drainage and flood control are an immediate obvious choice for assistance. However, the drainage system in the town of Mawlamyine makes good use of the undulating terrain and water is rapidly dispersed after heavy downpours. There is also little evidence of overtopping of the river banks to the west and north of the town. In Hpa-An and Myawaddy there are major flooding issues caused primarily by the overtopping of the Thanlwin River and Moei River during the wet season. However, the PPTA considers that a flood protection study would be extremely complex, lengthy and beyond the financial capabilities of the project.

3.2.2 ELECTRICITY

There are regular brownouts in both Mawlamyine and Hpa-An. However, work is proceeding on improving the supply in Mawlamyine and extra generating capacity is promised by end of July. Myawaddy currently gets its power from Thailand although it is intended to rely on a local supply from 2016.

3.2.3 WASTE WATER

There are no waste water networks in any of the 3 towns with most residential outflows to pit latrines (a ventilated improved pit latrine system is used in Hpa-An with one sludge collection truck) and septic tanks, if at all. It will be an extremely costly endeavour to start to develop a network from scratch in each town and accordingly this is considered beyond the scope of this PPTA.

3.2.4 ROADS

The major roads project in the region is the completion of AH 1 through Hpa-An to Thaton and beyond to Bago. Away from this route there is little inter-urban traffic for the mostly 2 lanes roads. Within the urban areas the existing networks are adequate for the amount of traffic, with only localised congestion especially at

school times. The general condition of urban roads is considered acceptable in comparison with needs identified in other infrastructure sectors.

3.2.5 WATER SUPPLY

The project needs to consider a number of on-going studies/projects by other agencies: this includes JICA (Mawlamyine and Hpa-An) and that from Thai Tap Water (TTWP) in Mawlamyine. In Myawaddy, water supply is by two private companies. It is necessary to ensure that all projects and other interventions are complimentary and are an efficient use of available resources.

The data collection and analysis process has shown that there is clearly a need to extend/improve all networks, increase amounts/qualities of water produced and to reduce levels of NRW. In concert with these, operational and financial management needs to be improved, whether this is within government or the private sector.

For both Mawlamyine and Hpa-An there are real risks to current systems from expected future climate change. In addition, proposals for dams on existing supply rivers provides a high level of uncertainty as to the location of any new surface water intakes. But an area of the country which receives an average of 5 meters of rain per annum should not really have a problem in developing an appropriate and safe supply of potable water. In Myawaddy, the issues revolve more around use of the private sector and utilising surface and/or groundwater sources in future.

3.2.6 SOLID WASTE

Walking the streets and riverbanks of Mawlamyine it is impossible to miss the rubbish which is carelessly and deliberately dumped in streams, rivers and any accessible but unused open spaces. Apart from the major health and environmental concerns the piles of solid waste and unconcerned attitude of local dumpers are a poor advertisement for visitors to the town.

The Mawlamyine Town Development Committee (MTDC) provides solid waste collection services to 23 of the 28 wards (covering about 90% of the total population). It has only 7 waste vehicles for and manage to collect waste twice a week. The town produces about 142 ton/day and initial observations estimate that about 50% of waste is collected and dumped at the designated dump site. Hazardous waste is not separately collected but mixed with household waste. Solid waste is dumped at a site to the east of the main city and upstream of the two river water supply intakes; there is a clear risk of contamination of these water resources by leachate from the dump site. Burning of waste takes place at the dump site to reduce waste volumes; this is a clearly a health hazard to the waste pickers and also is a matter of complaints from the nearby village and the Sports Academy.

In Hpa-An the Cleansing Department has implemented a detailed cleansing program to collect solid waste from the 9 wards. Four garbage trucks are used operating 3 trips each per day and disposing their waste at the dumpsite. A number of wards are operating successful community-based collection systems. Solid waste is disposed at the Htan Koe Pin dump site a little over 11 km (7 miles) away from the town. While not affecting water resources this dump site is near to a major

tourist attraction and resorts near Mount ZweKabin. Hpa-An generates about 42 tons of solid waste per day with only about 15 tons being collected and dumped at the small dumpsite (4.4 acres (1.8 ha)).

Myawaddy generates about 64 tons of solid waste per day. Half of the collected waste is dumped at two small open dump sites. The remaining is dumped illegally along streets and in water bodies such as the Moei River (or Thaungyin River) which borders with Thailand.

In all 3 towns there is potential (within the budget) to improve the solid waste collection and disposal systems, using both the public and private sectors, although there will also need to be an intense and prolonged public education program for residents, especially those living along major public thoroughfares.

3.3 Capacity Building

The technical, administrative and financial capabilities of government to operate public services are low in all 3 towns. This is clearly demonstrated by the low coverage of public water supply and solid waste collection and the widespread use of generators. State government revenues are low and constrained which makes it almost impossible to plan ahead without Union government support. State government staff mostly operate with extremely limited equipment, often in cramped and unsuitable working conditions.

If the PPTA is to recommend improved and/or new infrastructure it will be essential that the funds to maintain and operate them are also available for a considerable period of time.

4 PROJECT DESCRIPTION

The location of the project proposals for all 3 towns are shown on **Figure 4-1**, **Figure 4-2** and **Figure 4-3**. The Design and Monitoring Framework for the projects is contained in **Appendix 1**.

Figure 4-1: Mawlamyine Project Locations

Figure 4-2: Hpa-An Project Locations

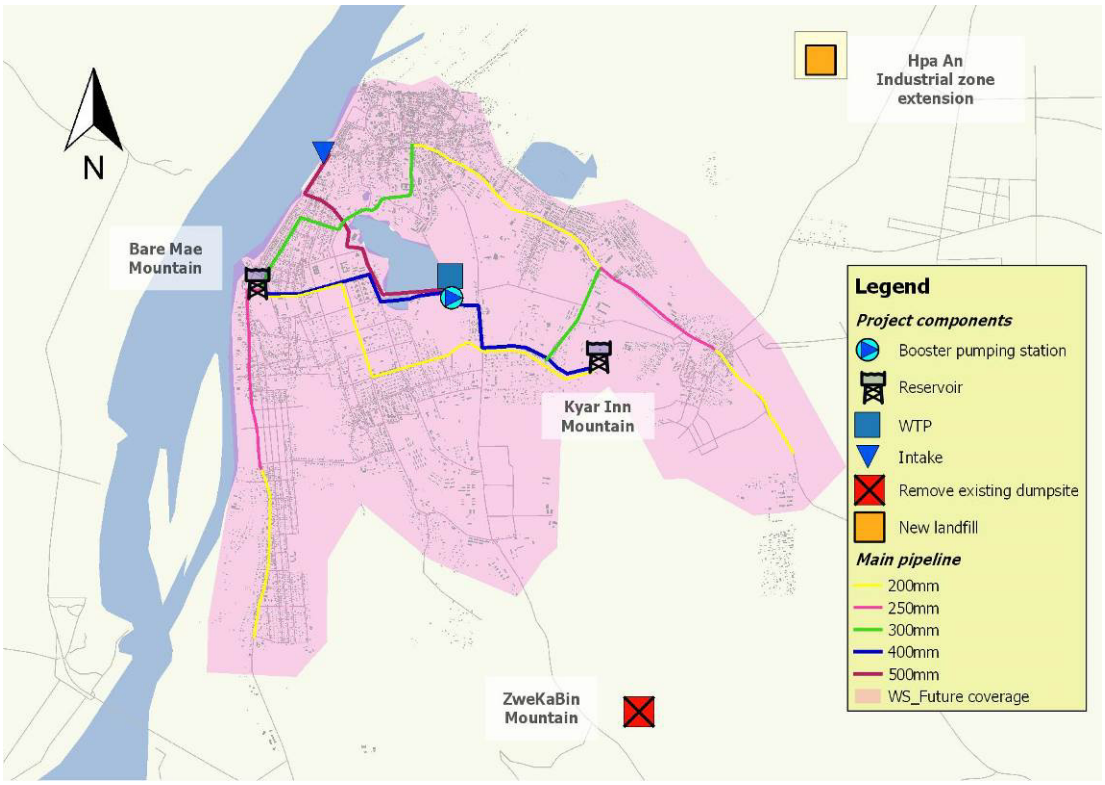
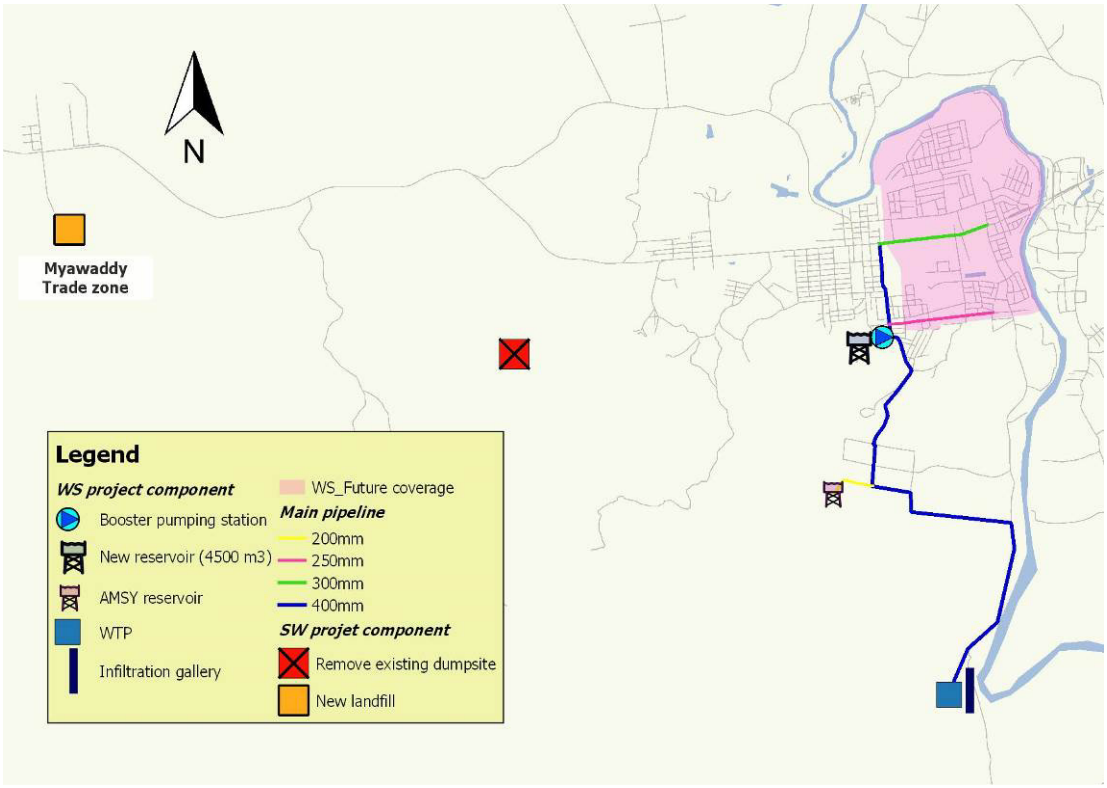


Figure 4-3: Myawaddy Project Locations



4.1 Water Supply

4.1.1 OBJECTIVES

This chapter provides the summary of technical feasibility of the proposed project and investment for water supply component in the cities of Mawlamyine, Hpa-An and Myawaddy. It includes a description of the existing contexts and challenges from which an overall strategy for different horizons has been developed. A stepwise strategy has been adopted for this project through an evolutive approach to face and solve existing issues together with futures challenges.

For every city, main objective is to enhance resilience and sustainability of the water supply system. Based on existing assets, the strategy is to improve the current system with a stepwise modernization and reinforcement of the capacities. From a technical point view the strategy is to build on existing system with reinforcement and rehabilitation of existing assets together with new infrastructure. Furthermore improvement of the system will only come with a specific capacity building plan focusing on people, and with a financial strategy leading toward long term sustainability and development. Participative approach and involvement of citizens in this process is a key aspect as part of public awareness strategy.

In order to improve the water supply system in each city, the main objectives are following:

- Secure water resources and improve quality, ensuring good water quality everywhere in the network from the production to the consumers' taps. Using existing assets and available resources, water will be treated in order to comply with WHO and upcoming national standards in terms of quality.
- Increase the coverage of the water supply system in the project areas together with the production, in accordance with targets specific to each city.
- Provide a good level of service to the population: continuous water service (24h/d and 7d/week) together with an appropriate monitoring system.
- Improve NRW Management together with the promotion of asset management and long term sustainability

4.1.2 MAWLAMYINE WATER SUPPLY

WATER RESOURCES

In terms of the existing public water supply, Mawlamyine is served by three distinct resources namely:

- Water from the KhinPonChong reservoir created in 1904 together with an old distribution system which is still supplying 24/7 water by gravity to the main storage reservoirs and thereafter distributing to parts of the city;
- A newer reservoir, ShweNatTaung reservoir which supplies by pumping to the main storage reservoirs (3 tanks of 500,000 gallons each) in the downtown area;
- Two water intakes from the Attran River, which shall be replaced in the future by one intake and associated treatment plant under a proposed PPP (via a Thai water company).

Inhabitants supplement these water resources via shallow groundwater (tubewells and wells), rainwater during rainy season and also via bottled water.

Existing information concerning the quality of these resources is extremely sparse. To supplement this the PPTA Consultant undertook a series of measurements during September 2015. The main findings of these surveys are summarised below:

- The KhinPonChong water resource presents interesting water quality with low organic pollution and turbidity in relation to the small size of the catchment and the absence of major pollution sources. Despite a low mineralization, all parameters are compatible for its use as drinking water after treatment. Similar conclusions apply to the ShweNatTaung dam water quality.
- The high salinity of tube well N°1 located along the Thanlwin river bank reflects the influence of the sea and the salinity of the water in the estuary. Turbidity and TSS values are high for underground resources, probably reflecting the inappropriate design of the tube wells or the fine sediment at the level of the pumping. All wells are contaminated, as a result of discharges from septic tanks representing the predominant sanitation system of Mawlamyine.
- Turbidity of the Attran river intakes is high and also there is evidence of salinity related to the proximity of these intakes to the Thanlwin estuary. The turbidity of water from Attran intakes 1 and 2 is reduced by sedimentation in ponds before reaching the households. This is the only purification process in Mawlamyine water supply system.

In terms of water resources option analysis the following different sources have been considered:

- Groundwater;
- Surface water dams and reservoirs;
- Surface water from the Attran River

With regard to groundwater, available information indicates that this is either polluted by septic tank effluents (shallow groundwater) or saline (deeper tubewells). Given also the limitation with respect to yield, existing resources should be discontinued.

Turning to possible dams/reservoirs, we have not considered the development of new dams/reservoirs but focused on identifying existing dams which could be eventually used for domestic water supply. Available hydrological information would indicated that the water resources of the ShweNatTaung are abundant and not limiting due to the large storage capacity and catchment basin. Resources in the KhinPonChong are likely to be more limited especially at the end of the dry season and also in relation to known leakages associated with this reservoir. Nevertheless, this resource is strategic due to its quality, elevation and location.

The current Attran intakes are close to the Thanlwin estuary. Studies undertaken by the PPTA Consultant indicate that these resources are highly likely to be saline in the short to medium term related to changes in the upstream hydrological regime (linked to operation of future dams) and also due to the sea level changes. In addition being located downstream of the main city, these intakes are subject to pollution from both wastewater systems and solid waste leachate discharges.

Finally, it has to be noticed that none of the resources has a protection plan for environmental protection purpose as well as preservation, to prevent from pollution or undesirable/illegal uses.

DIAGNOSTIC OF EXISTING WATER SUPPLY SYSTEM

The provision of urban environmental services in Mawlamyine Town is the responsibility of the Mawlamyine Town Development Committee (MTDC) which covers a service area of 28 wards with a total urban population of 253 734. The main conclusions regarding the water supply system in Mawlamyine as included in the complementary modelling report are described below.

KEY FIGURES

- ✓ Service area coverage : about 14 km²
- ✓ 26% of the population covered with piped water
- ✓ Unsteady functioning with intermittent supply for some areas
- ✓ About 50 000 people supplied with nearly 9 250 installed water meters
- ✓ 2 reservoirs : KhinPonChong and Shwe Nat Taung
- ✓ 2 Treatment plants and intakes on the Attran River
- ✓ Amount of supplied water : ~ 25 000 to 30 000 m3/d
- ✓ 107 Km pipe lines : -
  - ◆ Transmission& distribution mains: 16 km
  - ◆ Internal network :91 km
- ✓ 4 storage : RTC, 3 tanks Reservoir, SanayDine and SaTaNar
- ✓ 3 booster pumping stations : RTC, SanayDine and MyaingThaYar
- ✓ 10 000 m^3 storage => 8 to 10 hours autonomy of current production
- ✓ NRW : >80**%** (estimation including commercial losses)
- ✓ No treatment apart from sedimentation process

- Production & treatment: None of the existing facilities treat the water apart from natural sedimentation process. Hence, only raw water is distributed with regular presence of bacteria. The age of some facilities, limited capacity and lack of maintenance limit their use in the immediate future. The existing dams are a major asset since they benefit from a significant elevation and good water quality; water from the dam has the advantage to have a low turbidity throughout the year compared to the Attran river sources. Implementation of new production facilities able to treat water from these resources would enable to fulfil the short and medium term requirements for Mawlamyine considering the project area (southern part of the city). However, low mineralization of the water has been identified in KhinPonChong Dam. The adopted treatment process would need to consider this parameter in order to prevent the water supply system from possible damages due to aggressive water (possible deterioration of DI pipes, civil work… leading to leakages).
- Transmission & Storage: some transmission lines especially from KhinPonChong Dam, are in very bad condition due to their age (over 100 years) and material (cast iron). In addition, many of these lines are now under-sized in relation to

increasing demand of the service area. Hence, rehabilitation as well as strengthening shall be undertaken to ensure the transfer of future water production. Concerning the storage and focusing on the southern area in connection with the project's boundaries two reservoirs exist:

- RTC reservoir with a limited capacity, leakages and overflow as indicated by the measurement campaign. Accordingly, the rehabilitation of this key facility shall be considered, as well as the rehabilitation and resizing of the pumps.
- 3 tank reservoir is a strategic facility located close to the downtown area and functioning under gravity. Available storage capacity is considerable with 1.5 Mgal (~ 6 800m^3). However, due to its age (nearly 80 years old), the reservoir should be rehabilitated. Existing connexions appear to be also in bad conditions because of the age of the installation and lack of maintenance.

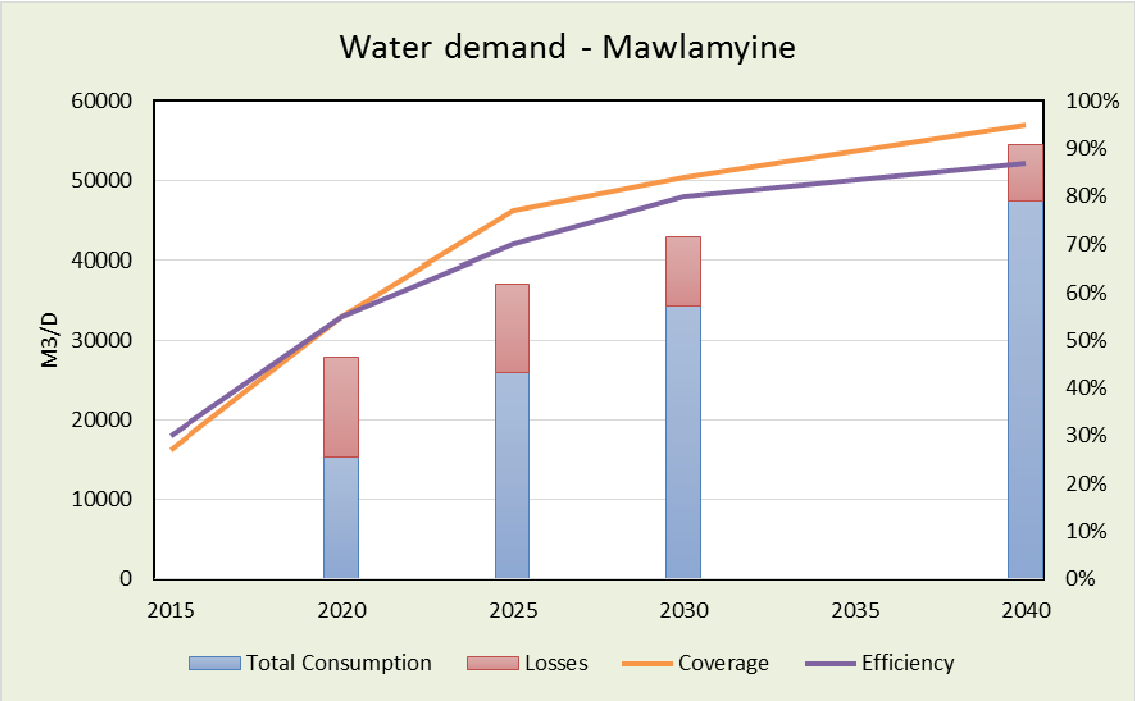
- Distribution: Existing distribution network represents a total length of nearly 90km with the oldest cast iron pipes laid almost 100 years ago in the downtown area. Presently, the number of connections estimated to be around 9 250, mainly equipped with Chinese water meters with questionable accuracy. The coverage for the urban area is quoted as only 27%. Clearly rehabilitation of the existing network is necessary together with improvement of service coverage.
- Operation and management: limited human and technical resources have been identified. As a consequence, a lack of planning is noticeable as well as the absence of NRW management. Indeed, both commercial and physical losses are high, with a total amount of NRW estimated at over 80%. In addition, limited capacity does not allow a sufficient maintenance and operating of the facilities.

FUTURE REQUIREMENTS & OBJECTIVES FOR WATER SUPPLY OF MAWLAMYINE

The requirements for future water supply provision are based upon the concept plans developed by DUHD and discussed in the overall FSR for Mon State in which the population is set to grow at around 2.0% per annum reaching almost 360,000 by 2025 and 485,000 by 2040.

On the basis of these plans and projections, water demand for future horizons up to 2040 has been estimated covering the urban area and surrounding villages. These projections indicate a requirement of approximately 37,000 m3/day for the urban area by 2025. This would increase to almost 55,000 m3/day in the long term (2040). The way that water consumption is planned to increase together with service coverage and overall system efficiency (reduction of physical losses) is shown in **Figure 4-4**.

Figure 4-4: Mawlamyine Water Supply and Demand to 2040



Looking at the entire city and as indicated above, water supply coverage from the TDC system is planned to increase from 27% to 77% in the short term (focusing firstly on the urban area) and up to 95% in the long term. Connections will increase to 47,000 by 2025 and 86,000 by 2040. Population served will increase to almost 235,000 in the short term and 430,000 in the long term considering the accessible villages surrounding the urban area to be connected in long term. In addition water supplies will all be treated and provided continuously (i.e. 24/7 supplies).

OTHER PROJECTS

- *JICA's project : Phases 1 and 2*

JICA's project is part of an overall JICA loan agreement with the Union of Myanmar covering several towns, including Mawlamyine. This project in Mawlamyine is proposed to include 2 phases. Further details and information on the project are provided in FSR for Mon State.

Aside from this water supply project, JICA is undertaking another project under a 1M First phase of the project consists in a 1M US$ loan which aims to increase the production capacity. This project is supposed to include two main components:

- Creation of a new production facility near ShweNatTaung dam which aims to produce nearly 3.12 Mgal/d (~ 14 000m3/d) using Slow Sand Filter Process. This project consists in intake structure from ShweNatTaung Dam, the WTP using slow sand filters and the associated storage.
- Implementation of a transmission line from RTC to 3 Tanks Reservoir: it is proposed to lay a 300mm pipe (PVC) between the two facilities.

In addition, a second phase is planned by JICA which is supposed to complement the functioning of ShweNatTaung system. The scope of work of the second phase is

currently under discussion between TDC, DUHD and JICA, and have not been approved yet and should include transmission from ShweNatTaung to RTC, improvement of RTC system and installation of water meters (5000 no.)

Consequently, the overall project would cover the entire system from SNT and provide up to 14 200m3/d to the western part of the city, including 3 tanks reservoir. While the review of the designs associated with these projects provided in the report indicates certain deficiencies, it is clear that the systems as a whole need to function together. A more detailed analysis is provided in the Regional report of Mon State.

The proposed ADB project described hereafter will need to function in a complementary manner to the one financed by JICA. The scope of works of the two projects has been studied in details to prevent from overlapping. In particular, ShweNatTaung system (production, storage and transmission) will be under JICA's project whereas ADB project will include the distribution (network and connections).

- *PPP project from Thai Tap Water Company*

A PPP project from Thai Tap Water Company is currently being studied. This projects aims to construct a new WTP in the North-Eastern part of the city and replace existing facilities Attran 1&2. The project area would cover the 11 northern wards of Mawlamyine.

The proposed project includes:

- Construction of a WTP using rapid sand filter process together with clarifiers and chlorination. Overall capacity is proposed to be 30 000m3/d with expandable structure to reach 40 000m3/d.
- Clear water tank (3000m3) and BPS at the WTP
- Main transmission and distribution lines
- Additional storage (2000m3) for the western area

Considering this PPP and under the current circumstances, it is assumed that the northern part of the city (wards 1 to 12) are covered by the PPP and is not part of the project area. Nevertheless, a note is proposed in the FSR for Mon State covering the eventuality where an agreement would not be reached and the PPP not push through.

OPTIONS ANALYSIS

The previous analysis confirmed the need for large increases in production capacity, treatment facilities (currently inexistent) and associated networks to improve service coverage in water supply together with improved operational and financial management.

As part of the interim report, two options were studied consisting of providing water supply from primarily the existing reservoirs and secondly from a combination of the reservoirs and the Attran resource. As a result of the different technico-economic analysis undertaken it was shown that separate systems for each service area was the most economic option.

In addition, during the Interim and Final phases of the assignment further details of two associated projects presented above have been obtained allowing to refine the

Project and ensure their consistency and complementarity. Consequently, it is proposed that JICA project will cover the entire production and transmission line from Shwe Nat Taung to 3 tanks reservoir, including RTC reservoir while PPP is supposed to cover the Northern part of the city (wards 1 to 12). Considering future water demand spatial distribution, implementation of both projects is necessary to fulfil the water need of the entire urban area.

Further analysis of the proposed project during the final phase of this assignment focused on the identification of an appropriate site for the intake and treatment plant and the preliminary design of the network facilities (including storage).

In accordance with resource analysis, SWOT analysis and previous conclusions detailed in the FSR Mon Report, it is proposed the creation of a new water treatment plant with a nominal capacity of 8 000m^3/d (16h/day functioning). Capacity has been set according to the hydrological analysis of KhinPonChong. This capacity will fulfill the water need within the dedicated area. It has to be noticed that rehabilitation of the dam is also part of the project, including measure to reduce water losses from the dam and optimize the storage.

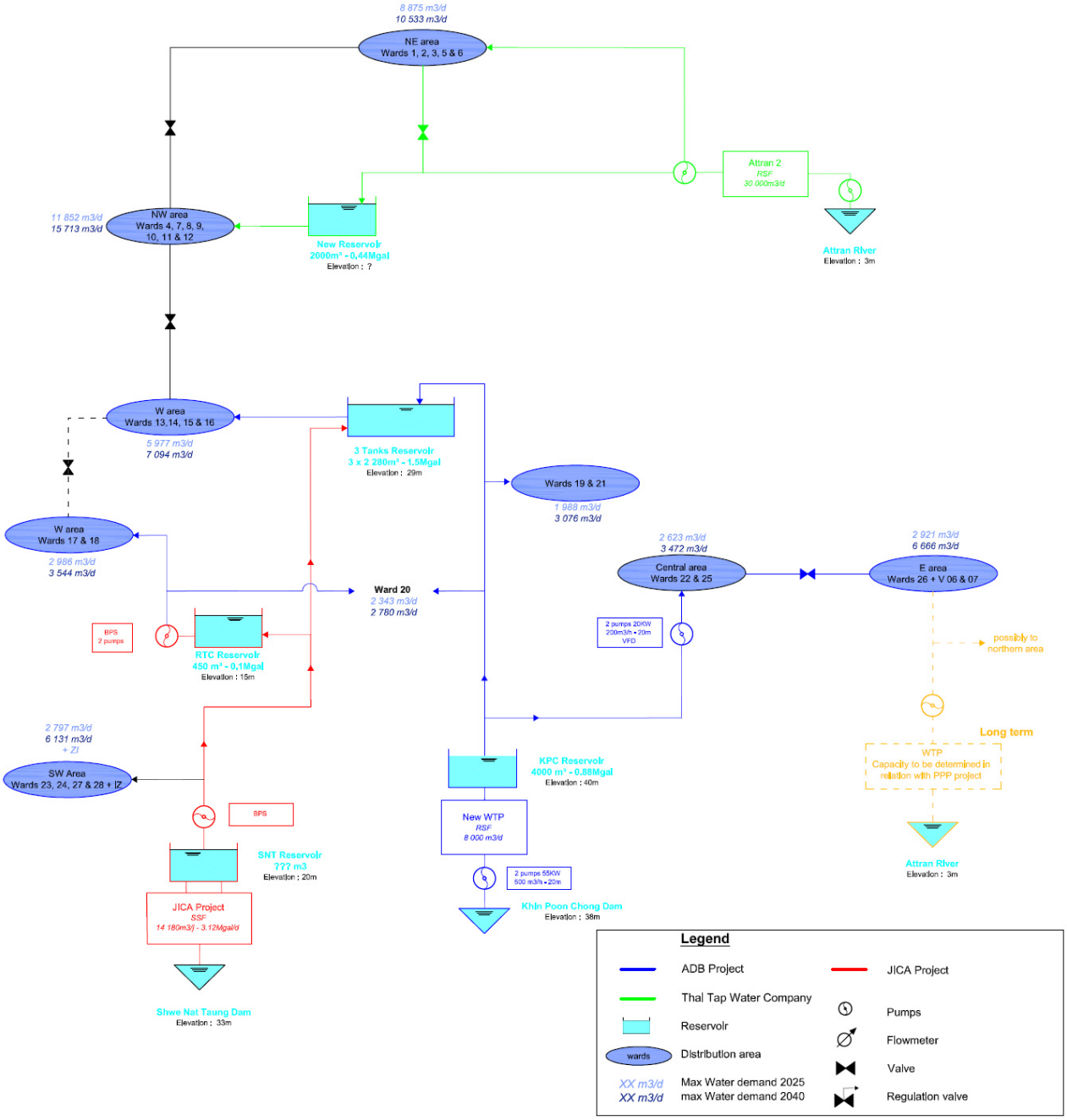
It is also proposed to upgrade the storage facilities in order to increase the autonomy of the system and to promote water supply under gravity thereby saving on operating cost. As an initial approach it is advised a minimum storage capacity of half day per distribution area or system. Consequently, sufficient storage shall be implemented at KhinPonChong. Besides, existing 3 tank reservoir presents a significant storage capacity with a strategic location allowing gravity distribution to the city center. It is proposed to keep the functioning of this key system which need to be secured and rehabilitated.

To distribute the treated water and extend the coverage, a large amount of pipe will have to be newly installed, whereas existing network will have to be rehabilitated and strengthened to ensure reliable supply in the covered areas. Installation of the internal distribution system remains in the scope of ADB project for the entire project area.

Apart from TTW area (outside project perimeter), 5 distribution areas can be identified, each of them can be easily metered as part of NRW strategy. Among them: two are only supplied from KhinPonChong, two others from ShweNatTaung whereas both resources can supply 3 tanks area. Looking at longer term and requirements, Eastern development zone and related distribution area can be identified in **Figure 4-5**, together with the work repartition.

In addition, reduction of NRW will be one of the focal point regarding both commercial and physical losses. The objective of the proposed action plan is tackle current high level of NRW and to counterbalance in long term the entropic tendency of the losses to increase. Alongside with infrastructure, capacity building and new methodologies shall be implemented to reduce commercial losses in particular regarding the customer management and billing activities. This component shall be supported by the use of modern tools, particularly software & support (GIS, customer&billing management software…).

Figure 4-5: Mawlamyine Schematic of Scheme



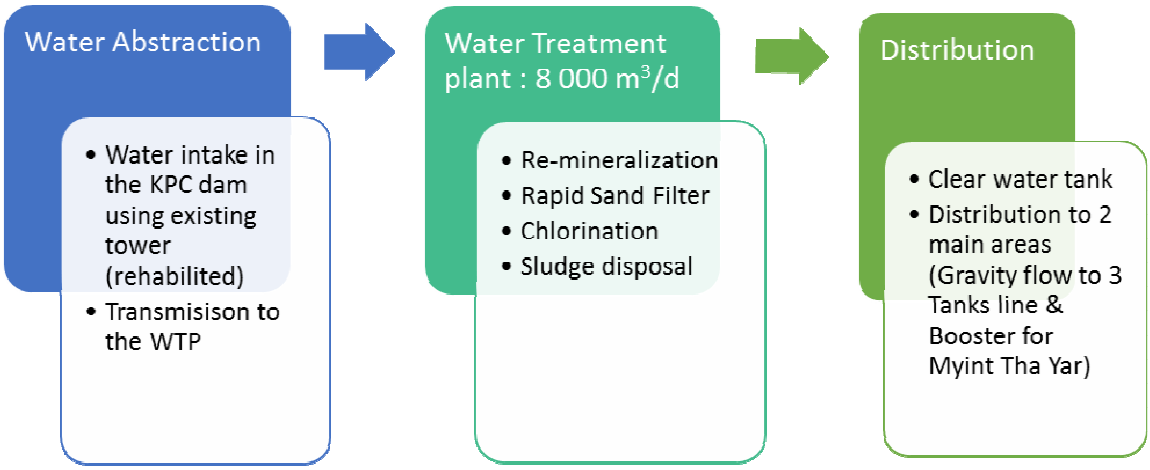
THE PROPOSED PROJECT

In line with previous objectives and strategy the proposed project consists of four major elements as depicted on Figure 4-7 and detailed in the FSR for Mon State:

- Production and treatment: Increase production capacity is a crucial component to cope with future water demand considering the urban growth. In order to achieve this objective in a sustainable and secured manner, it is proposed to optimize and upgrade existing resources by treating the water thanks to a new water treatment plant at Kin Pong Chong together with the rehabilitation of the reservoir. Based on rapid sand filtration, the treatment plant would have an

overall capacity of 8,000 m3/day. This capacity will fulfil the water need within the dedicated area (average daily need).

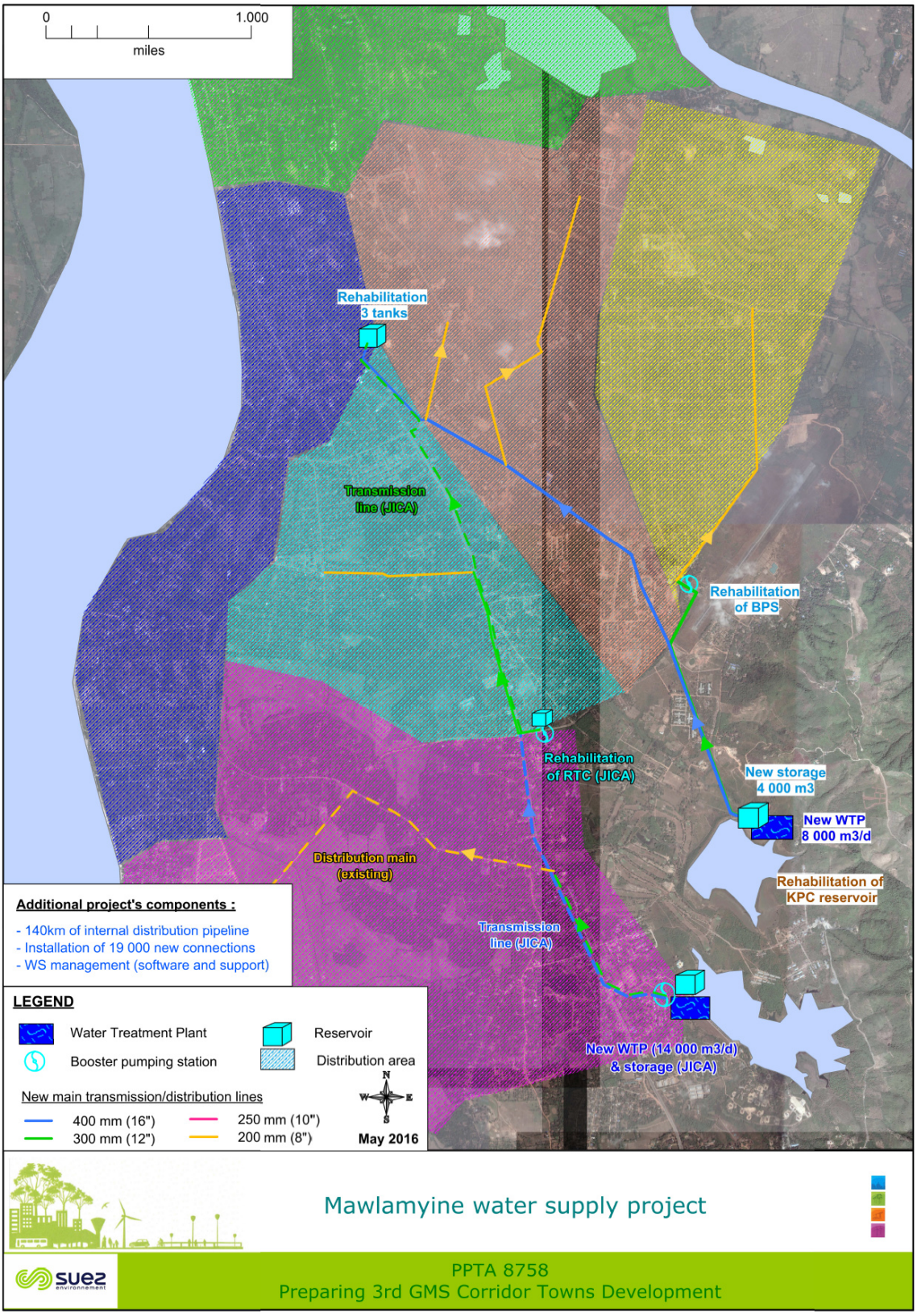
Figure 4-6: Mawlamyine KhinPonChong system



- Storage: treated water storage capacity needs to be increased. It is hence proposed the creation of new storage facilities at KhinPonChong (4000 m^3 capacity) alongside the WTP, from which water will be supplied to the distribution area. It is also proposed the rehabilitation of the existing key storage facility of 3 Tanks reservoir which capacity is sufficient but requires to be upgraded and secured.
- Distribution: To distribute treated water and increase water coverage, a large amount of pipeline will be newly installed. The network is organized and structured based on the main distribution lines from which some need to be strengthened or replaced. The outline designs of the proposed networks have been analyzed using hydraulic modeling techniques. The results demonstrate that maximum velocities and pressures are acceptable for both the short and long term requirements. Consequently, almost 13 km of transmission lines and main networks (200 to 400mm) and 140.2 km of distribution system (including tertiary networks < 100 mm) are proposed, together with the rehabilitation of the existing network. The project would also include a fund to finance approximately 19 000 new connections.
- Improved Operation & Management covering asset management, GIS, billing and customer management, NRW control. A full NRW strategy is hence proposed and detailed in the FSR for Mon State These latter aspects will be procured as part of

The following map presents the proposed system including WTP and transmission/distribution lines.

Figure 4-7: Mawlamyine Location of WTP and main distribution lines



PROJECT COSTINGS

The following table summarizes the overall base cost estimate for the Mawlamyine water supply project described above. Capital expenditures have been divided between: Construction (civil work), main supplies (electrical & mechanical) and others; according to 5 categories. Details of the calculation together with operational expenditures are presented in the FSR for Mon State.

These costs do not include physical and price contingency, nor operation costs which have been estimated separately. In addition, it should be noted that these costs are subject to revision during the detailed design, especially in the absence of detailed investigations on KhinPonChong dam, the estimated costs remain approximate. Total Physical Cost has been calculated at 22.7 million USD consistent with previous estimations at the Interim Phase. Adding other engineering costs (including supervision) would bring the Base Cost of the component to nearly 24.3 million USD.

Table 4-1: Mawlamyine Water Supply Proposed Investment Program

INVESTMENT PROGRAM			MAWLAMYINE Water Supply			
			Cost estimate			
ID	*Item*	*Description*	*Civil (USD)*	*E&M (USD)*	*Other (USD)*	*TOTAL (USD)*
1.0	PRODUCTION					
	Rehabilitation of KPC Dam		4 000 000.00			4 000 000.00
	Intake (2pumps)			150 000.00		150 000.00
	Transmission lines to WTP		51 900.00			51 900.00
	WTP KPC - RSF (500m3/h - 8 000m3/d)		720 000.00	1 080 000.00		1 800 000.00
2.0	STORAGE					
	Construction of new reservoir at KPC (4000m3)		500 000.00			500 000.00
	BPS Myaing Tha Yar			100 000.00		100 000.00
	Rehabilitation of 3 tanks Reservoir		150 000.00			150 000.00
	Pipeline connections, equipments & flowmeters - 3 Tank reservoir			50 000.00		50 000.00
3.0	MAIN DISTRIBUTION LINES					
	DN400		892 680.00			892 680.00
	DN300		303 280.00			303 280.00
	DN200		523 580.00			523 580.00
4.0	DISTRIBUTION NETWORK					
	DN200		658 752.00			658 752.00
	DN150		2 242 560.00			2 242 560.00
	DN100		3 433 920.00			3 433 920.00
	Tertiary (<100mm)		2 803 200.00			2 803 200.00
	Connections		2 874 000.00			2 874 000.00
5.0	OTHERS					
	Renewing existing pipeline		1 992 000.00			1 992 000.00
	Leakage detection equipment			30 000.00		30 000.00
	Software and support - WS Management				100 000.00	100 000.00
TOTAL PHYSICAL COST			**21 145 872.00**	**1 410 000.00**	**100 000.00**	**22 655 872.00**
	ENGINEERING AND SUPERVISION					
a)	Engineering and management overheads	5% Total physical cost			1 132 793.60	1 132 793.60
b)	Construction supervision - Civil	2.50% of Civil Physical Works			528 646.80	528 646.80
	Construction supervision - M&E	1% of M&E Works			14 100.00	14 100.00
	sub total					**1 675 540.40**
BASE COST						**24 331 412.40**

Remark: at this stage, connection cost has been fully included in the investment. Nevertheless, it is suggested to consider a social strategy involving public participation in line with the willingness to connect.

PROJECT IMPLEMENTATION PLAN & CONTRACTING STRATEGY

An implementation schedule has been provided in the Preliminary Design Report as shown in **Table 4-2**. Overall project implementation would commence in 2017 with the first year covering design and tendering of this component. Construction of the physical works would take place from 2018 to 2022 inclusive (5 years). It is envisaged that the majority of the works will be implemented as part of a DBO contract with an operation phase 3.15 million USD based on a preliminary design

and associated surveys undertaken by the Project Implementation Consultant. Rehabilitation of the KhinPonChong dam however would be undertaken following a standard civil works package following detailed design/geotechnical investigations.

Table 4-2: Mawlamyine Implementation Schedule

IMPLEMENTATION PLAN		MAWLAMYINE Water Supply							
		YEAR							
ID	Item	2017	2018	2019	2020	2021	2022	2023	Total
1.0	PRODUCTION								
	Rehabilitation of KPC Dam		25%	25%	25%	25%			100%
	Intake (2pumps)		50%	50%					100%
	Transmission lines to WTP		50%	50%					100%
	WTP KPC - RSF (500m3/h - 8 000m3/d)		50%	50%					100%
2.0	STORAGE								
	Construction of new reservoir at KPC (4000m3)		50%	50%					100%
	BPS Myaing Tha Yar		50%	50%					100%
	Rehabilitation of 3 tanks Reservoir		50%	50%					100%
	Pipeline connections, equipments & flowmeters - 3 Tank reservoir		50%	50%					100%
3.0	MAIN DISTRIBUTION LINES								
	DN400		25%	25%	25%	25%			100%
	DN300		25%	25%	25%	25%			100%
	DN200		25%	25%	25%	25%			100%
4.0	DISTRIBUTION NETWORK								
	DN200		25%	25%	25%	25%			100%
	DN150		25%	25%	25%	25%			100%
	DN100		25%	25%	25%	25%			100%
	Tertiary (<100mm)		25%	25%	25%	25%			100%
	Connections		20%	20%	20%	20%	20%		100%
5.0	OTHERS								
	Renewing existing pipeline			50%	50%				100%
	Leakage detection equipment		100%						100%
	Software and support - WS Management		100%						100%
6.0	LAND & RESETTLEMENT								
	Land & resettlement	50%	50%						100%
7.0	ENGINEERING AND SUPERVISION								
	Engineering and management	30%	20%	10%	10%	10%	10%	10%	100%

4.1.3 HPA-AN WATER SUPPLY

WATER RESOURCES

Due to the limited coverage of public network, most inhabitants get water supply from shallow groundwater (tubewells and wells), rainwater during rainy season and also via bottled water. In terms of the existing public water supply, Hpa-An system is served predominantly from untreated surface water complemented with a dozen of small tubewells. While it can be appreciated that the existing data is rather limited a number of observations can be made particularly in relation to the water quality analysis of the different resources.

- Thanlwin: as a raw water source, Thanlwin River presents acceptable quality despite a high level of turbidity / suspended solids registered during the monsoon season. Location of Hpa-An, 40km upstream the estuary, prevents from intrusion of salty water despite tide influence on water level.
- Of the existing tube wells, only the tubewells located along the Thanlwin River would appear to have a reasonable yield (of the order of 450 m3/day); other tubewells located further away from the Thanlwin have much lower yields.
- The tubewells located close to the Thanlwin (pumped to the storage reservoirs on the Bare Mae hill) have high Iron, Suspended Solids/Turbidity and bacterial pollution. These results show limited filtration of pollutants in relation to the Thanlwin River water resource and suggest that these resources should be treated prior to distribution.

- In general other tubewells have lower levels of pollution although as would be expected bacterial pollution, ammonia and suspended solids are all above WHO/draft Myanmar standards indicative of pollution from wastewater. These indications and the relative low yield would suggest that these are no longer suitable as long term water resources. In addition, with the expansion of the city all shallow private and public tubewells should be discontinued in the absence of any wastewater collection system.

There remains thereafter the possible resources of

- Deep groundwater;
- Surface water dams and reservoirs;
- Surface water from the Thanlwin River

With regard to deep groundwater, we have no data nor water quality measurements. However, it can be generally appreciated as per similar deep groundwater resources in deltaic regions of South and South East Asia, that there is a risk or Arsenic pollution and we have therefore not considered further this resource for Hpa-An.

Turning to possible dams/reservoirs, given the current difficulty of land acquisition and the extreme sensitivity of this issue with regard to the Karen population, we have not considered the development of new dams/reservoirs but focused on identifying existing irrigation dams which could be eventually used for domestic water supply. Following an inventory of the existing sites, the only reservoir nearby (Yae Boke irrigation dam) would not be an acceptable solution and would require considerable pumping. However, in the future and with a continued long term ceasefire, the development of new storage reservoirs would be a preferred long term option.

Finally, surface water from the Thanlwin River remains the most suitable solution for the short and medium term but would require an effective treatment system to provide good quality water. Quality analysis indicates that an effective filtration is necessary to reduce turbidity to suitable level (<5 NFU), while coagulation process should reduce cadmium concentration. In addition, it has to be noticed that water level is strongly impacted by the season and presents important variations throughout the year with impact of tidal water.as well.

DIAGNOSTIC OF EXISTING WATER SUPPLY SYSTEM

KEY FIGURES OF THE SYSTEM

- ✓ Service area coverage : nearly 4 km²
- ✓ 11% of the population covered with piped water
- ✓ Unsteady functioning with intermittent supply
- ✓ About 8 000 people supplied with nearly 1 150 installed water meters
- ✓ 70% of the production from river surface water with 4 river intakes
- ✓ 30% of the production from groundwater with a dozen of small tubewells
- ✓ Amount of abstracted water : ~ 5 000 m^3/d
- ✓ 35 km pipe lines :
  - Transmission mains: 2.7 km
  - Distribution network :34.7 km including 18.1mk of tertiary (< 100mm)
- ✓ 1 main storage at Bare Mae equipped with 5 different tanks
- ✓ Several small scale independent systems across the city (river intake or tubewells, storage and distribution network)
- ✓ NRW : >70**%** and likely to be up to 98% (estimation including commercial losses)
- ✓ No treatment

The public water supply system of Hpa-An comprises a central sub-system (the Bare Mae system) with one main storage facility and related distribution network (1 river intake, 2 tubewells and 5 tanks). Other facilities are small independent systems relying on river intakes or tubewells. With regard to these systems the following remarks have been made:

- Production & treatment: water resources are various with 3 small river intakes (among which one is supplying its own system) and several small tubewells (≤150mm) most of which are out of service. None of existing facilities include treatment (not even disinfection). Hence, only raw water is distributed with regular presence of bacteria and sometimes very high turbidity. The age of some facilities, limited production and lack of maintenance limit the use of existing facilities for future water supply. In addition, the existing capacity is insufficient to cover future water demand. Implementation of a central production system able to treat raw water especially during the monsoon season and fulfill the water needs for the medium and long term is a clear requirement.
- Storage: Currently, main storage facilities consists of Bare Mae reservoirs, composed of 5 tanks for an overall capacity of 0.52 Mgal (i.e. 2 300m3), since other smaller tanks remains secondary (≤ 220m3). However, among the 5 tanks, 3 of them are in poor condition with presence of leakages due to the age of the civil work (nearly 50 and 40 years old) and absence of maintenance. Furthermore, existing capacity appear to be insufficient looking at future water demand. Nonetheless, the location of this facility is strategic as it stands on a

high elevation point within the urban area. The possibility to rehabilitate/renew this facility should be considered. Apart from this storage, a lack of main storage is noticeable in the Eastern part of the city, where urban development is undergoing. Implementation of a storage facility would appear necessary while increasing the coverage.

- Distribution: Under existing conditions, the absence of a structural network or main distribution lines is noticeable since no distribution pipeline exceed 150mm in the entire network. The existing distribution network represents a total length of nearly 30km with the oldest pipes laid in the 60s - 70s; the number of connections estimated to be around 1150, mainly equipped with Chinese water-meters of which accuracy seem questionable. The coverage for the urban area is around 10.5%. Not only is there a need to increase the service coverage, but also to secure, strengthen and re-organize the distribution system according to the future water demand.
- Operation and Management: Hpa-An has limited human and technical resources at the township level with only 21 staff primarily involved in water supply (many of which appear to have other engineering functions). There is a lack of planning, poor overall maintenance of facilities and an equally poor or quasi inexistent commercial management. This is reflected in the high levels of NRW covering both commercial and physical losses probably in excess of 70%. Undoubtedly, capacity building and strengthening of the water supply utility is crucial.

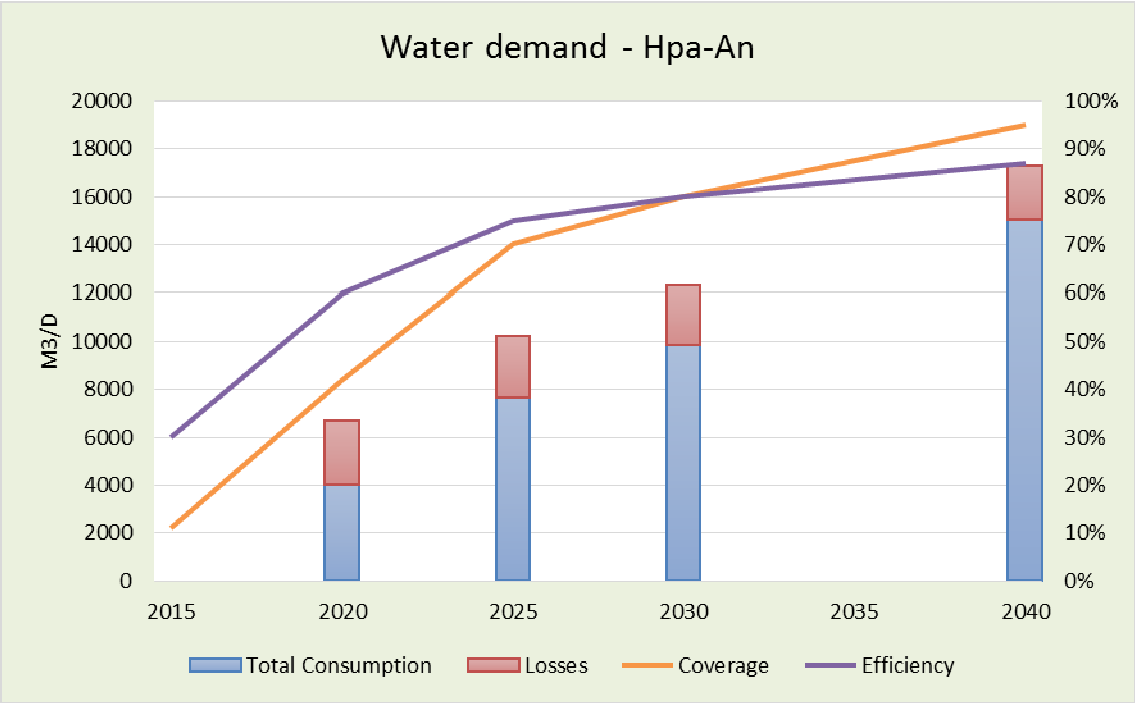
FUTURE REQUIREMENTS FOR WATER SUPPLY OF HPA-AN

The requirements for future water supply provision are based upon the concept plans developed by DUHD and discussed in the overall FSR for Kayin State in which the population is set to grow at around 2.5% per annum reaching almost 100,000 by 2025 and 143,880 by 2040.

On the basis of these plans and projections, water demand for future horizons up to 2040 has been estimated covering the urban area and the industrial zone. These projections indicate a requirement of approximately 10,000 m3/day for the urban area and up to 5,000 m3/day for the HIZ by 2025. These would increase to 17,000 m3/day and 15,000 m3/day in the long term respectively (2040). The estimates for the HIZ clearly depend on the rate at which enterprises access the zone and the nature of the industries which are largely unknown at this stage.

The way that water consumption is planned to increase together with service coverage and overall system efficiency (reduction of physical losses) is shown in **Figure 4-8**, focusing on the urban area.

Figure 4-8: Hpa-An Water Supply and Demand to 2040



As indicated above water supply coverage from the TDC system is planned to increase from 11% to 70% in the short term (via the Project) and up to 95% in the long term. Connections will increase from 1150 to almost 14 000 by 2025 and almost 27,000 by 2040. Population served will increase from under 10,000 to almost 70,000 in the short term and 140,000 in the long term. In accordance with objectives of the project, produced water will comply with quality objectives and will be distributed continuously (i.e. 24/7 supply).

OTHER PROJECTS

- *JICA's project : Phases 1 and 2*

Apart from this project, JICA is financing a water supply project in Hpa-An which is part of an overall JICA grant to the Union of Myanmar covering several towns. According to the available data, this project includes two main components:

- Creation of a new production facility on Bare Mae Hill which aims to produce nearly 1 Mgal/d (~ 4 5000m^3/d) using Slow Sand Filter Process. Water resources are both river water (new intake structure) and existing tubewells.
- Implementation of an independent water supply system North-East of the city (Hla Ka Myin quarter) for an overall production of 900m3/d.

While a technical review of the designs associated with these projects provided in the FSR for Kayin State indicates certain deficiencies, it is clear that the systems as a whole need to function together. It is noted that the use of slow sand filters (SSFs) is questionable regarding the high levels of turbidity measured on the Thanlwin River and cannot therefore provide high water quality to domestic and

commercial/industrial customers.A more detailed analysis is provided in the Regional report of Kayin State.

In addition, a second phase is planned by JICA and preliminary scope, which has not been approved yet, appears to be overlapping with ADB's project through the construction of a new WTP (using slow sand filtration) and associated distribution system to cover the city. Both projects will need to be consistent and work in a complementary manner.

- *Hpa-An Industrial Zone*

Water Supply Project for the Hpa-An Industrial Zone (IZ) is known to be financed by the Union Government. However few details of the project and arrangement are available at this stage.

OPTIONS ANALYSIS

The previous analysis confirmed the need for large increases in production capacity, treatment facilities (currently inexistent) and associated distribution system and networks to improve service coverage in water supply together with improved operational and financial management.

As part of the interim report, two options were studied consisting of providing water supply from a unique source for both the urban area and the HIZ and secondly from two different sources. As a result of the different technico-economic analysis undertaken it was shown that separate systems for each service area was the most economic option, given the large distance of the IZ from the urban area itself. In addition development trend of the Industrial zone, related water needs and time frame remain uncertain.

In addition, during the Interim and Final phases of the assignment further details of the other water supply projects in Hpa-An have been obtained, allowing to refine and adapt the Project consequently.

Given the latter project, the conclusion to consider separately the urban area and the HIZ was confirmed by the KSG during presentation of the Interim Report. It was also decided given the relative small size of the JICA project, to ensure that the project proposed as part of the PPTA could be stand-alone and not linked to the former.

In accordance with resource analysis, SWOT analysis and previous conclusions detailed in the FSR for Kayin State, the proposed strategy to supply the urban area consists in developing a new centralized water supply system using surface water from the Thanlwin River. Abstracted water will need to be treated using a new water treatment plant able to produce suitable amount of water in line with quality standards objectives (WHO), prior to storage and distribution. Accordingly, it is suggested that existing small independent systems should be progressively decommissioned while developing a new main distribution system.

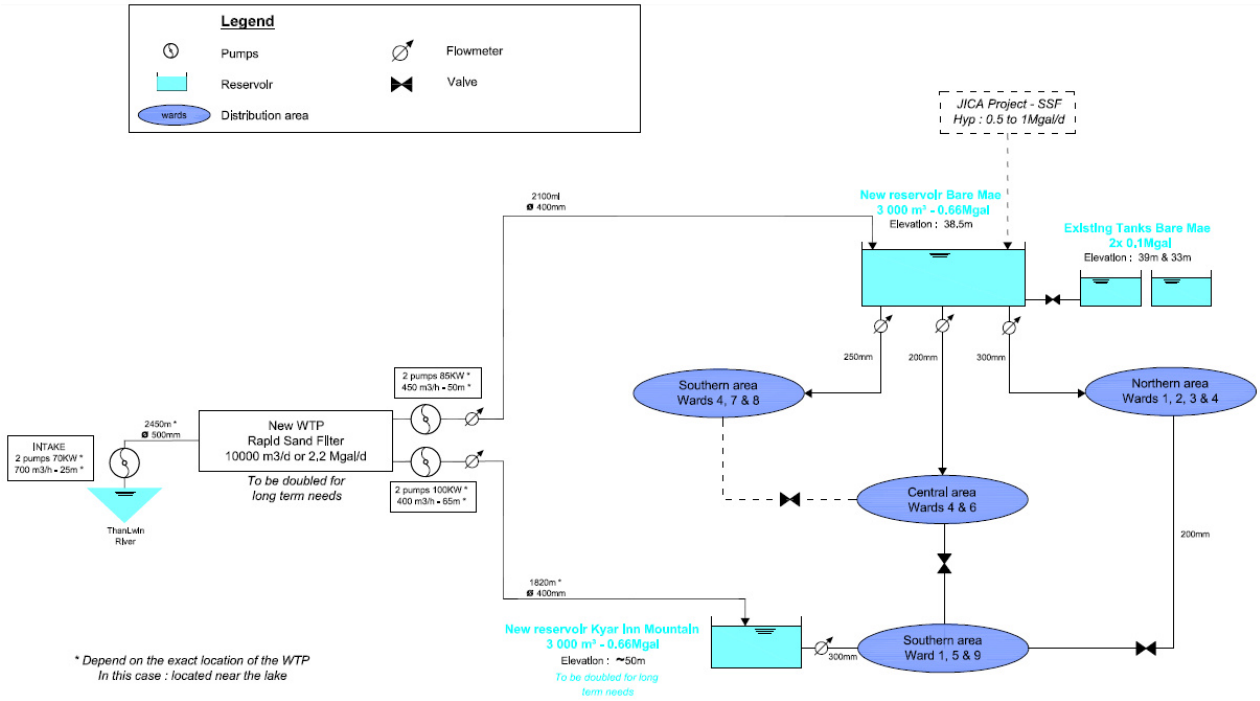
Further analysis of the proposed project during the final phase of this assignment focused on the identification of an appropriate site for the intake and treatment plant and the preliminary design of the network facilities (including storage). Three scenarios were considered for the location of the intake and treatment plant site:

- Scenario 1: Intake and WTP near /on Bare Mae Hill (or replacing JICA project)

- Scenario 2A: Intake to the south of the city with a WTP near to Thanlwin bridge;
- Scenario 2B: Intake located to the north of the city with a WTP near Kanthar Lake (several locations have been proposed).

Of these different options, **Scenario 2B** was selected so as to enhance technical functioning, minimize land acquisition and resettlement costs), to be as far upstream as possible to avoid near bank pollutant discharges (existing and future) and finally to be completely separate from the proposed JICA project. A schematic of Scenario 2 is provided in **Figure 4-9**.

Figure 4-9: Hpa-An Schematic of Scenario 2

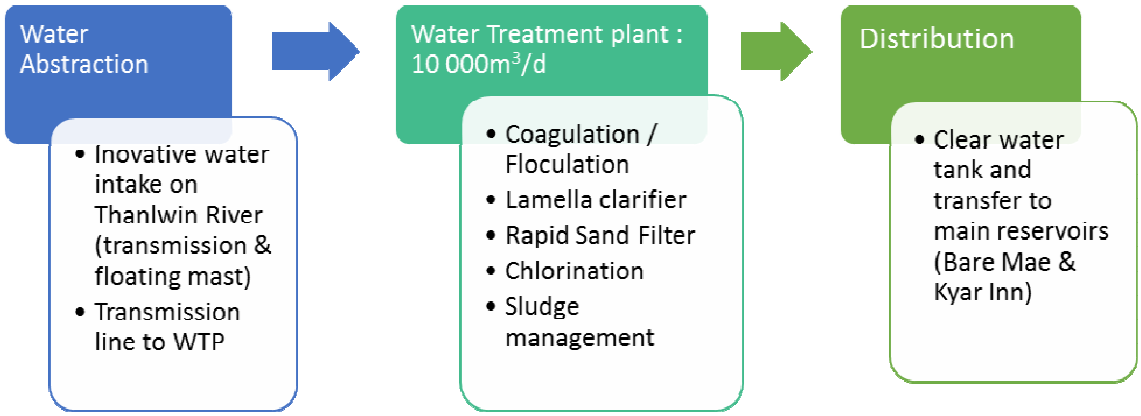


HPA-AN THE PROPOSED PROJECT

In line with previous objectives and strategy the proposed project consists of four major elements as depicted on the plan overleaf and detailed in the FSR for Kayin State:

- Production and treatment: Creation of a new intake and new treatment plant (located near to Kanthar lake): the treatment plant would have an initial capacity of 10,000 m3/day (to be financed under this project) with the possibility to expand to 18,000 m3/day in a second phase to cope with long term requirements. The process would include coagulation/flocculation, rapid sand filtration, disinfection and sludge treatment as illustrated **Figure** 4-10. Using transfer and floating masts, the proposed intake is a permanent structure innovative and adapted to the site, able to abstract water from the top layer (lower turbidity).

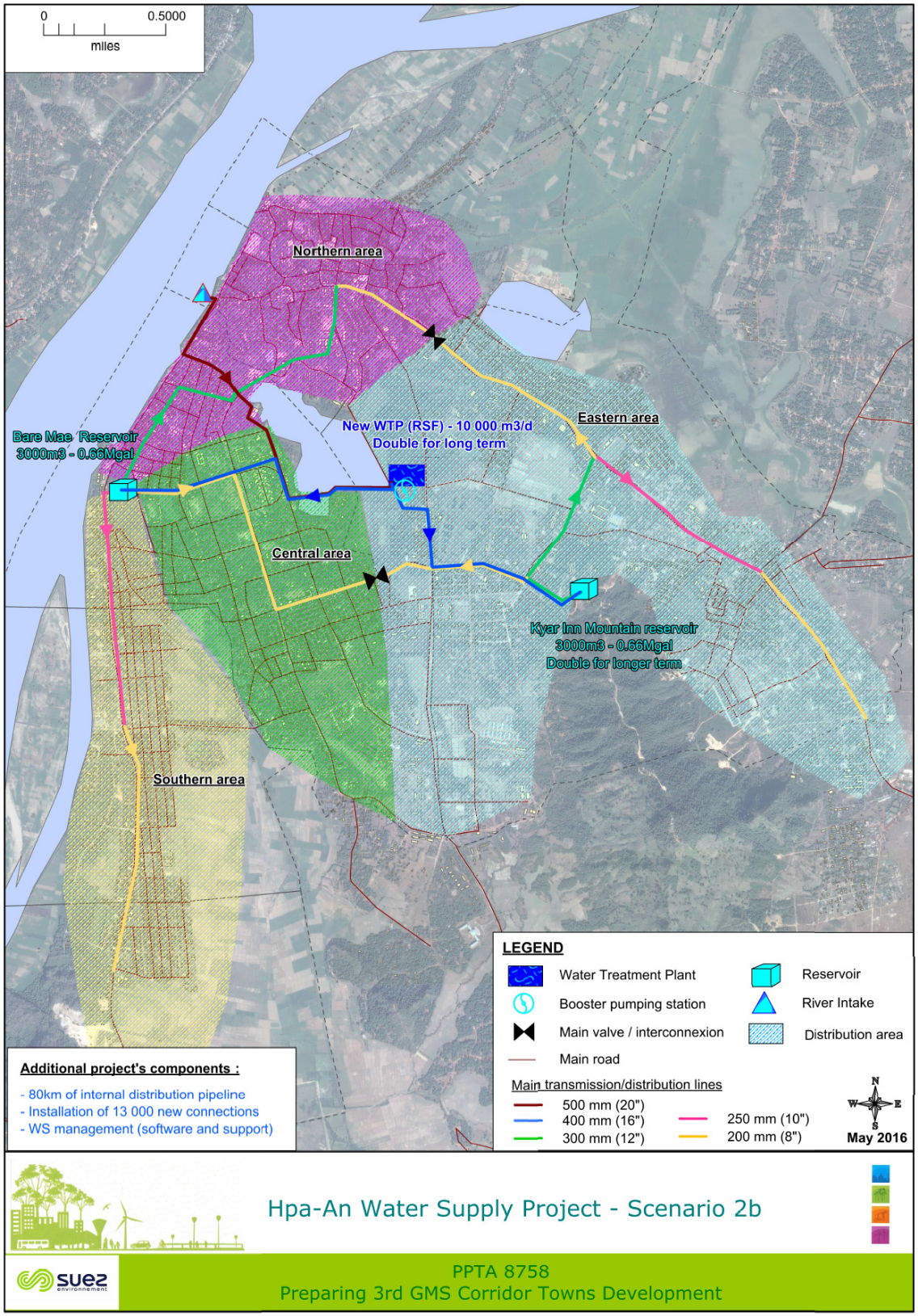
Figure 4-10: Hpa-An Elements of Scenario 2B



- Storage: Increase water storage capacity (half day autonomy), with the strategy to develop two main storages, Eastern and Western part of the city, together with specific distribution areas. The Project includes the rehabilitation and extension of the storage facilities at Bare Mae reservoir with replacement of oldest tanks with a 3000 m^3 reservoir, and creation of a new storage facility at Kyar Inn Mountain (3000 m^3);
- Distribution: To distribute treated water and increase water coverage, a large amount of pipeline will be newly installed: 21.5 km of transmission lines and main networks (diameters from 200-400 mm) and 79.1 km of distribution network (including tertiary networks <100 mm). Distribution system is organized according district metering areas (DMAs) and sized for long term requirements using modelling tools. Existing connections will be renewed and part of the existing distribution system replaced/strengthened. The project would also include a fund to finance over 10 000 new connections.
- Improved Operation & Management covering asset management, GIS, billing and customer management, NRW control. A full NRW strategy is hence proposed and detailed in the FSR for Kayin State. These latter aspects will be procured as part of a management contract.

The outline designs of the proposed networks have been analyzed using hydraulic modeling techniques. The results demonstrate that maximum velocities and pressures are acceptable for both the short and long term requirements. A map of the proposed system including WTP and transmission lines is shown on **Figure 4-11**.

Figure 4-11: Hpa-An Location of WTP and Transmission Lines



HPA-AN PROJECT COSTINGS

The following **Table 4-3** summarizes the overall base cost estimate for the Hpa-An water supply project described above. Capital expenditures have been divided between: Construction (civil work), main supplies (electrical & mechanical) and others; according to 5 categories. Details of the calculation together with operational expenditures are presented in the FSR for Kayin State.

These costs do not include physical and price contingency, nor operation costs which have been estimated separately. In addition, it should be noted that these costs are subject to revision during the detailed design together with the acquisition of additional data. Total Physical Cost has been calculated at 16.3 million USD consistent with previous estimations at the Interim Phase. Adding other engineering costs (including supervision) would bring the Base Cost of the component to nearly 17.4 million USD

Table 4-3: Hpa-An Water Supply Proposed Investment Program

INVESTMENT PROGRAM			HPA-AN Water Supply			
			Cost estimate			
ID	*Item*	*Description*	*Civil (USD)*	*E&M (USD)*	*Other (USD)*	*TOTAL (USD)*
1.0	PRODUCTION					
	Water intake		400 000.00	200 000.00		600 000.00
	Transmission line		563 500.00			563 500.00
	WTP - RSF (650m3/h - 10 000m3/d)		1 400 000.00	2 100 000.00		3 500 000.00
	Main transmission lines to storages		678 160.00			678 160.00
2.0	STORAGE					
	Destruction of 3 existing tanks (Bare Mae)		100 000.00			100 000.00
	Construction of a new reservoir 3000m3 (Bare Mae)		375 000.00			375 000.00
	Pipeline connections, equipments and flowmeters (Bare Mae)			30 000.00		30 000.00
	Construction of a new reservoir 3000m3 (Kyar Inn)		375 000.00			375 000.00
	Pipeline connections, equipments and flowmeters (Kyar Inn)			15 000.00		15 000.00
3.0	MAIN DISTRIBUTION LINES					
	DN300		444 720.00			444 720.00
	DN250		380 000.00			380 000.00
	DN200		825 320.00			825 320.00
4.0	DISTRIBUTION NETWORK					
	DN150		1 266 400.00			1 266 400.00
	DN100		1 939 000.00			1 939 000.00
	Tertiary (<100mm)		1 780 000.00			1 780 000.00
	Connections		1 919 700.00			1 919 700.00
5.0	OTHERS					
	Regulation system		15 000.00	15 000.00		30 000.00
	Renewal existing connections		172 500.00			172 500.00
	Renewing existing pipeline		1 136 240.00			1 136 240.00
	Leakage detection equipment			20 000.00		20 000.00
	Software and support - WS Management				100 000.00	100 000.00
TOTAL PHYSICAL COST			**13 770 540.00**	**2 380 000.00**	**100 000.00**	**16 250 540.00**
	ENGINEERING AND SUPERVISION					
a)	Engineering and management overheads	5% Total physical cost			812 527.00	812 527.00
b)	Construction supervision - Civil	2.50% of Civil Physical Works			344 263.50	344 263.50
	Construction supervision - M&E	1% of M&E Works			23 800.00	23 800.00
	sub total					**1 180 590.50**
BASE COST						**17 431 130.50**

Remark: at this stage, connection cost has been fully included in the investment. Nevertheless, it is suggested to consider a social strategy involving public participation in line with the willingness to connect.

HPA-AN PROJECT IMPLEMENTATION PLAN & CONTRACTING STRATEGY

An implementation schedule has been provided in the Preliminary Design Report as shown in **Table 4-4**. Overall project implementation would commence in 2017 with the first year covering design and tendering of this component. Construction of the physical works would take place from 2018 to 2022 inclusive (5 years). It is envisaged that the works will be implemented as part of a DBO contract with an operation phase 2.6 million USD based on a preliminary design and associated surveys undertaken by the Project Implementation Consultant.

Table 4-4: Hpa-An Implementation Schedule

IMPLEMENTATION PLAN		HPA-AN Water Supply							
		YEAR							
ID	Item	2017	2018	2019	2020	2021	2022	2023	Total
1.0	PRODUCTION								
	Water intake		100%						100%
	Transmission line		100%						100%
	WTP - RSF (650m3/h - 10 000m3/d)		50%	50%					100%
	Main transmission lines to storages			100%					100%
2.0	STORAGE								
	Destruction of 3 existing tanks (Bare Mae)		100%						100%
	Construction of a new reservoir 3000m3 (Bare Mae)		50%	50%					100%
	Pipeline connections, equipments and flowmeters (Bare Mae)		50%	50%					100%
	Construction of a new reservoir 3000m3 (Kyar Inn)		50%	50%					100%
	Pipeline connections, equipments and flowmeters (Kyar Inn)		50%	50%					100%
3.0	MAIN DISTRIBUTION LINES								
	DN300		25%	25%	25%	25%			100%
	DN250		25%	25%	25%	25%			100%
	DN200		25%	25%	25%	25%			100%
4.0	DISTRIBUTION NETWORK								
	DN150		25%	25%	25%	25%			100%
	DN100		25%	25%	25%	25%			100%
	Tertiary (<100mm)		25%	25%	25%	25%			100%
	Connections		20%	20%	20%	20%	20%		100%
5.0	OTHERS								
	Regulation system			100%					100%
	Renewal existing connections			50%	50%				100%
	Renewing existing pipeline			50%	50%				100%
	Leakage detection equipment		100%						100%
	Software and support - WS Management		100%						100%
6.0	LAND & RESETTLEMENT								
	Land & resettlement	50%	50%						100%
7.0	ENGINEERING AND SUPERVISION								
	Engineering and management	30%	20%	10%	10%	10%	10%	10%	100%

4.1.4 MYAWADDY WATER SUPPLY

WATER RESOURCES

Existing water supply in Myawaddy is from a variety of resources including:

- Spring water which is used (untreated) by one of the private operator
- Moei river water which underground flow is abstracted and supplied by the other private company without proper treatment
- Groundwater with the existence of public tubewells operated by TDC and a multiplicity of private shallow wells and tubewells.

Sampling of these resources was undertaken by the PPTA Consultant during October 2015. While the data is very limited, certain observations can be made with respect to the observed water quality:

- Water quality of the Moei River is not surprisingly highly turbid especially during the monsoon season. Organic and bacterial pollution is surprisingly lower than spring and groundwater resources, perhaps indicative of a high dilution during the monsoon period. While the observation point was downstream of the solid waste dumps and potentially impacted by leachate discharges, there was no evidence of high toxicity/heavy metals (again potentially due to higher dilution during the monsoon).
- The tubewell monitored showed evidence of high suspended solids, high conductivity, organic pollution, high level of BOD and minerals (including high chloride and sodium values)
- Spring water supplying the reservoir for the Aye Mya San Ye Company has similar water quality as the tubewells, albeit with a lower mineral content; again treatment would be required for this resource which is currently absent.

While there is a lack of data in both quantity and quality to characterize water resources in Myawaddy the following main recommendations can be drawn:

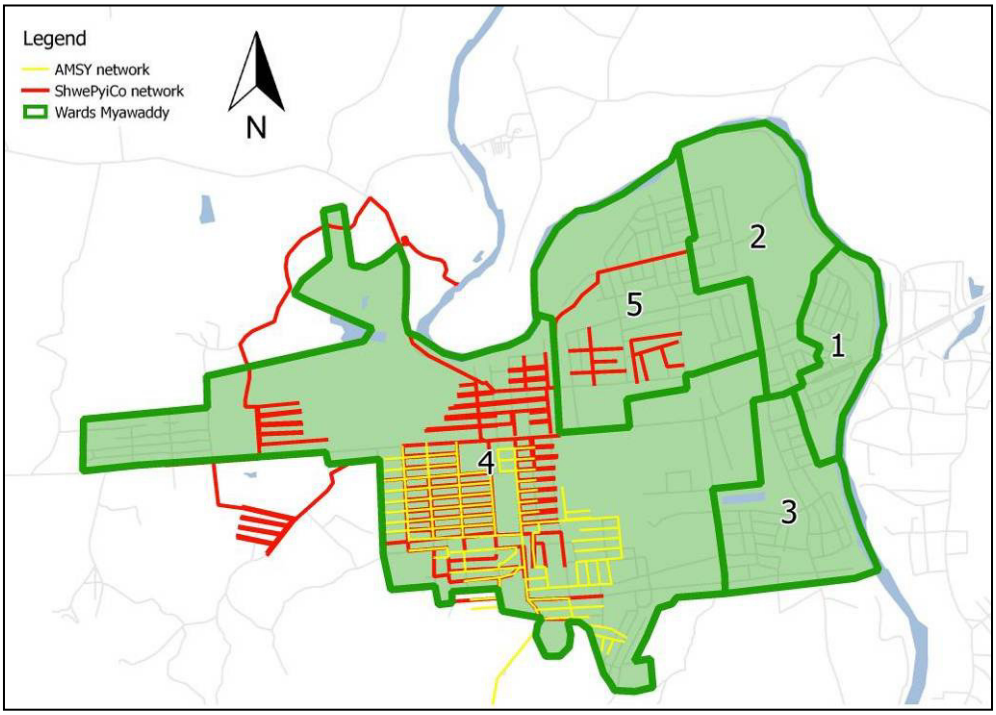
- Groundwater: While accurate hydrogeological analysis is inexistent, the observation of drying up during the drought periods and also the poor observed water quality, would indicate that the use of the existing tubewells and shallow wells should be discontinued;
- Spring water: The spring water used by AMSY Co. is not sustainable as upstream villages divert increasing amounts of water for their own water supply. The lack of water occurs every year in the dry season and limits the extension of AMSY Co. service area;
- Irrigation/Reservoir water: According to information provided by the Ministry of Irrigation, there is no available dam located near the city which could be used for domestic water supply; in the long term such a solution could be envisaged although the current situation precludes the identification of a suitable long term location.
- River: While the Thaungyin river level can be dramatically low in dry season, the proposed solution would be to rely on the alluvial aquifer and underground river flow linked to the river itself, similar to that currently implemented by the Shwe Pyi Co. Such approach would enable the abstraction of higher quality water after natural filtration resulting in a lower turbidity. However, there is a clear need for further information and analysis of this resource.

Finally, it has to be noticed that none of the resources has a protection plan for environmental protection purpose as well as preservation, to prevent from pollution or undesirable/illegal uses of the water resources.

DIAGNOSTIC OF EXISTING WATER SUPPLY SYSTEM

The provision of urban environmental services in Myawaddy Township is the responsibility of the Myawaddy District Development Committee (MDDC). Under current conditions there is no public water supply system in Myawaddy. Two private operators have been granted the right to distribute piped water to different wards in the township. These networks as shown in **Figure 4-12** are extended on a rather ad hoc basis without any formal planning in response to customer demand for connections. The two networks are overlapping in ward #4 and some customers receive water from both companies, opening the tap depending on resource availability. None of the two systems is equipped with reliable treatment facility.

Figure 4-12: Myawaddy Existing Water Supply Networks



Consequently, there is no water supply system in the Eastern part of the city where people can only get water from 26 public tubewells abstracting water from the shallow aquifer.

- ShwePyi Co., the "Northern Company", supplies ward #4 and recently extended to ward #5. They are extending their network out of the township boundaries on the western side. Myawaddy ShwePyi Company is managing a network of nearly 35 km, from 50 to 250mm diameter, with water pumped from the alluvial aquifer of the Thaungyin.
- AyeMyaSan Yae Company (AMSY) has a more modest network (17km) located in ward #4. AMSY Co. is a private company collecting the water from LatKhatTaung, a series of hills located 6 km in the South of Myawaddy. This company faces a lack of resources during the dry season limiting it expansion.

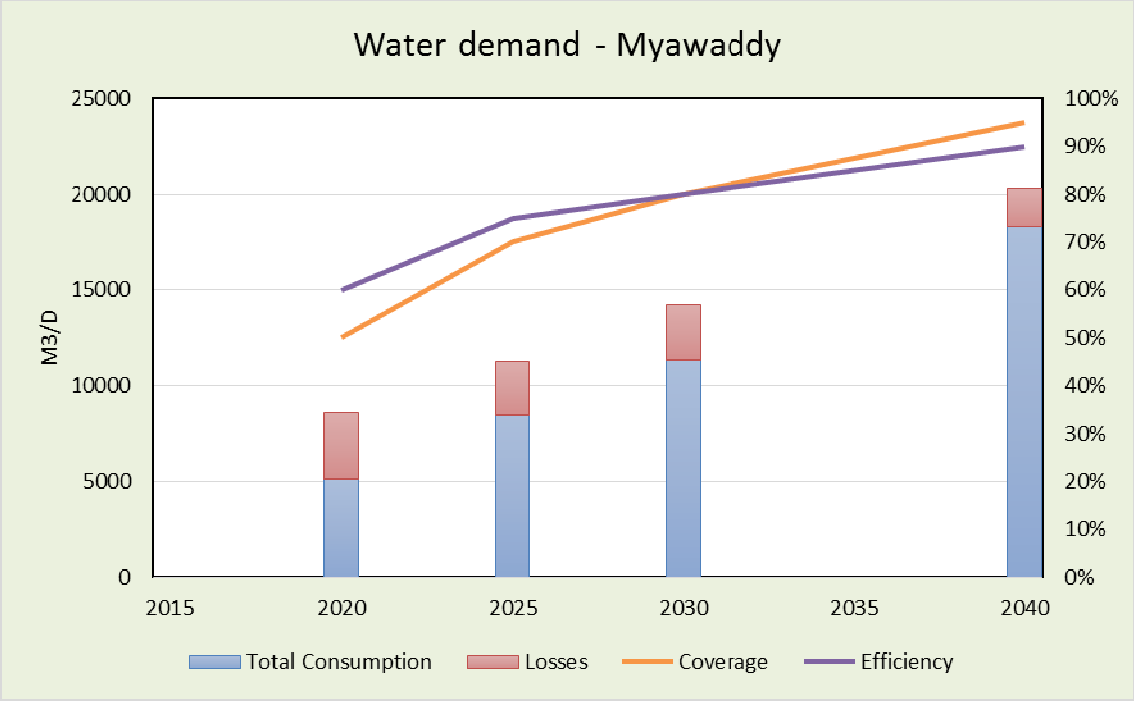
FUTURE REQUIREMENTS & STRATEGY FOR MYWADDY WATER SUPPLY

The requirements for future water supply provision are based upon the concept plans developed by DUHD and discussed in the overall FSR for Kayin State in which the population is set to grow at around 3% per annum reaching almost 150,000 by 2025 and 250,000 by 2040.

On the basis of these plans and projections, water demand for future horizons up to 2040 has been estimated covering the entire urban area. These projections indicate a requirement of approximately 11,300 m3/day for the urban area by 2025. These would increase to 20,000 m3/day in the long term (2040). These figures are under the influence of the large ratio of "floating" population which is assumed to lead to an overall lower consumption.

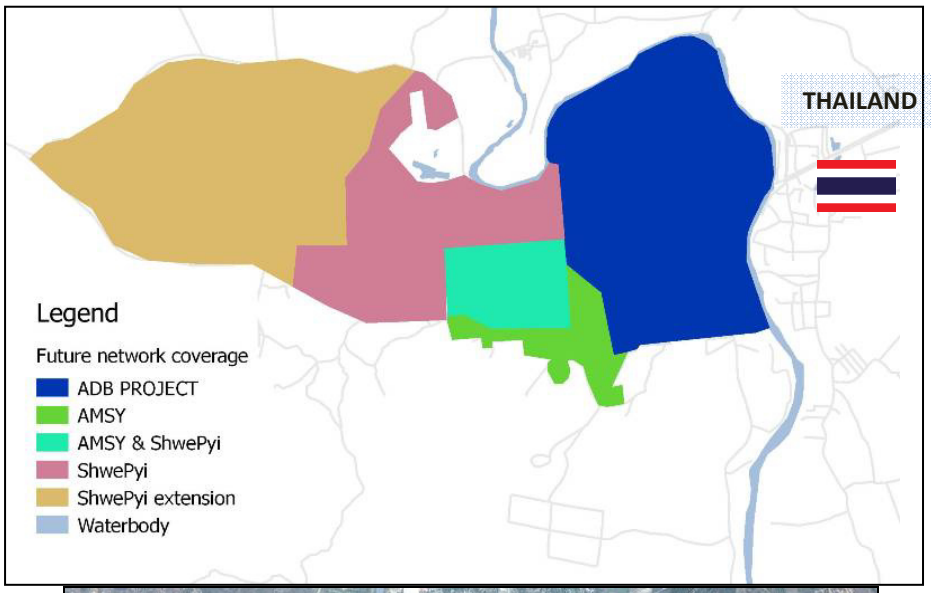
The way that water consumption is planned to increase together with service coverage and overall system efficiency (reduction of physical losses) in Myawaddy is shown in the figure below, focusing on the urban area.

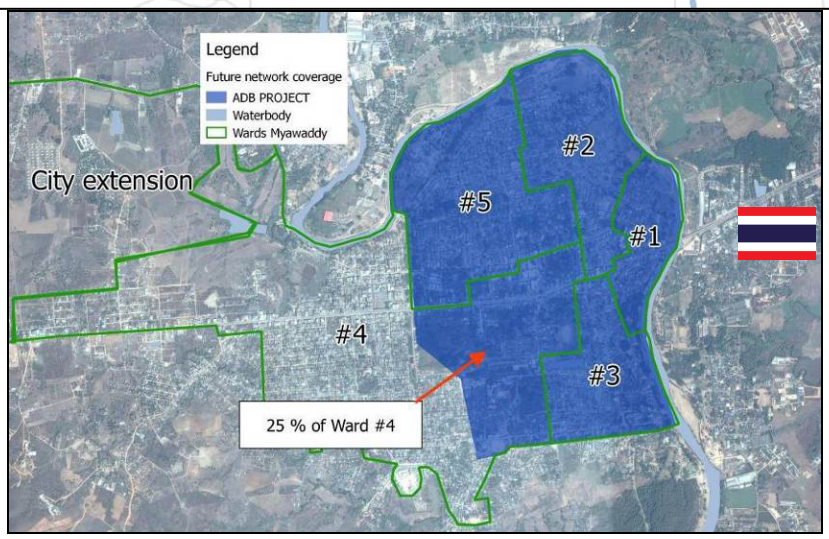
Figure 4-13: Myawaddy Water Supply and Demand to 2040



Taking into consideration the current situation and existence of private operators, it is proposed that water supply project focuses on the unserved area, that is to say the eastern part of the city. Looking at the entire township, the organization of the water supply and distribution areas could be as shown in **Figure 4-14**.

Figure 4-14: Myawaddy Future Network Coverage





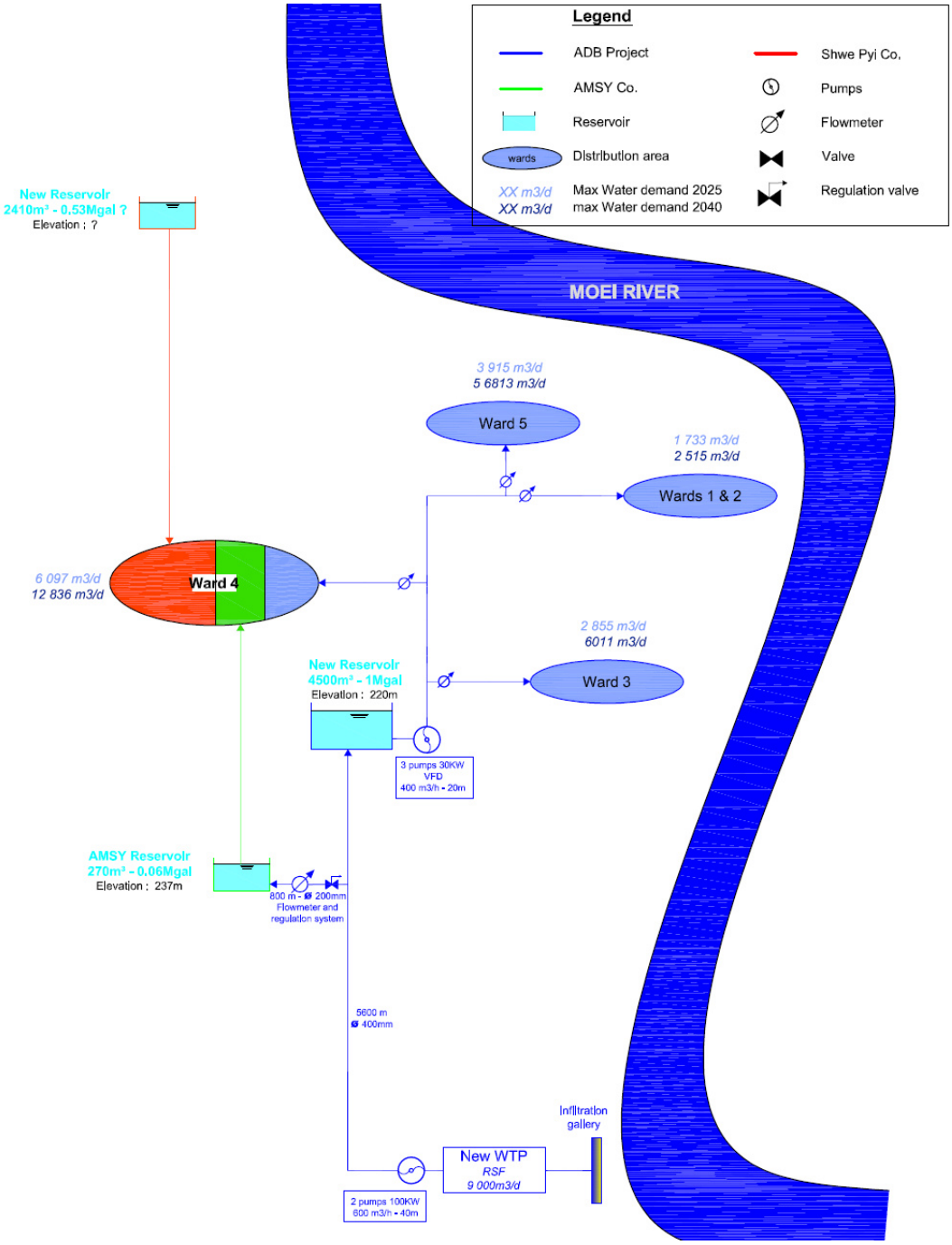
Hence, it is assumed that ADB project will supply wards # 1, 2, 3 & 5 and 25% of ward #4 as shown on the figure above. Accordingly, the ADB project will also supply the urban development towards the south whereas the western extension of the city would be part of ShwePyi future system.

Furthermore, AMSY Company has expressed its willingness to be supplied with treated water from proposed ADB financed project. Finally, it is assumed that ADB project will include the creation of a complete water supply system for the eastern part of the city as shown in **Figure 4-15** and will also provide and sell treated water to AMSY Co.

In accordance with resource analysis, SWOT analysis and previous conclusions detailed in the FSR for Kayin State, the proposed strategy to supply the project area consists in developing a new centralized water supply system using underground water flow from the Moei River. Abstracted water will need to be treated using a new water treatment plant able produce suitable amount of water in line with quality standards objectives. The previous analysis confirmed the need to

implement production and treatment facility (currently inexistent) and associated storage and distribution system together with improved operational and financial management.

Figure 4-15: Myawaddy project flow diagram



On the basis of these plans and projections, water demand for future horizons up to 2040 has been estimated covering the project area. These projections indicate a requirement of approximately 9 000m3/day by 2025 and up to 15,500 m3/day by 2040 (average daily need). Water supply coverage from the TDC system is planned to increase to 70% in the short term (via the Project) and up to 95% in the long

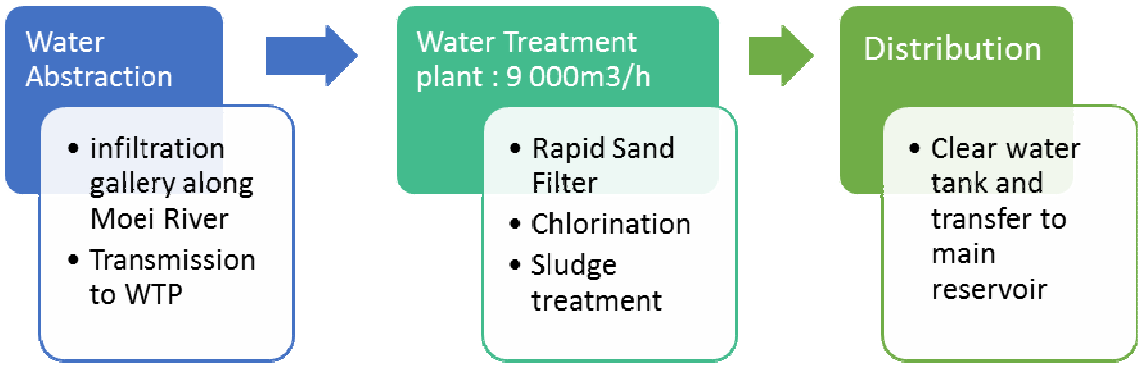
term. Connections will increase to almost 15000 by 2025. Population served will increase to almost 110,000 in the short term and 240,000 in the long term. In addition water supplies will all be treated and provided continuously (ie. 24/7 supplies) in the proposed project areas.

MYAWADDY THE PROPOSED PROJECT

The proposed project for Myawaddy City is detailed in the FSR for Kayin State and summarized on **Figure 4-17** illustrating the main proposed facilities covering water production and treatment, storage and distribution and improved operation and management.

- Production & treatment: Creation of a new production capacity is a crucial component to provide water to the project area and cope with future water demand considering the urban growth. In order to achieve this objective in a sustainable and secured manner, it is proposed to treat the water abstracted from the Moei River and its associated alluvial aquifer which appears to be the only available short term water resource. This system will substitute existing public water supply using tubewells. Hence, it is proposed to use an infiltration gallery to benefit from bank filtration and ensure water abstraction throughout the year providing up to 9,000 m3/day in a first phase. Thereafter water would be treated using rapid sand filtration possibly without coagulation/flocculation process (depending on raw water quality) and aquifer's characteristics followed by disinfection. Available land has been proposed by TDC along the Moei River, 4km south of the city (see summary map). Opportunity to extend this facility in long term shall also be considered in order to cope with long term requirements.

Figure 4-16: Production system in Myawaddy



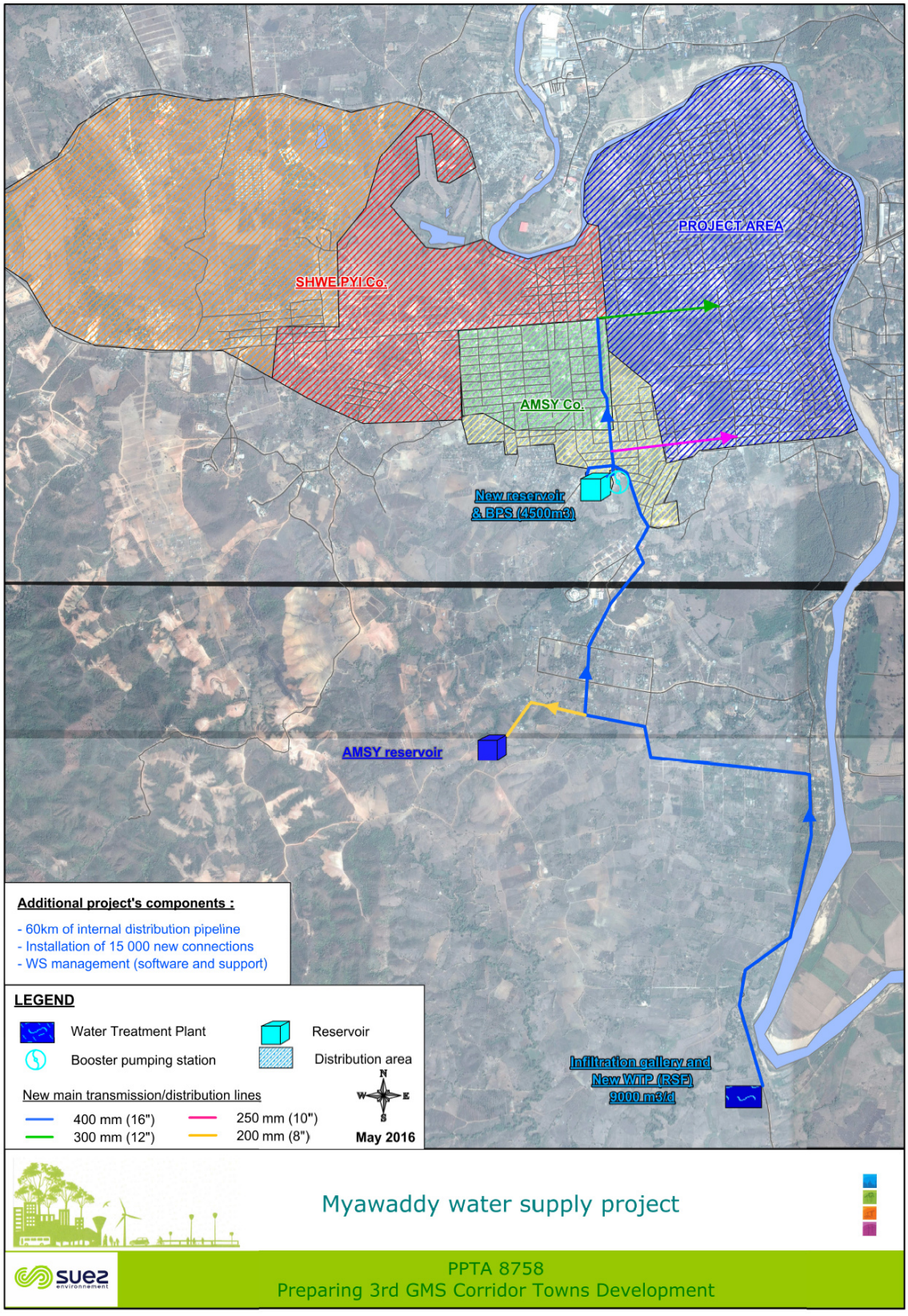
- Transmission & storage: treated water from the WTP will be stored into a clear water tank and then pumped via a main transmission line to a new storage tank located within the downtown area, on public land owned by TDC. As new storage, it is proposed to implement a 4 500m^3 (1 M gallons) storage in the downtown area in order to ensure a sufficient autonomy (half-day autonomy) and absorb the peak demand. Under these assumptions, this transmission line would require a 400mm pipeline. In addition, a connection from the transmission line equipped with a flow meter and regulation system will be used to supply the AMSY Company's main reservoir. Under this scenario, water would be transferred and sold to the company.
- Distribution network: Treated water from the main reservoir, will be distributed with the implementation of a new distribution system. A large amount of pipeline will be newly installed in the project area: 9 km of transmission lines and main networks (diameters from 200-500 mm) and nearly 60 km of internal

distribution system, including tertiary networks and new connections (almost 15 000 numbers)

- Improved Operation & Management covering asset management, GIS, billing and customer management, NRW control. A full NRW strategy is hence proposed and detailed in the FSR for Kayin State. These latter aspects will be procured as part of a management contract.

The proposed water supply project for Myawaddy and its components is summarized in the following summary map:

Figure 4-17: Myawaddy Proposed Project



MYAWADDY PROJECT COSTINGS

The following tableTable 4-3 summarizes the overall base cost estimate for the Myawaddy water supply project described above. Capital expenditures have been divided between: Construction (civil work), main supplies (electrical & mechanical) and others; according to 5 categories. Details of the calculation together with operational expenditures are presented in the FSR for Kayin State.

These costs do not include physical and price contingency, nor operation costs which have been estimated separately. In addition, it should be noted that these costs are subject to revision during the detailed design together with the acquisition of additional data. Total Physical Cost has been calculated at 11.3 million USD consistent with previous estimations at the Interim Phase. Adding other engineering costs (including supervision) would bring the Base Cost of the component to nearly 12.1 million USD.

Table 4-5: Myawaddy Project base Costs

INVESTMENT PROGRAM			MYAWADDY Water Supply			
			Cost estimate			
ID	*Item*	*Description*	*Civil (USD)*	*E&M (USD)*	*Other (USD)*	*TOTAL (USD)*
1.0	PRODUCTION					
	Intake : Infiltration gallery		150 000.00	150 000.00		300 000.00
	Transmission line		25 000.00			25 000.00
	WTP - RSF (600m 3/h - 9000m3/d - 2Mgal/d)		1 000 000.00	1 500 000.00		2 500 000.00
2.0	STORAGE					
	Construction of new reservoir (4500m3)		562 500.00			562 500.00
	Pipeline connections, equipments & flowmeters			30 000.00		30 000.00
	BPS		100 000.00	100 000.00		200 000.00
3.0	MAIN TRASNSMISISON / DISTRIBUTION LINES					
	DN400		1 133 150.00			1 133 150.00
	DN300		106 080.00			106 080.00
	DN250		93 750.00			93 750.00
	DN200		75 200.00			75 200.00
4.0	DISTRIBUTION NETWORK					
	DN200		280 120.00			280 120.00
	DN150		952 000.00			952 000.00
	DN100		1 457 400.00			1 457 400.00
	Tertiary (<100mm)		1 189 500.00			1 189 500.00
	Connections		2 230 500.00			2 230 500.00
5.0	OTHERS					
	Software & support - WS management				100 000.00	100 000.00
	Flowmeters and regulation equipment for DMA			45 000.00		45 000.00
	Leakage detection equipment			20 000.00		20 000.00
	Flowmeter, equipment and regulation system at AMSY reservoir			30 000.00		30 000.00
TOTAL PHYSICAL COST			**9 355 200.00**	**1 875 000.00**	**100 000.00**	**11 330 200.00**
6.0	ENGINEERING AND SUPERVISION					
a)	Engineering and management overheads	5% Total physical cost			566 510.00	566 510.00
b)	Construction supervision - Civil	2.50% of Civil Physical Works			233 880.00	233 880.00
	Construction supervision - M&E	1% of M&E Works			18 750.00	18 750.00
	sub total					**819 140.00**
BASE COST						**12 149 340.00**

Remark: at this stage, connection cost has been fully included in the investment. Nevertheless, it is suggested to consider a social strategy involving public participation in line with the willingness to connect.

MYAWADDY PROJECT IMPLEMENTATION PLAN & CONTRACTING STRATEGY

An implementation schedule has been provided in the Preliminary Design Report as shown in **Table 4-6**. Overall project implementation would commence in 2017 with the first year covering design and tendering of this component. Construction of the physical works would take place from 2018 to 2022 inclusive. The majority of the works will be implemented as part of a DBO contract with an operation phase of 5 years based on a preliminary design and associated surveys undertaken by the Project Implementation Consultant.

Table 4-6: Myawaddy Project Implementation Plan

IMPLEMENTATION PLAN		MYAWADDY Water Supply							
		YEAR							
ID	Item	2017	2018	2019	2020	2021	2022	2023	**Total**
1.0	PRODUCTION								
	Intake : Infiltration gallery		50%	50%					**100%**
	Transmission line		50%	50%					**100%**
	WTP - RSF (600m 3/h - 9000m3/d - 2Mgal/d)		50%	50%					**100%**
2.0	STORAGE								
	Construction of new reservoir (4500m3)		50%	50%					**100%**
	Pipeline connections, equipments & flowmeters		50%	50%					**100%**
	BPS		50%	50%					**100%**
3.0	MAIN TRANSMISSION / DISTRIBUTION LINES								
	DN400		40%	40%	10%	10%			**100%**
	DN300		25%	25%	25%	25%			**100%**
	DN250		25%	25%	25%	25%			**100%**
	DN200		50%	50%					**100%**
4.0	DISTRIBUTION NETWORK								
	DN200		25%	25%	25%	25%			**100%**
	DN150		25%	25%	25%	25%			**100%**
	DN100		25%	25%	25%	25%			**100%**
	Tertiary (<100mm)		25%	25%	25%	25%			**100%**
	Connections		20%	20%	20%	20%	20%		**100%**
5.0	OTHERS								
	Software & support - WS management		100%						**100%**
	Flowmeters and regulation equipment for DMA		100%						**100%**
	Leakage detection equipment		100%						**100%**
	Flowmeter, equipment and regulation system at AMSY reservoir		100%						**100%**
6.0	LAND & RESETTLEMENT								
	Land & resettlement	50%	50%						**100%**
7.0	ENGINEERING AND SUPERVISION								
	Engineering and management	30%	20%	10%	10%	10%	10%	10%	**100%**

4.2 Solid Waste

The main goal is "Improved Solid Waste Collection & Disposal" through: improved solid waste collection and coverage; improved solid waste disposal; recycling, sorting and segregation of organic waste and composting; potential analyses for Waste to Energy; and separate disposal of toxic/medical wastes.

4.2.1 ANALYSIS OF THE PRESENT SITUATION

MAWLAMYINE

The Mawlamyine Town Development Committee (MTDC) Cleansing Department operates 7 garbage trucks. Communities bring their waste to the truck when the bell rings on their rounds. They cover only 23 of the 28 Wards, which contributes to illegal dumping along roads and in nearby water courses or at the sea front. It is estimated that only about 50% of the generated waste is collected. Assuming a population of 258,809 with a waste generation of 0.55/kg/capita/day, results in about 171 ton/day, prognosis 2040 is 458 ton/day.

Waste is taken to an uncontrolled dumpsite about 10 km east of the city and upstream of the two water supply river intakes, which may increase the risk of contamination of water supplies with toxic leachate. The site is sometimes set on fire to reduce the volume. Several scavengers are present to take out the remaining recyclables. There is no soil covering nor groundwater protection and the waste burning creates very high health risks due to the air pollution. The dumpsite is large enough (about 18 ha) to implement a controlled landfill: but at present the dumped solid waste is spread haphazardly in layers of 1-4 meters high.

HPA-AN

The Cleansing Department operates only 4 garbage trucks with an illegal dumping and collection regime similar to that in Mawlamyine. The trucks visit every ward twice a week, using a bell ringing system.Hpa-An generates about 51 tons/day, with a prognosis by 2040 of 155 tons/day. The collected waste is dumped at Htan Koe Pin, near ZweKabin Hill, a tourist attraction. The dumpsite is much too small for future extension (only 1.8 ha. = 4.4 acres).

MYAWADDY

The town generates about 77 ton/day, by 2040 that may be 267 ton/day with an estimated half of this current amount being taken to two small open dump sites till end 2015. Another dumpsite was recently created west of the city. The remaining waste is dumped illegally along streets and in water bodies such as the Moei River (or Thaungyin River) which borders with Thailand. The 5 Ward Development Committees (WDC) execute the collection, transport and disposal to the dump site by themselves. Private owned waste trucks are hired by the WDCs who also collect the funds for waste collection. Houses are classified into: low, normal and high, with fees of 500 K, 1000 K and 1500 Kyats/month respectively.

4.2.2 INTEGRATED SOLID WASTE MANAGEMENT STRATEGY

The proposed strategy uses the Waste Management Hierarchy. This Hierarchy has as its top priority "Source Reduction & Reuse", and as last option "Disposal land filling". Adapting the 3Rs is very important as "Reduce, Reuse and Recycling" can significantly reduce the waste to be land-filled, thus smaller land areas are required or there can be a longer lifespan for the landfill. A Vision for the community could

be "may our municipality be clean and prosperous, with protection of the Environment, improved Health conditions and creating employment opportunities". Some objectives to reach this are clear definitions of roles and responsibilities for the waste sector, improving public awareness, phasing out current uncontrolled dumpsites etc.

The main target is to keep the city clean and sanitary by removing waste from the living areas and disposing of it in an environmentally acceptable manner. Targets are presented for the Short and Medium term, and for the Long term (>25 years). A minimum level is indicated for the short term to be reached: to collect all generated waste within a service area on a regular basis and disposal at a controlled landfill site.

The main items to implement an Integrated Solid Waste Management (ISWM) system are divided into 3 parts:

- Collection (primary and secondary collection systems)

Modernisation of collection by acquiring proper collection bins or bags and collection trucks.

The collection system will be improved with more waste bins and waste containers in certain collection points in the towns. To collect 95% of the waste generated, more collection vehicles will be purchased.

- Recycling

Recycling with the Informal Sector is already good, but only the formal sector can improve more recycling from 16% to 20% separated. Therefore at offices, schools, government buildings etc. separate recycle bins and containers will be placed for higher recyclable rates.

- Re-use and Composting

For recycling and composting it is important to start with source separation in the towns. Separate coloured bins are provided to separate the waste streams into recyclables, 'wet' waste for composting purposes and 'dry' waste for rejects to be land-filled. Composting is one of the most promising solutions for waste reduction. A composting facility is proposed to be implemented at the landfill locations.

A controlled composting plant is foreseen in the project for each town. The organics will be separate collected and transported to a Compost Plant at the Landfill facility site. To get good quality compost for sales, it is important to separate already the organics in town as much as possible. A Source Separation Organics (SSO) system will be implemented in the towns. Separate coloured bins and containers will be placed in the towns at the Collection Points.

A criteria analysis was made for the composting processing techniques which should be constructed. After analysing several options for a) Passively aerated systems and b) Actively aerated systems, the preferred option recommended was the ASP System (Aerated Static Piles). In this system air is forced into the piles which enhanced the composting processes and results in good quality compost.

The process consists of sorting (with 10 -20% rejects), composting piles, maturing period, and final screening (<10mm) and storage area for ready product.

It is envisaged in this project to start with a smaller Composting Plant first, to get experience and to get the population familiar with the separation system. Start with

25% or Organics generated to the Compost plant the first 5 years; after 5 years extension of the Compost plant to 40% or Organics to be processed. In the general lay-out of the landfill area, the extension for the compost plant is already foreseen.

A Compost Plant will be constructed in each project town. The compost plant consists of a Sorting area, a Composting Pad with a 'monsoon' cover, hangar style roof, a maturing (or curing) pad, a storage area for ready product (4 months storage maximal), and several civil works like office and sanitary provisions.

The compost Plant for Mawlamyine will have a capacity of 55 ton/day in 2019-2020. Total area phase 1 required: 12,100 m^2. The compost Plant for Hpa-an will have a capacity of 17 ton/day in 2019-2020. Total area phase 1 required: 4,100 m^2. The compost plant for Myawaddy will have a capacity of 26 ton/day in 2019-2020. Total area phase 1 required: 6,230 m^2.

- Final Disposal.

Solid waste treatment and disposal is at the moment below the minimum level. Three variants are analysed: 1) Incineration with WtE (Waste to Energy); 2) Composting and land filling combination; 3) mixed land filling with biogas production for WtE (waste to energy). Incineration is not recommended because of very high investment costs, the waste in SE Asia has a high moisture content with low caloric value and high skilled workers would be required as well as air pollution control system. Mixed Land filling with biogas production for WtE is mainly feasible for large size landfills (or Regional Landfills), in most cases with smaller landfills like in Hpa-An and Myawaddy the biogas is simply flared without any energy production. The option Composting of Organics with land filling is the best option, easy to implement and to operate, and lower investment costs for Hpa-An and Myawaddy. For Hospital Medical waste a small size medical waste incinerator is foreseen, one for each town.

MAWLAMYINE

A new controlled landfill is anticipated in the project. It would be a carefully engineered facility with soil, air and groundwater protection. A bulldozer and a tractor with cart-trailer will be purchased under Supplies of Equipment. A small Hospital medical waste incinerator will also be implemented in Mawlamyine, with a capacity of about 30kg/hr or max. 150 kg/day.

The existing site will be upgraded to a new controlled landfill site as shown on **Figure 4-18**. The present dumped waste will be set apart temporarily during the construction activities and after finishing of the landfill cell, this waste will be transferred into the controlled landfill.

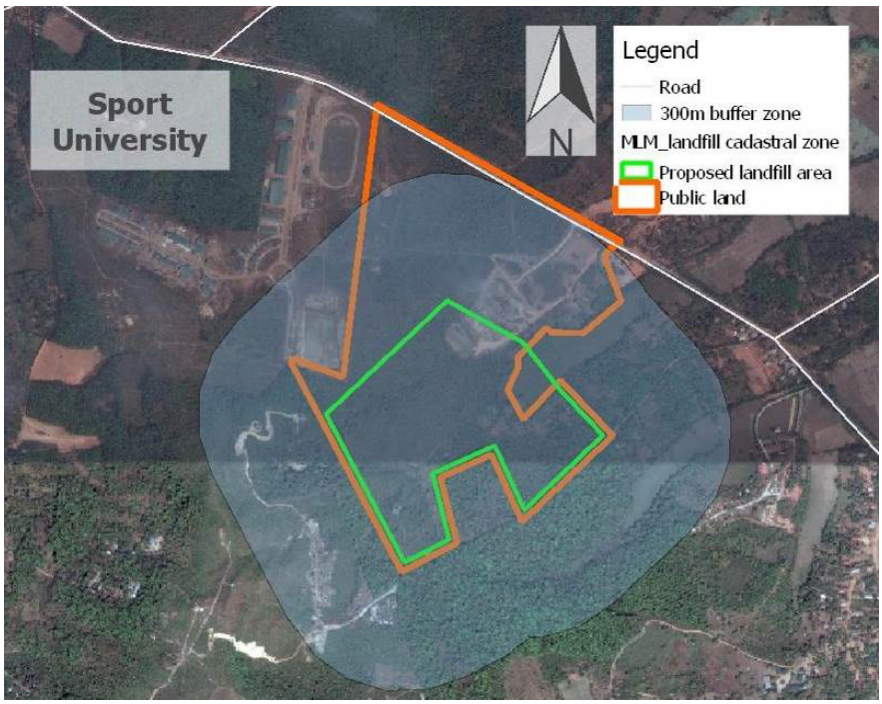
The design capacity of the landfill is calculated with the total generated waste quantities for 25 years till 2040, with 20% (of total collected wastes) diverting of the recyclables, and diverting another 25% first 5 years of composting materials and after 2025 with diverting 40% of composting quantities. Further the calculations are with about 50% not collected today 2015, to 5% not collected in 2020 and further to 2% not collected in 2040.

The total rejects waste to be disposed at the controlled landfill for Mawlamyine is 1,174,000 ton/25 years. The landfill area is calculated with additional waste tonnes from the existing dumpsite to be removed to the controlled landfill, including a daily cover of soil +30% and average height of the landfill of 12.00 m. Total landfill area required for Mawlamyine: 168,000 m2 (41.5 acres). This is without the area

required for the compost plant. For construction activities the landfill facility is divided into several Landfill cells each for 5 years coverage: Mawlamyine landfill will have 5 Cells; each cell is about 30,000 m2.

A summary of project proposals for Mawlamyine is contained in the Mon Report and its appendices.

Figure 4-18: Mawlamyine Location of Proposed Landfill



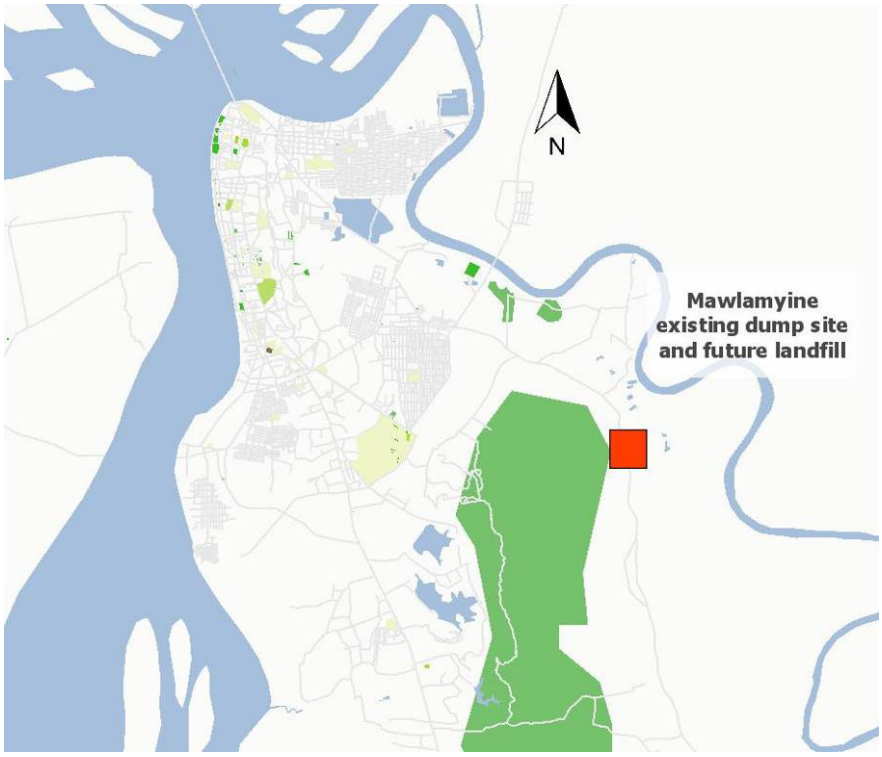


Table 4-7: Mawlamyine Solid Waste Proposals

Description	Subdivision	Number to purchase
Primary Collection		
Small containers 240 ltr in 3 different colours for the three different separation waste streams: for each ward two collection points (28 Wards)	Green colour containers for organics; Blue colour containers for recyclables Yellow colour containers for the reject waste	56 56 56
Aluminium containers 1100 ltr for siting at small size collection points. Two different containers for separating organics and rejected waste. It is assumed that most of the recyclables are already removed by the informal sector	Aluminium container with large text on site: ORGANICS Aluminium container with large text: ONLY REJECTS WASTE Aluminium container with large text: ONLY RECYCLABLES	28 28 28
Transport containers content 3 m3 for collecting with hooklift trucks	Steel containers 3 m3 hook lift system	28
Collection trucks for above containers	Small trucks with lift system for 240 l and 1100 l containers Hook lift Truck for 3m3 steel containers	2 2
Compactor for market area	16 m3 compaction truck	1
Recycling		
Formal sector: Introducing at schools, township offices and other official buildings the separation and recovery of recyclables using 3 different colour containers	recyclables ("dry waste"): 240 l containers Blue compost ("wet waste"): 240 l containers Green reject waste: 240 l containers Yellow	28 28 28
Adding some extra 3m3 containers in the most populated wards of town	Additional containers 3m3 hook lift system in most populated wards	15
Hospital Waste Treatment		
Implementation of a small incinerator on the landfill site	Works: construction of foundation structures and connections to fuel/electricity Supply of small Incinerator: Capacity about 30 kg/hr – 150 kg/day maximum with spare parts	25 m2 1
Composting		
Construction of a composting plant of 55 tons/day capacity	Sorting area Composting Pad Maturing Pad Storage Area Mechanical Equipment Area	500 m² 4,000 m² 1,600 m² 4,000 m² 2,000 m²
Landfilling		
Upgrading the existing dumpsite into a controlled landfill with bottom liner and leachate collection over 16.8 ha including 5 cells (only 1 cell constructed under this Project Phase, others scheduled in 2024, 2028, 2032, 2036)	Landfill Infrastructures area (access, office, storage) Environmental monitoring wells Weighbridge Bulldozer 248 HP Small 4x4 drive truck tractor	14.6 ha 2.2 ha 6 40 tons 1 1
Leachate treatment: anticipated production is 23,000 m3 per sub-cell during 5 months of wet season	Recirculation into landfill Passive evaporation from holding ponds On-site physical & biological treatment	3000 m² pond and leachate treatment plant

COSTS MAWLAMYINE

Investment costs of the Integrated Solid Waste Management System in Mawlamyine are shown in **Table 4-8**. A detailed cost estimate is provided in the Mon Report and its Appendices. This is detailed for the following:

i) Collection,

ii) Recycling and Hospital Waste Incinerator,

iii) Composting

iv) Upgrading to Controlled Landfill.

Engineering cost

This consists of the fees paid for consulting and technical services including facility design, construction supervision, and communication with the community/municipality for siting issues. This is taken as a percentage of the construction cost. A default value of 5 percent is envisaged.

Table 4-8: CAPEX Supplies and Works for ISWM in Mawlamyine

Total CAPEX Mawlamyine	WORKS	SUPPLIES	USD
Collection Improvement	196,000	766,400	962,400
Recycling + Hospital Waste Incinerator	2,000	200,900	202,900
New Controlled Landfill	7,677,700	381,000	8,058,700
Compost Plant	3,931,800	896,500	4,828,300
Total estimate ISWM System Mawlamyine:			**14,052,300**

Future Costs

Besides replacement costs for machines and equipment, also new landfill Cells have to be constructed as indicated in the previous section. The overview of new landfill cells to be implemented with the estimated costs in year 2015 prices is included in the Mon Report.

HPA-AN AND MYAWADDY

A new controlled landfill is anticipated in the project for both towns. It is required due to the fact that the existing dumpsites are much too small, too close to housing areas, too close to rivers with flood problems, etc. The design capacity of the landfill is calculated as for Mawlamyine.

The total rejects waste to be disposed at the new landfill for Hpa-an is 362,900 ton/25 years. The total rejects waste to be disposed at the new landfill for Myawaddy is 616,900 ton/25 years. The landfill area is calculated with additional waste tonnes from the existing dumpsites to be removed to the new landfill, daily cover of soil +30% and average height of the landfill of 10.00 m.

Total landfill area required for Hpa-an: 75,000 m2 (17.4 acres). This is without the area required for the compost plant. Total landfill area required for Myawaddy: 119,000 m2 (27.6 acres). This is without the area required for the compost plant.

For construction activities the landfill facility is divided into several Landfill cells each for 5 years coverage: Hpa-an landfill will have 3 Cells; each cell is about 22,000 m2; Myawaddy landfill will have 4 Cells; each cell is about 27,000 m2.

A small Hospital medical waste incinerator will be implemented in each town. The incinerator will have a capacity of about 30 kg/hr or max. 150 kg/day.

The proposed project components for each town are shown in **Table 4-9**.

Table 4-9: Hpa-An and Myawaddy Solid Waste Components

Description	Subdivision	Number to purchase	
		Hpa-An	Myawaddy
Primary Collection			
Small containers 240 l in 3 different colours for the three different separation waste streams: for each ward two collection points (28 Wards)	Green colour containers for organics; Blue colour containers for recyclables Yellow colour containers for the reject waste	18 18 18	10 10 10
Aluminium containers 1100 l for siting at small size collection points. Two different containers for separating organics and rejected waste. It is assumed that most of the recyclables are already removed by the informal sector	Aluminium container with large text on site: ORGANICS Aluminium container with large text: ONLY REJECTS WASTE Aluminium container with large text: ONLY RECYCLABLES	15 15 9	13 13 5
Transport containers content 3m3 for collecting with hook lift trucks	Steel containers 3 m3 hook lift system	13	8
Collection trucks for above containers	Small trucks with lift system for 240 l and 1100 l containers Hook lift truck for 3m3 steel containers	2 2	2 1
Recycling			
Formal sector: Introducing at schools, township offices and other official buildings the separation and recovery of recyclables using 3 different colour containers	recyclables ("dry waste"): 240 l containers Blue compost ("wet waste"): 240 l containers Green reject waste: 240 l containers Yellow	9 9 9	5 5 5
Hospital Waste Treatment			
Implementation of a small incinerator on the landfill site	Works: construction of foundation structures and connections to fuel/electricity Supply of small Incinerator: Capacity about 30 kg/hr – 150 kg/day maximum with spare parts	25 m2 1	25 m2 1
Composting			
Construction of a composting	Sorting area	150 m²	230 m²

Description	Subdivision	Number to purchase	
		Hpa-An	Myawaddy
plant of capacity: 17 tons/day for Hpa-An and 26 tons/day for Myawaddy	Composting Pad Maturing Pad Storage Area Mechanical Equipment Area	1,250 m² 500 m² 1,250 m² 950 m²	1,900 m² 750 m² 1,900 m² 1,450 m²
Landfilling			
Existing dumpsites to be removed to new controlled landfill with bottom liner and leachate collection. 3 cells anticipated in Hpa-An and 4 cells in Myawaddy. Only cell 1 built under this project in both city	Landfill Cell 1 area Infrastructures area (access, office, storage) Bulldozer 201HP Small 4x4 drive truck tractor Weighbridge 40 tons	5.6 ha 2 ha 0.9 ha 1 1 1	9.3 ha 2.5 ha 1.5 ha 1 1 1
Leachate treatment: Capacity requested for one operating sub-cell: 60 m3/h	Recirculation into landfill Passive evaporation from holding ponds On-site physical & biological treatment	50% 3000 m² pond	50% 4300 m² pond
Closure of old dumpsites, evacuation of waste, restoration of area (soil, plantation)	Area to close Volume of waste to transport	2.5 ha 0 m3	2 ha 120,000 m3

The proposed locations for the new landfills for Hpa-An and Myawaddy are shown in **Figure 4-19, Figure 4-20, Figure 4-21** and **Figure 4-22.**

The old dumpsites should be closed as soon as possible.

Figure 4-19: Hpa-An Proposed Landfill Site

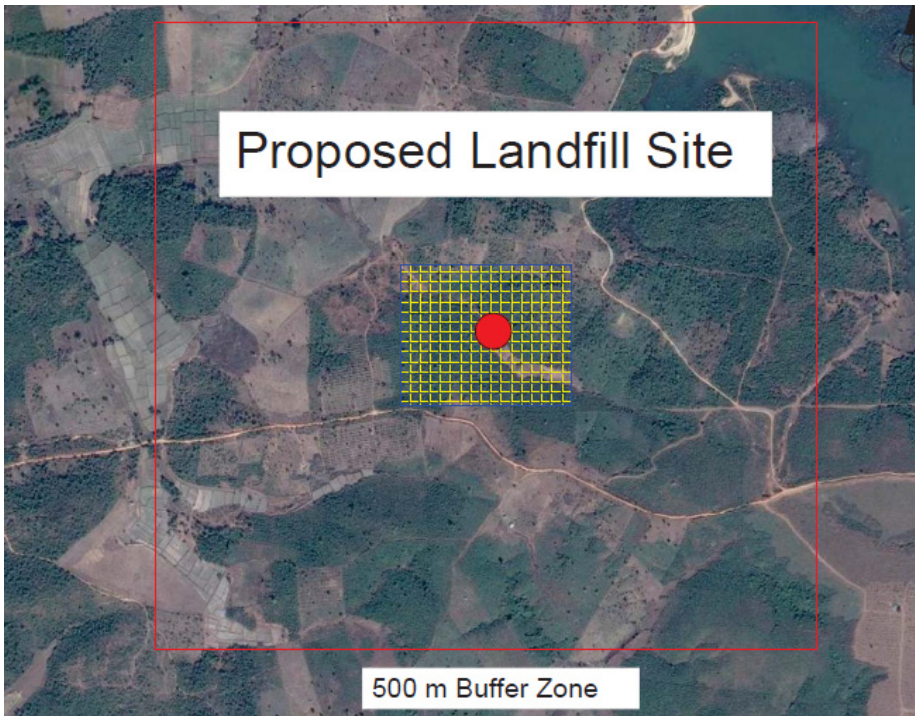


Figure 4-20: Hpa-An proposed landfill location and dump site closure

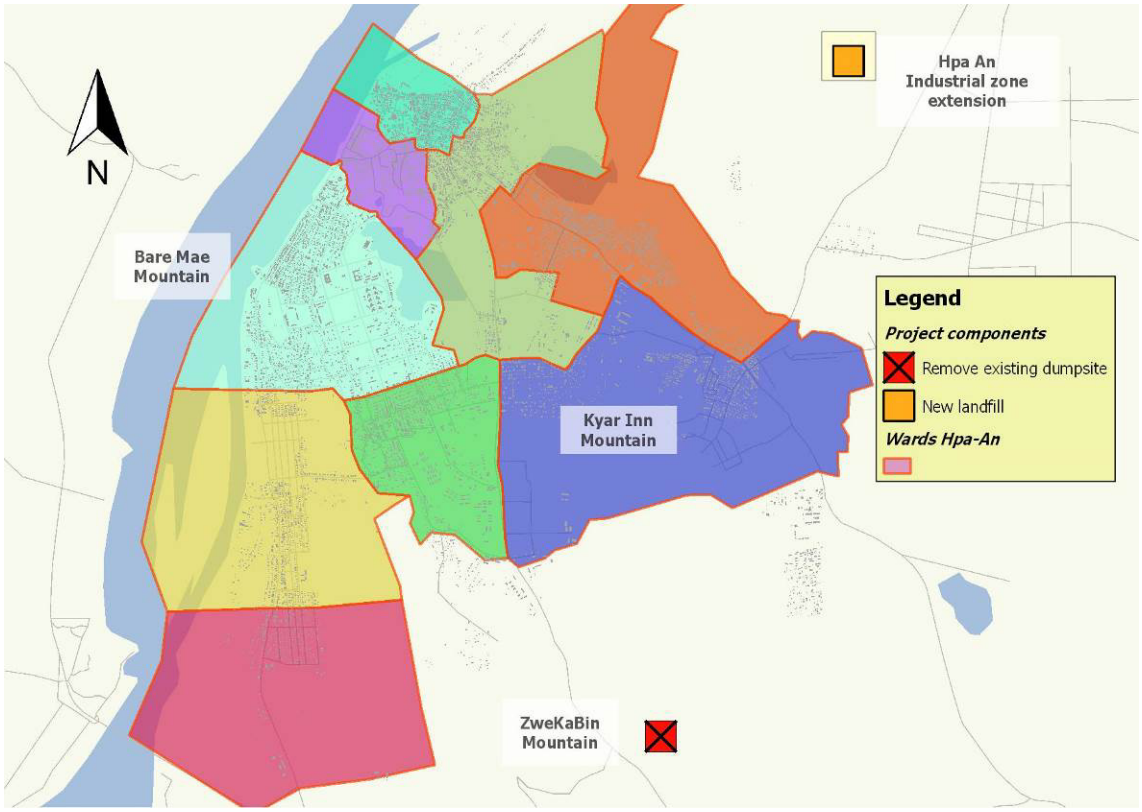


Figure 4-21: Myawaddy Proposed Landfill near Trade Zone

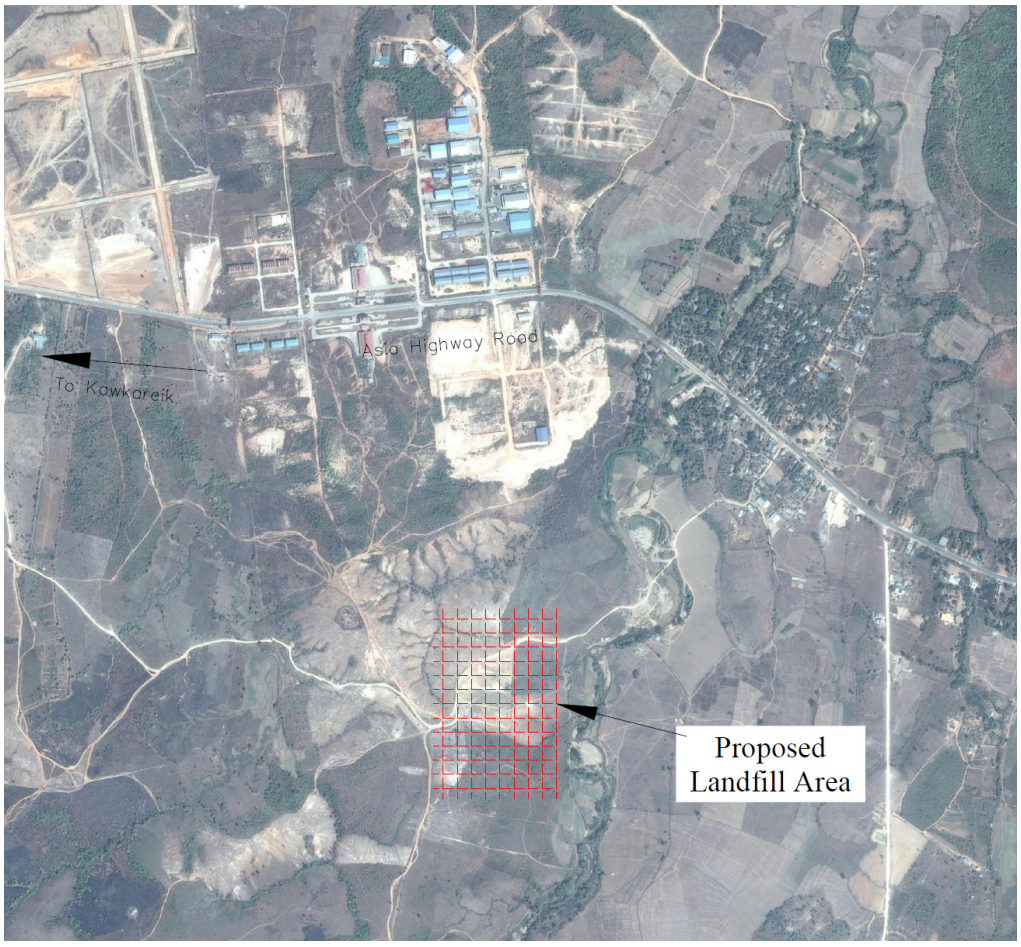
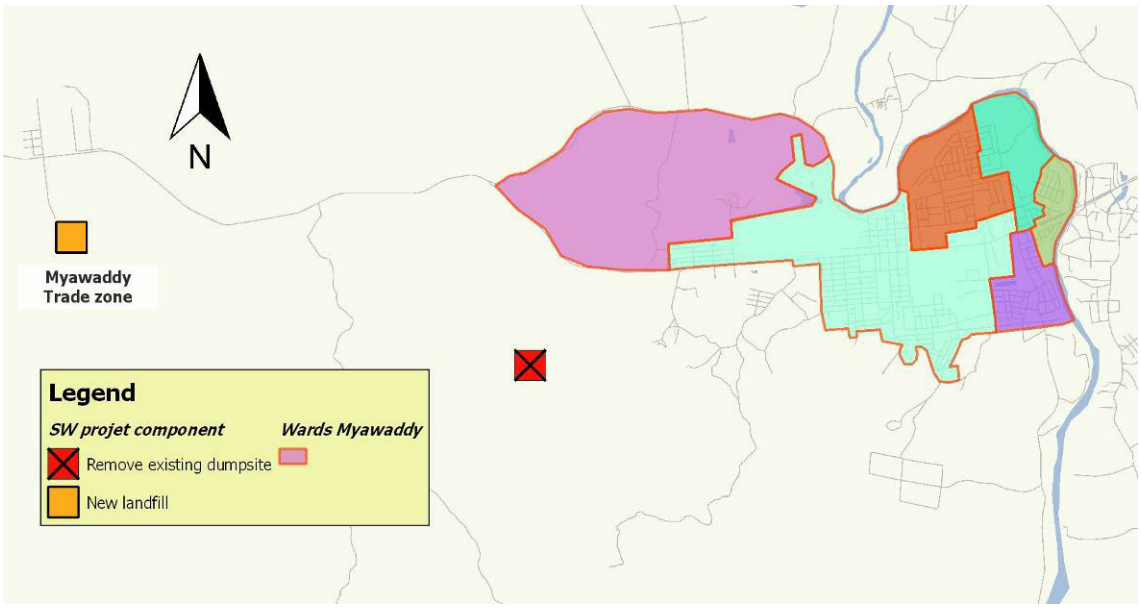


Figure 4-22: Myawaddy proposed landfill location and dump site closure



COSTS HPA-AN AND MYAWADDY

In Hpa-An the proposed estimate for the investments is based on a new landfill site location provided by the Government large enough to construct all the landfill facilities. The estimate is based on normal construction costs of a controlled landfill as constructed in similar projects. In case additional expenditures are required for specific land conditions, they should be added to the total estimate.

Table 4-10 provides an overview of the estimated capital costs for Hpa-An.

Table 4-10: CAPEX Supplies and Works for ISWM in Hpa-An

Total CAPEX Hpa-An	WORKS	SUPPLIES	TOTAL USD
Collection Improvement	63,000	354,200	417,200
Recycling + Hospital Waste Incinerator	2,000	117,450	119,450
New Controlled Landfill Cell 1	5,697,275	277,000	5,974,275
Compost Plant	1,395,250	706,500	2,101,750
Total estimate ISWM System Hpa-An:			**8,612,675**

In Myawaddy the proposed estimate is for the investments is based on a new landfill site location provided by the Government large enough to construct all the landfill facilities. **Table 4-11** provides an overview of the estimated capital costs for Myawaddy.

Table 4-11: CAPEX Supplies and Works for ISWM in Myawaddy

Total CAPEX Myawaddy	WORKS	SUPPLIES	USD
Collection Improvement	35 000	259 000	294 000
Recycling + Small Hospital Waste Incinerator	2 000	100 250	102 250
New Controlled Landfill Cell 1	4 366 860	277 000	4 643 860
Compost Plant	1 824 100	791 500	2 615 600
Total estimate ISWM System Myawaddy:			**7,655,710**

Engineering cost

For both towns this consists of the fees paid for consulting and technical services including facility design, construction supervision, and communication with the community/municipality for siting issues. This is taken as a percentage of the construction cost. A default value of 5 percent is envisaged.

Future Costs

Besides replacement costs for machines and equipment, also new landfill Cells have to be constructed as detailed in the main Kayin report.

CONCLUSION

At the moment the waste collection and disposal in all 3 towns is inadequate and create health risks, safety risks and environmental hazards for the population.

The proposed new ISWM system for all towns consists in:

- Improving primary collection system in the towns and transport to the landfills and composting sites;
- More efficient separation and collecting of recyclables, both through the informal sector and formal sector;
- Implementation of small Hospital Waste Incinerator in both towns;
- Introducing source separating organics (SSO) system for diverting large amounts of organic waste to the new planned Composting Plants;
- Implementation of a new Controlled Landfill for each town with bottom liner and leachate collection and treatment.

4.3 Conserving Heritage Buildings in Mawlamyine

4.3.1 THE RESOURCE

Mawlamyine currently has a rich built history which many other urban centres in the region have lost in their rapid desire to move to a "modern" city. There is a short window of opportunity (perhaps 5 years) during which there is time to conserve much of this heritage and then use or convert this resource to attract tourists and create related sustainable employment directly as guides/historians and indirectly through extra generated income in hotels, restaurants and travel related businesses. Several buildings currently in government use have the potential to be converted into more efficient and more appropriate working spaces better suited to modern needs. It would certainly be a cultural disaster to lose many of the old buildings and their settings. To do so would mean that Mawlamyine would become just another Asian city with little individual character or special reason to visit.

The country's tourism industry has seen major growth in recent years, in part brought about by economic and political reforms that have made the country an attractive tourism and investment destination. Figures for Mawlamyine show significant annual increases from 2011 – 14 of 32% for international and 18% for local visitors.

The 2013 – 2020 Tourism Master Plan (prepared by the Ministry of Hotels and Tourism) projects that there will be 7.5 million inbound visitors by 2020. If even a small proportion of these people visited Mawlamyine it would produce a massive boost for the local economy. Many of these tourists can now be more adventurous as the country becomes considered more safe and accommodating, while many restrictions on travel have also been lifted. The completion of the upgraded road link from the Thai border at Myawaddy/Mae Sot will further encourage visitors to Mawlamyine en route to Yangon or to the new destinations opening up to the south on the way to Dawei and beyond.

Mawlamyine has a number of attributes that provide it with plenty of potential to be a major historical attraction in its own right. These include:

- Its wide range of distinctive and strategically located religious buildings;
- Its connection with two famous authors, namely Rudyard Kipling and George Orwell;
- Its wealth of colonial secular and religious buildings, many of which are in need of significant renovation;
- Its attractive location on and views over the Thanlwin River which makes it an ideal location as a base for exploring the surrounding regional attractions; and
- The potential of Belu Kyun (Ogre Island) and its cottage industries which will become more accessible once the new bridge to the mainland is constructed.
- Mawlamyine is currently a Neglected Attraction. In 2014, the Union of Myanmar Travel Association (UMTA) noted that Mawlamyine (553 beds) was 14th in the list of bed numbers, behind places such as Pyin Oo Lwin (933 beds), Taunggyi (676) and Kalaw (636). This suggests that Mawlamyine, with the 5th largest urban population in Myanmar (2014 Census), is not currently fulfilling its full potential in attracting neither national or international visitors.

There is concern within the country that rapid unchecked development is already harming the physical and cultural environment in sensitive areas. In April 2015, the GoM released two heritage protection bills[1] that would help better protect heritage buildings and objects. The bills would protect "*more than 100-year-old buildings and antiquities across the country—either above or below the ground and water—that have historic, cultural, artistic, antique and archaeological values*."

4.3.2 FINDINGS TO DATE

The results from the investigations so far are:

- There are currently limited resources to renovate and/or convert heritage buildings.
- Many colonial era buildings are not fully appreciated by local people. For many in Mawlamyine these old buildings are simply places to stay and many are less comfortable than modern houses in which to live.
- There are hundreds of potential heritage (100+ years old) buildings/structures spread over a vast area within Mawlamyine, with a wide range of current government, religious, commercial and private uses.
- The pagodas and associated buildings on the ridge are significant in terms of their architecture and history. Given their geographical setting they form an important visitor attraction in their own right.
- There are a few colonial buildings of architectural merit remaining, but none on the scale of those which were constructed in Yangon.
- A number of mature trees have been retained in conjunction with several of the heritage attractions. They would also need to be protected in future as an integral part of each heritage building and its curtilage/habitat.
- Many buildings are still standing as no alternative economic use has yet been identified for them by the owners.

4.3.3 PROJECT PROPOSALS

The project recognizes that it is necessary to demonstrate that heritage buildings can be used (in their current form or as a conversion) to generate/raise economic activity by using them in a more efficient and more financially viable manner. It is not enough to appeal to an owner's good will. Owners must be convinced that a heritage building can be made more valuable/useful as it is rather than any other alternative potential use following its demolition. This argument will require the aid of both inducements and controls.

For Mawlamyine as a whole the purpose of any assistance would be to support the government's serious intention to raise the quality and future longevity of its built heritage which would then attract more visitors and investors to acquire and convert selected buildings to more economic uses (e.g. boutique hotels, restaurants

[1] Protection and Conservation of Ancient Buildings Bill and Protection and Conservation of Antiquities Bill

and professional offices). When successful, and at some point down the line it might be appropriate for the MSG to propose the inclusion of the town (or part of it, perhaps the ridge containing pagodas and monasteries) as a World Heritage Site[2]. That would lead to additional worldwide interest and increase the numbers of visitors to the area.

To support the MSG's desire to attract more visitors, as part of the PPTA the project team has compiled a register and photographic record of heritage buildings and groups of structures/attractions. This action has been supported by the Minister of Planning and Economic Development and a committee set up to provide inputs to this work. The output of this work is a book for international /local tourists in both Myanmar and English languages and an updateable database of structures. A copy is attached as an Appendix to this report.

The PPTA is therefore proposing the following:

4.3.4 TA FOR ESTABLISHMENT OF A NATIONAL HERITAGE CONSERVATION FUND

NEED FOR A HERITAGE FUND

The strategic rationale for the Heritage Fund TA is its focus on the nexus between four major essential stakeholder interests - tourism, key heritage buildings, associated municipalities, and local communities – to enhance local competitiveness through heritage-led development. Effective management of built heritage assets, urban regeneration, and enhanced heritage tourism are at the core of this project, with the goal being to have well functioning cities with an enabling environment for private sector investment, enhanced heritage buildings, and increased tourism. The proposed Heritage Fund TA will have two key development objectives: i)Objective 1: institutional capacity building for heritage-based economic development and ii)Objective 2: financing of conservation of heritage assets.

To meet the needs and to make an impact, it is initially proposed that the Heritage Fund be sized at $25 million.[3] It is envisaged that the Heritage Fund will be implemented through an application process.[4] Given the vast treasure of historical buildings in Myanmar, the Fund resources will not be sufficient to comprehensively address all the problems of physical and environmental degradation of Myanmar's heritage assets and deep institutional weaknesses. The Heritage Fund TA will therefore make some strategic choices in defining the scope of the Fund to maximize impact of its limited resources.

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[2] The example of Levuka, an historic port town in Fiji is very similar to Mawlamyine in its history and setting although Mawlamyine has significantly more varied buildings/culture and a longer more interesting history. Levuka was granted World Heritage listing in 2013. See http://whc.unesco.org/en/list/1399 for more details.
[3]The distribution of the Fund between the two objectives is preliminary envisaged to be 20%, or $5 million for Objective 1 and 80%, or $20 million for Objective 2.
[4]This application and selection process is described in more detail in the Project Administration section below.

Based on the work done to date under this PPTA, other ADB-related studies, interviews and literature review, this PPTA preliminarily recommends the following strategic choices. These strategic choices will be confirmed through the proposed Heritage Fund TA.

The first set of strategic choices relates more specifically to Objective 1: institutional capacity building for increasing heritage-based economic development.

Strategic Choice 1. Given that economic development falls under the purview of the regional governments, the Fund would build and leverage capacity of regional governments to respond to the varied ownership of heritage assets and the existing institutional structures and development regulations in Myanmar.

Strategic Choice 2. The Fund would assist select, potentially five, municipalities (and associated regional governments) with high concentration of historic buildings and high potential for tourism development initiate strategic plans for long-term rehabilitation of historic urban cores.

Strategic Choice 3. If needed, the Fund would finance critical infrastructures investments in these municipalities to make historic centers attractive to tourists, while at the same time improving the quality of local life and economic opportunity.

The next set of strategic choices relate more specifically to Objective 2: financing heritage building conservation and help define the ownership, level of funding and scope of projects that would be eligible for funding under the Heritage Fund TA.

Strategic Choice 4. Direct assistance will be limited by project and project type to ensure equitable distribution across assets and geographies. The Heritage Fund TA will provide a maximum financial contribution of $2 million per application. The work must directly relate to the conservation of the physical fabric of the built heritage building, and can include life-safety improvements.

Strategic Choice 5. Field research and interviews suggest that religious buildings, in general, have been maintained much better than government-owned buildings. It is therefore proposed that direct assistance be limited only to government-owned buildings.

Strategic Choice 6. To maximize the impact of the Fund, financing will be provided on a revolving loan basis of a proposed term of 7 years (with a 3 year grace period) and will require financial contribution of at least 20% from the Sponsor. This will ensure that the Heritage Fund is self-replenishing and the monies are used as a gap financing measure in combination with other sources of capital.

INPUTS

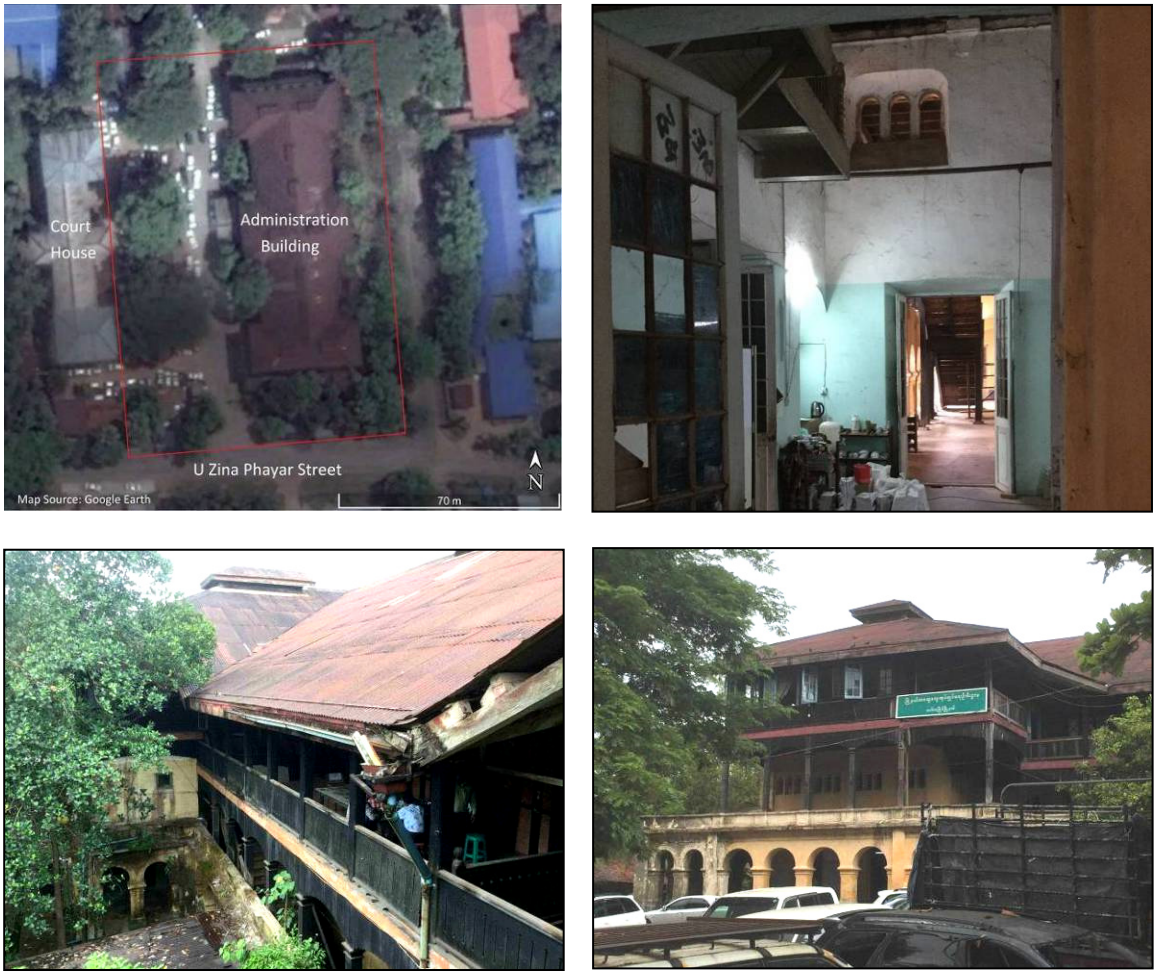
The Heritage Fund TA will be implemented over a 7-month period starting from the fielding of consultants. Costs for personnel and running costs for the 7 months study would be approximately $829,000 as detailed in the Mon State report.

4.3.5 PILOT STUDY FOR RENOVATING GOVERNMENT BUILDING

In order to demonstrate how the Restoration Fund can be initiated and used to renovate and to make buildings more efficient and useable, the Project is proposing

a pilot study based on the Administration complex in U Zina Phayar Street as depicted by the red line in **Figure 4-23**. The building is currently undergoing minor renovation works including painting, roof repairs and electrical upgrading.

Figure 4-23: GAD Building in U Zina Phayar Street



The current General Administration Department (GAD) building was originally the Courthouse and was shown on maps dating from 1876-77. The new and current Courthouse (to the left) was a later addition, probably in the late 1800's. The PPTA has sought the assistance of the Cities Development Initiative for Asia (CDIA) in progressing this proposal further. Their team has produced a number of concept ideas for the renovation and more efficient use of the building as shown for the preferred Scenario 2 on **Figure 4-24**.

The aim is to demonstrate a feasible development alternative that is respectful to the historic fabric and also provides more acceptable and affordable alternatives to residents compared to the common current practice of demolition and new build development.

SCENARIOS

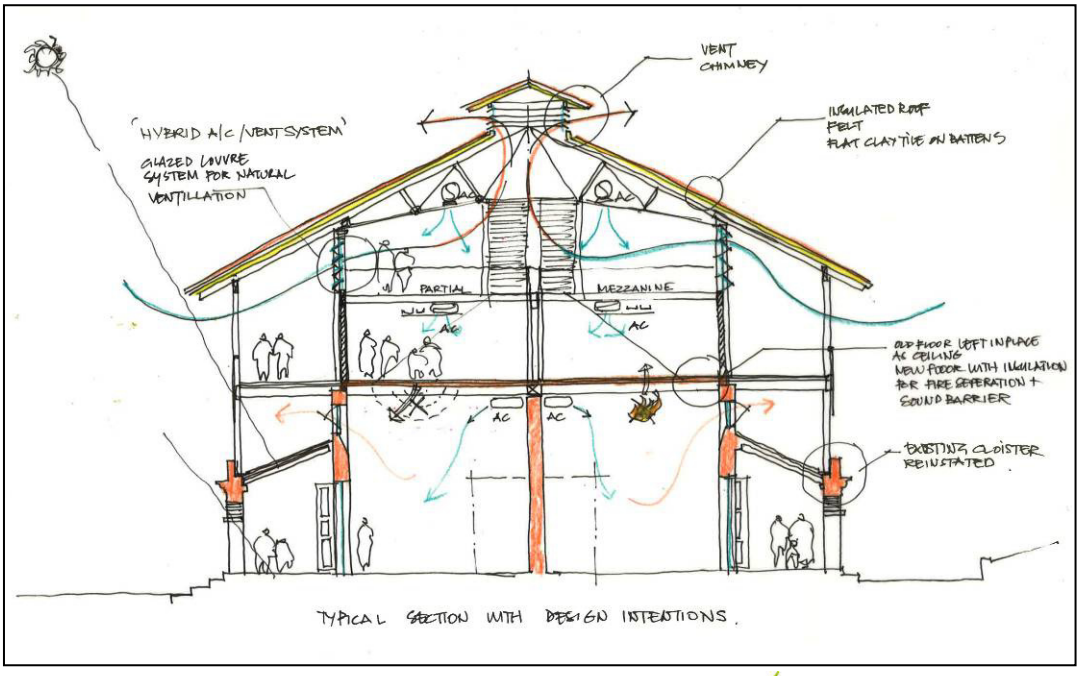
Three Scenarios have been considered for the future of the GAD building as shown on **Table 4-12** : "Do Minimal"; add Mezzanine floor; and Demolish and replace with a new construction.

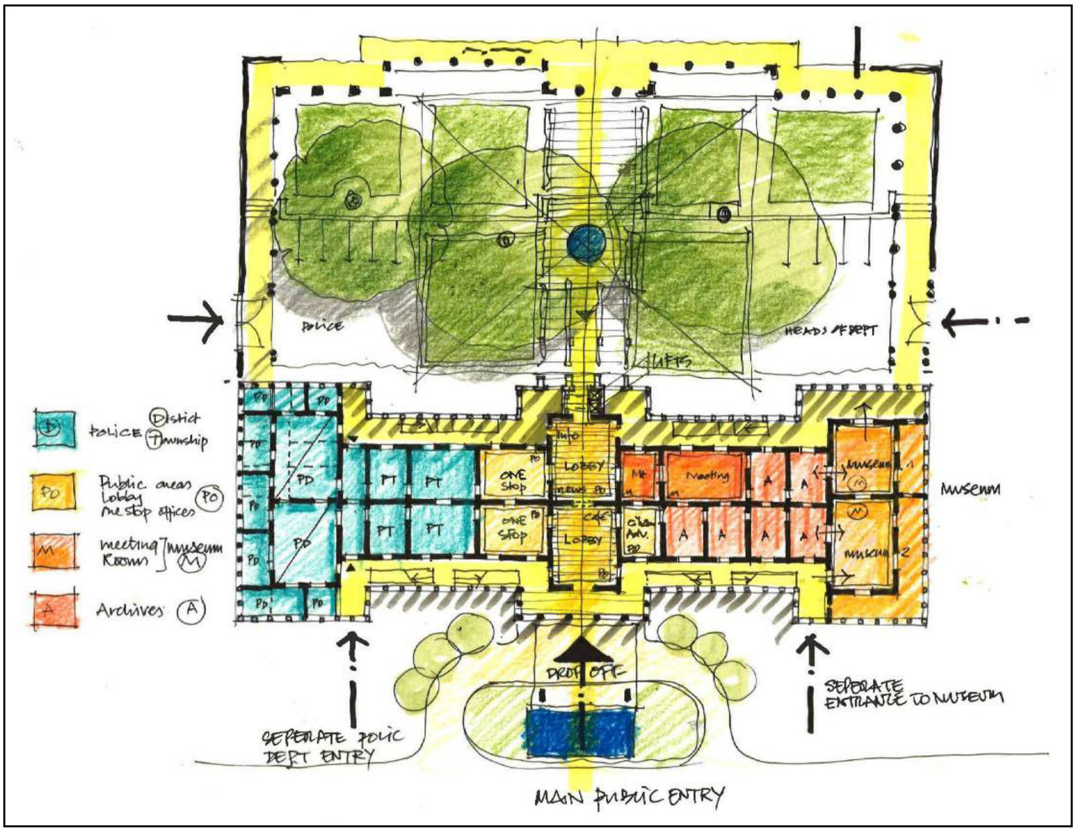
Table 4-12: GAD Building Scenarios Considered

One Stop Shop - District Level		Scenario 1 - "Do Minimal"		Scenario 2 - Mezzanine Rehabilitation		Scenario 3 - New Construction	
		Composition	MMK Million	Composition	Million	Composition	Million
Description		- Rehabilitation of existing building. - Efficiency improvements to accommodate all departments, excluding Education. - Courtyard enhancements		- Rehabilitation of existing building, including mezzanine. - Efficiency improvements to accommodate all departments. - Courtyard enhancements		- Demolition of existing building. - New Building to accommodate all departments. - Courtyard enhancements.	
Total Development Cost	MMK Million	1,547,925,935	94.4%	1,679,444,735	94.4%	3,904,942,500	93.5%
Financing Cost	MMK Million	91,200,000	5.6%	98,860,000	5.6%	272,300,000	6.5%
Total Loan Amount	% of proportion	1,639,125,935	100%	1,778,304,735	100%	4,177,242,500	100%
Amount USD (at MMK 1300/USD)		**1,260,866**		**1,367,927**		**3,213,263**	
Loan interest rate	p.a.	4.0%		4.0%		4.0%	
Inflation rate	p.a.	6.6%		6.6%		6.6%	
NPV and IRR Comparison		NPV	IRR	NPV	IRR	NPV	IRR
Financial		1,491,601,052	7.9%	3,094,694,735	10.8%	107,926,990	4.1%
Economic (Threshold IRR 12%)		(19,869,203)	11.9%	725,448,807	15.6%	(1,644,460,903)	7.4%

The figures show that it would be substantially more expensive to demolish (USD 3.2 million) and rebuild the complex to incorporate the same number of people and functions compared to the preferred Scenario 2 which would add more space (USD 1.4 million). There would be little cost difference (USD 0.1 million) in a "Minimal" compared to an approach which incorporated a mezzanine floor to the second floor to provide more useable office space (221 compared to 153 persons).

Figure 4-24: Concept Plan for Renovation of GAD Building




POLICE
HEADS OF DEPT
LIFTS
Police District Township
Public areas Lobby one stop offices
meeting Rooms
Museum
Archives
ONE Stop
LOBBY
Meeting
MUSEUM
DROP OFF
SEPERATE POLIC DEPT ENTRY
SEPERATE ENTRANCE TO MUSEUM
MAIN PUBLIC ENTRY

4.4 Mae Sot - Myawaddy Spatial Development Plan

The proposed project is to undertake a cross-border study to jointly revise and expand the existing Spatial Development Plans (SDP) for both Myawaddy and Mae Sot for reasons specified in the Main Report for Kayin State.

It is proposed that the loan will support such a study with the output being formal statutory plans to the year 2040 for the 2 towns endorsed and adopted by both governments as legal documents, at both local and central levels. Specifics are proposed in the Main Report for Kayin State and include:

The planning study will be undertaken jointly by staff from the Kayin State Government (KSG) (Myanmar) and Tak Province (Thailand) with support from both international and national consultants.

The study will involve capacity building of urban planning and related staff from both Myawaddy and Mae Sot through hands on training in spatial planning techniques, urban transportation, project identification, infrastructure, financial planning and GIS, directly related to the preparation of the plans.

Public participation throughout the planning process will be a key means of obtaining ideas and feedback on the planning process and outputs to date.

Central government agencies will have an overall supervisory role to ensure that national interests and concerns are considered and incorporated into the planning process and agreed outputs.

The plans will include a costed list of supporting projects for each future 5 year plan to year 2040.

The study is costed at $938,000 including $725,000 for consultants (International, Thai and Myanmar) and $113,000 for operational costs including equipment for local governments as well as workshops and exhibitions. Details are included in the Kayin State report.

4.5 Hpa-An Industrial Zone development plan

As mentioned in the previous chapter about projects identification, the Hpa-An Industrial Zone development plan would include:

- An update of local industrial strategy and investors prioritization;
- A list of actions to promote Hpa-An Industrial Zone;
- A feasibility study for infrastructure services, particularly for water supply and solid waste management within the IZ;
- A large amount of training and awareness sessions (functions expected from IZ, principle of local industrial development in growing globalized economies, investment promotion, etc.);
- financial and economic analysis;
- capital investment plans joint analysis of foreign case studies (e.g. Thailand, India, China, Vietnam, Cambodia);
- satisfaction / expectations surveys;

- workshops with State leaders, Union ministries, business community and donors.

A regional seminar to be held in Hpa An would be organized, opened to Union's and State organizations, companies identified as potential investors in Hpa An (as investors or service providers), and donors and national banks.

Details about this sub-project are developed in Kayin State report.

4.6 Capacity Building

4.6.1 CAPACITY ASSESSMENT

Township staff in all 3 towns are mostly involved in operational tasks, State staff concentrate on administrative ones. According to capacity assessments conducted among managers of State departments and Townships, Development Committees' Office (DCO) capacities are globally low. Respondents often point out their lack of knowledge and experience in project management. Poor equipment, rare large project opportunities have not enabled the situation to significantly improve in recent years in spite of increasing urban challenges. Moreover, data on salaries suggest that remuneration is not very attractive.

The main features of the capacity assessment are:

- Organization of agencies is relatively rigid. Merging or transforming an organization is not a frequent practice.
- Staff is significantly composed of women in State administrations, although the rate varies according to organizations.
- Commonly at management or administration levels, permanent staffs are graduated from university.
- Agencies deplore a lack of technical skills and of knowledge of innovative techniques.
- Interest of respondents to learn more in particular within DHUD and MS-DA, and expectations from the Capacity Building Program (CBS) are high.
- The administrations benefit of training programs organized by different ministries. However they take the only form of traditional courses.
- Lack of computers, connections, and equipment in general.

4.6.2 CAPACITY BUILDING STRATEGY

Capacity needs are high as expectations expressed by respondents as regards the Capacity Building Strategy (CBS). This CBS should also address institutional and organizational challenges / issues as highlighted by PPTA consultant (for instance Public Private partnerships (PPP) or local governance). Since the Union Government usually hesitates allocating a large part of loans to capacity building (usually understood as training only), the MS-CBS should be operational. Moreover, the CBS should not only target the strengthening of individual skills but also to strengthen institutions, in particular at the Township level, and to support both increased flexibility of organizations (e.g. merging agencies) and updating regulation.

The CBS should contribute locally to the implementation of the decentralization policy adopted by the Myanmar Government, to be likely confirmed after the recent elections. It will mainly target agencies such as Township Development Affairs

Office (XxT-DCO[5]). But Development Committee members should be welcomed to events organized (workshops, working groups, study works, etc.). The DUHD in both States should also be involved in CBS activities, and such activities should lead States to closely interact with Union's ministries in Nay Pyi Taw, in particular the MOC.

Also, the role of Community Based Organizations (CBOs), Non-Governmental Organizations (NGOs) and Wards is often unseen and unnoticed. Yet, many CBOs, NGOs and Wards administrations are key actors in urban management. Therefore, the CBS should support interactions between State and Township administrations on the one hand and Wards and CBOs/NGOs on the other.

CBSs mostly target both short-term and medium-term horizons. Its goals will be fourfold:

- Goal 1: improve capacities of State and Township agencies particularly involved in GMS 3 project implementation;
- Goal 2: strengthen capacities of T-DCO to operate and maintain the facilities constructed and financed by ADB loan, including PPP arrangements;
- Goal 3 (transversal): increase self confidence and motivation of the State/Township staff and local stakeholders (Ward representatives, CBOs, Is, residents, business community, etc.) to contribute collectively (and not separately) to a balanced development.
- Goal 4 (transversal): Develop further motivation of staff including promotion of women and, when necessary, encouraging ethnical diversification (Mon, Karen, Bamar) of positions occupied.

It is estimated that 100 to 140 staff from the Townships (mostly T-DCO) will directly benefit from the CBS and 40 to 60 from State Department, mostly Development Affairs (DA). Total number of persons to benefit from the CBS is larger, likely nearer 500 (other State and Township agencies, wards, CBOs, NGOs etc.), residents not included.

4.6.3 CAPACITY BUILDING STRATEGY IMPLEMENTATION

CBS is expected to last 5 years totally, but most of its activities will be implemented between year 2 and 3 (expectedly 2017 to 2018). In sectors targeted by the loan and by several CBS activities (water supply and solid waste), a private operator is expected to complement the action of the CBS.

CBS implementation will be managed by the PMO Director. To be more effective, the CBS should be designed simply and benefit of the strong assistance of Project Implementation Consultants (PIC). The CBS will require 81.5 MM international consultants (58.5 MM financed by the loan) and 117.5 MM national consultants (71.5 MM financed by the loan).

[5] These are referred to in the report as MaT-DCO (Mawlamyine), HpT-DCO (Hpa-An) and MyT-DCO (Myawaddy).

Apart from capacity building specialists to coordinate the Program, the PIC will recruit two International Young Professionals (IYP)[6]; their time being allocated 25% to CBS implementation (75% to support PMO/PIU and project implementation in general). Given the overall low capacities and the need for an extended CBS it makes sense to encourage long working relationships in a cost effective way.

It is also recommended PMU to contract with CBOs and NGOs active in the 3 towns to facilitate relations with local stakeholders during CBS implementation.

4.6.4 CAPACITY BUILDING / SUB-ACTIVITIES AND COSTS

The CBS is composed of four activities, most of them composed of sub-activities.

- Activity 1; Advance Assistance to Strengthen Capacities to Implement the Project. This activity will aim at providing training courses to familiarize IA/PMO staff with ADB requirements for GMS 3 project implementation.
- Activity 2: Technical Strengthening in House Technical Knowledge and Practice. Activity 2 will be composed of assistance to T-DCO to strengthen its daily technical capacities to manage water supply (Sub-activity 2.1) and solid waste services (Sub-activity 2.2.)
- Activity 3: Strengthening O&M of Urban Services by Involving the Private Sector. Activity 3 aims at attracting private qualified enterprises to manage water supply and solid waste services, and at assisting States and Townships to elaborate and monitor related PPP arrangements (and further ones). Activity 3 includes three sub-activities: Water Supply Management (Sub-activity 3.1.), Solid Waste Management (Sub-activity 3.2.) and Regulatory and Institutional Initiatives (Sub-activity 3.3.)
- Activity 4; Strengthening Urban (and Spatial) Planning. It aims at increasing capacities of the States to interact the Ministry of Construction's (MOC's) urban planners and its capacity to justify modifications / adjustments during urban planning process. Activity 4 also aims at developing awareness to urban planning in an economic perspective, in particular by impacting positively on urban heritage and tourism. Activity 4 will be composed Heritage promotion through building conservation in Mawlamyine. In Myawaddy the focus would be on urban planning in practice through the joint Myawaddy – Mae Sot spatial planning TA.

[6] All proposed International Young Professionals (IYP) will be aged 25 or less, with a BA/BSc or equivalent qualification and linked preferably with some practical field experience in the required subject. The IYP must be fluent in English and be prepared to study the Myanmar language both on and off-the-job to obtain a working knowledge within 12 months of the assignment commencing.
The IYPs will be attached to the PMO in each State and/or to a PIU in one or more of the 3 project towns. Apart from their specific roles the IYP will be expected to: support the PMO/PIU in the management and implementation of specific project components; providing feedback to nominated members of the managing contractor's staff; on-the-job training to PMU and/or PIU staff in their specialist subject; and informal on-the-job language exchange in Myanmar/English to raise the capabilities of the IYP and national staff;

In Mon State the Cost of Activities 1, 2 and 3 is estimated at 2,464,990 US$ (taxes included). These activities should be financed by GMS 3 loan. Cost of Activity 4 is estimated at 871,660 US$ to be financed by another source, possibly a CDTA. Total cost for Activities 1 to 4 is estimated at 3,336,650 $.

In Kayin State the Cost reaches 2,492,270 US$ (taxes included), to be financed by GMS 3 loan and 835,660 US$ to be financed by another source, possibly a CDTA. The detailed budget of KS-CBP is inserted into Appendix, as well as the estimate of the specialists' profiles required to implement this program. Total cost for Activities 1 to 4 is estimated at 3,327,930 $.

4.7 Project Implementation Consultants

For successful execution of the program, a Project Implementation Consultant (PIC) will be appointed to oversee all components of the work including design, DBO and other contract procurement and some field supervision activities. The Consultant will be selected following a competitive bidding process carried out in compliance with the ADB's current 'Procurement Guidelines' (2013, as amended from time to time) and related guidelines on the 'Use of Consultants by ADB and Its Borrowers' (2013, as amended from time to time).

Overall, the intent of the appointment will be ensure that the project is aligned with the GMS Strategic Framework [2012–2022] for facilitating cross-border trade, investment, and tourism and the GMS Regional Investment Framework [2013–2020]. These initiatives having been embraced by the ADB's own medium-term goal of promoting sustainable and inclusive economic growth in support of the government's objectives for poverty reduction and national reconciliation as outlined in the ADB's own Strategy 2020.

The PIC will be required to closely collaborate with the Project Management Offices [PMO] to be established separately under each of the recipient state governments [i.e. Kayin State Government or 'KSG' and Mon State or 'MSG'].These agencies are expected to be supported by experienced staff drafted in from the Ministry of Construction at the Union level. At the same time, the PIC must work closely with the Project Implementation Units to be created at the Township level in each region.

The PIC's responsibilities will extend into at least the following areas:

- Preparation of outline requirements and performance specifications for facilities[7] to be procured by DBO contract methods;
- Definition of the timeframes for both the design and operational phases of the above DBO contracts;
- Establishment of DBO bidding procedures acceptable to GoM and in compliance with ADB regulations;
- Assistance with the evaluation of bids and the subsequent appointment of the ''sponsors'' of the various projects/ packages.
- Development of design details and conventional tender documentation for other Works[8] and Goods [Shopping]- and additional Professional Services contracts if necessary;
- Assistance to PMOs and PIU's with the procurement of the above contracts using international and national bidding procedures;

[7] These are expected to be for the provision of particular water supply and solid waste management system components within the cities of Mawlamyine, Hpa-an and Myawaddy
[8] These are expected to be related to the provision of features relating to water storage facilities in the cities of Mawlamyine and Hpa-an.

- Construction / installation supervision of features included in non-DBO contracts [e.g. capacity improvements at reservoir sites].
- Management capacity assessment[9]and the development of training programs and the making of arrangements for the delivery of agreed training courses;
- Improved governance issues to ensure compliance with all procurement, policy / legal and institutional requirements;
- General oversight of safeguarding efforts in the areas of environmental, social, resettlement and indigenous people issues.

It is anticipated that the PIC's tenure will extend over a period of **7 years** starting in the **third quarter of 2017** [assuming the date of loan effectiveness to be in December of 2016 per Table 2 of the ADB's November, 2014 Concept Paper] and ending by **January, 2024.**

The estimated value of the PIC's contract is of the order of US$ 7.5 million excluding contingencies etc. using funds to be provided from the ADB's contribution to the project.

[9] Items of interest likely to include IT / data management systems, economic assessment, infrastructure maintenance and safeguard monitoring procedures

5 ENVIRONMENTAL ISSUES

5.1 Mon State

The Project intends to significantly improve the environmental conditions in Mawlamyine and the quality of life of its population through the improvement of water supply and solid waste facilities.

5.1.1 WATER SUPPLY

Water supply is presently insufficient in terms of serviced areas, service duration, quantities supplied and water quality. The Project beneficial impacts are the followings:

- Improvement of the water supply efficiency by the improvement of KhinPonChong reservoir water resource mobilisation;
- Improvement of public safety through the construction of a water treatment plant based on rapid sand filtration process with disinfection by chlorine;
- Improvement of water supply security by increasing the water supply storage capacity through (i) the construction of a new 4,000 m^3 new water storage, located next to the proposed water treatment plant and (ii) the rehabilitation of the 3 existing storages of Kan Thone Kan;
- Improvement of distribution networks and extension over the whole town of Mawlamyine (except the 12 wards in the North that would be managed by Thai Tap Water Company);
- Improvement of quality of life and reduction of public health risks related to water.

5.1.2 SOLID WASTE

Solid waste management is a major environmental issue in Mawlamyine where only 50% of the solid wastes are collected at present. The remaining 50% are dumped all over the city where the waste either decay with unpleasant smells and proliferation of insects or is burnt by the residents with emission of unpleasant and dangerous smokes as materials like plastics are also burnt. The collected waste is disposed in a large dumping site where it is regularly burnt in dry season and from where untreated leachates are discharged into the surface water bodies. Large quantities of waste are dumped into the storm drainage networks, clogging the drains and creating localised flooding during the rainy season.

The solid waste component beneficial impacts include:

- Improvement of quality of life and public health by (i) increasing the collection rate of solid waste in the city and (ii) improving collection points facilities;
- Improvement of storm drainage efficiency by reducing the amount of waste dumped in the drains and clogging the system;
- Reduction of water pollution load by improved collection rate and construction of a sanitary landfill with leachate collection and treatment;
- Reduction of air emissions and particularly GHG through (i) construction of a composting plant on the landfill site and (ii) collection of landfill gas and flaring;

- Improvement of waste recycling efficiency resulting in secondary beneficial environmental impacts through significant avoidance of GHG emission;
- Reduction of public health risk particularly among the population of waste pickers through the construction of an incinerator facility for the treatment of medical waste from the several hospitals and clinics and presently disposed in the dumping site without any precautionary measure.

The proposed acquisition of private land (3.7 acres or 1.5 ha) to build the future sanitary landfill near MuYong Village in Kyaikmayaw is only involving agricultural land. Then it will affect no household.

The only affected households are the wastepickers living in the existing dump site area that will be closed. Details regarding their affectation are available in resettlement plan report.

5.1.3 HERITAGE BUILDINGS

The built heritage in Mawlamyine is represented by Mon buildings dating from several centuries ago up to the British colonial era, with most of the latter in very poor condition. The project intends to stimulate the rehabilitation of such buildings with the objectives to:

- improve the general urban landscape and city beautification;
- stimulate the returns from the development of tourism;

None of the Project components requires land acquisition as the proposed pilot study is located on Mon Government land and involves mostly internal works with some paving of an outside courtyard.

None of the Project components involves significant forest clearing or encroachment into wetland or other conservation area.

5.1.4 CLIMATE CHANGE

Following the principles of Green Cities, the project will support innovation with the construction of the first composting plant in Myanmar, attached to the landfill and will equipped the proposed new landfill with a system of gas collection and flaring. When compared with the situation without project, the solid waste component of the Third GMS in Mon State shall reduce the annual emissions of GHG from generated waste by more than 42,000 t CO2-eq/year in 2020 and even by 132,000 t CO2-eq/year in 2040 when compared to a situation without Project. From 2016 to 2040, the reduction of cumulated GHG emissions shall be reduced by more than 2 million tons CO2-eq.

The IEE also considered climatic trends at the national, regional and local scale in Myanmar and more specifically in Mawlamyine for which long term climatological data is available. Both temperature and rainfall show increasing trends in Mawlamyine along the last 50 years of observations, in line with MOECAF trend analysis for Mon State. Annual rainfall increased by 500 mm over a 50 years period, or a raise of about 100 mm/decade. The month of July shows the highest raise during the 50 years period, about 300 mm, followed by May with 120 mm. Other months are almost stable or show only slight increase.

Temperature also increased over the same period. The average annual maximum temperature rose by 1.1°C over the last 48 years, or an increase of about 0.23°C per decade, a value significantly higher than what is considered in the Mon State

(0.14°C increase per decade). July and November are the months showing the highest raise over the period, about 2°C. According to IPCC, sea level rise could reach 0.82 m by the end of the century. The present project considers a safety over-elevation of 1 meter as a design criteria for concerned project components, to avoid long term flooding risk.

5.1.5 ENVIRONMENTAL IMPACTS

The results of AWARE were considered in the preparation of the IEE Report. In this connection, climate change and natural hazards considerations had been incorporated in the IEE. AWARE was used by ADB to undertake an initial climate risk screening exercise. The results had rated the project as MEDIUM RISK and have identified flooding and landslide as a high level risk factor as the project is located in a region which has experienced recurring flood events in the recent past. However, the effective risk level is dependent on local geographical factors. On this basis, due to the location of Mawlamyine in a flat or smoothly undulating area, the risk for landslide may be considered as low. Mawlamyine experiences infrequent flooding mainly localized next to the Thanlwin River which may affect the strand road, but hardly more of the urban area as the elevation raises quickly by several meters. None of the Project sub-component is localized in flood prone area. The WTP, located next to the KhinPonChong reservoir is designed to be higher than the maximum elevation of water in the reservoir. The Project components shall not be affected or put at risk by climate change.

A screening carried out during the Interim phase of the Project confirmed that environmental impacts raised by the project were either very beneficial or mainly related to the risks of nuisances during the construction phase and easily controllable by appropriate construction site supervision and conventional mitigation measures. Consequently, the proposed categorisation of the Project was B, involving the preparation of the present IEE. The conclusions of the present report confirm this initial categorization as category B Project.

Aside from the several and undisputable beneficial impacts of the Project in Mawlamyine, some potential risks of limited impacts are still to be considered should the management program anticipated be deficient:

- Appropriate operation and maintenance of the incinerator, particularly of the furnace temperature and of the stacks filters is required to ensure no hazardous air contamination results from the process. The EMP recommends long term monitoring of air emissions as part of the routine O&M activities.
- Most of the anticipated environmental and social impacts are related to nuisances which may happen during the construction activities. Because of the project located in an urban environment, risk of nuisances is higher: traffic congestion, temporary alienation of access, temporary disruption of community facilities, noise and engine gas and dust release may temporarily disturb the nearby communities. However, recommendations formulated in the present EMP combined with a solid environmental contractual framework and an effective inspection and supervision of construction sites will definitely reduce these risks to acceptable levels.

The EMP also emphasizes the low level of consideration for occupational health and safety (OHS) in Myanmar but also in Mawlamyine nowadays. Construction sites generally ignore safety signals, personal or collective protections for workers, safety belts, EHS awareness training, public safety measures for activities in populated areas etc. This situation is not compliant with the EHS requirements of international

lending organisations as the ADB. For that reason, the EMP emphasises (i) the need for EHS capacity building for MTDC, the PMO and the PIU staff, (ii) the need for very strict and detailed EHS specifications for the tender documents and (iii) the need for strict EHS enforcement through monitoring of construction activities.

5.2 Kayin State

The Project intends to significantly improve the environmental conditions in the two towns of Hpa-An and Myawaddy and the quality of life of its population through the improvement of water supply and solid waste facilities.

5.2.1 WATER SUPPLY

Water supply is presently insufficient in terms of serviced areas, service duration, quantities supplied and water quality. The expected beneficial impacts of the projects are the following:

In Hpa-An:

- Improvement of the water supply efficiency by the mobilisation of new water intake in Thanlwin River;
- Improvement of water supply security by increasing the water supply storage capacity in Hpa-An through the construction (i) of a new 3,000 m^3 water storage on Bare Mae Hill in replacement of 3 old reservoirs and (ii) of a new 3,000 m3 reservoir on Kyar Inn Mountain;
- Improvement of public safety through the construction of a water treatment plant with a capacity of 10,000 m3/day (and a possibility to extend to 18,000 m^3/d in a second phase), based on rapid sand filtration process with disinfection by chlorine;
- Creation of transmission lines and distribution lines including 21.2 km of transmission lines and main networks (diameters from 200-400 mm) and 79.1 km of distribution system (including tertiary networks <= 200 mm). The project would also include a fund to finance over 10 000 new connections.

In Myawaddy:

- Improvement of the water supply efficiency by the mobilisation of new water intake by infiltration gallery near Thaungyin (Moei) River;
- Improvement of water supply security by increasing the water supply storage capacity in Myawaddy through the construction of a new 4,500 m^3 water storage;
- Improvement of public safety in Hpa-An and Myawaddy through the construction of a water treatment plant, with a capacity of 9,000 m3/day, based on rapid sand filtration process with disinfection by chlorine;
- Rehabilitation and expansion of distribution network in wards 1,2,5 and a part of ward 4.

5.2.2 SOLID WASTE

Solid waste management is a major environmental issue in Hpa-An and Myawaddy where only respectively 35% and 50% of the solid wastes are collected at present. The remaining 50% are dumped where the waste either decays with unpleasant smells and proliferation of insects or is burnt by the residents with emission of

unpleasant and dangerous smoke as materials like plastics are also burnt. The collected waste is disposed in Hpa-An in a dumping site where it is regularly burnt in the dry season and from where untreated leachates are discharged into the surface water bodies. In Myawaddy, collected waste is dumped in 3 sites. Two of them are located within the urban area along the Thaungyin River and a new dump site has been recently created west of the city. Large quantities of waste are dumped into the storm drainage networks, clogging the drains and creating localised flooding during the rainy season.

The solid waste component beneficial impacts include:

- Improvement of quality of life and public health by (i) increasing the collection rate of solid waste in the city and (ii) improving collection points facilities;
- Improvement of storm drainage efficiency by reducing the amount of waste dumped in the drains and clogging the system;
- Reduction of water pollution load by improved collection rate and construction of a sanitary landfill with leachate collection and treatment in each town;
- Reduction of air emissions and particularly GHG through (i) construction of a composting plant on the landfill site and (ii) collection of landfill gas and flaring;
- Improvement of waste recycling efficiency resulting in secondary beneficial environmental impacts through significant avoidance of GHG emission;
- Reduction of public health risk particularly among the population of waste pickers through the construction of an incinerator facility in each town, for the treatment of medical waste from the several hospitals and clinics and presently disposed in the dumping sites without any precautionary measure.

With the exception of Hpa-An new storage on Kyar-Inn mountain located on lands owned by monastery communities but presently unused, none of the other Project components requires land acquisition as they are all developed on Hpa-An or Myawaddy TDC land or on Kayin State Government land. Water distribution networks are located in public areas (roads and streets).

The affected households are the wastepickers living in the existing dump sites areas that will be closed. Details regarding their affectation are available in resettlement plan report.

None of the Project components involves significant forest clearing or encroachment into wetland or other conservation area. Only few urban trees may be cut depending on the detailed design of each component, but EMP shall limit the cutting and impose the plantation of 2 new trees per cut tree.

5.2.3 CLIMATE CHANGE

Following the principles of Green Cities, the project will support innovation with (i) the construction of the first composting plant in Myanmar, attached to the landfill of each city and (ii) the equipment of each proposed new landfill with a system of gas collection and flaring. When compared with the situation without project, the solid waste component of the Third GMS in Kayin State will reduce the annual emission of GHG from generated waste in 2020 by 13,500 tons CO2-eq/year for Hpa-An and by 18,500 tons CO2-eq/year for Myawaddy. GHG abatement shall reach in 2040 42,500 tons CO2-eq/year for Hpa-An and 66,700 tons CO2-eq/year for Myawaddy.

The IEE also considered climatic trends at the national, regional and local scale in Myanmar and more specifically in Hpa-An for which long term climatological data is available. Both temperature and rainfall show increasing trends in Hpa-An along the last 50 years of observations, in line with the MOECAF analysis for the Kayin State. Annual rainfall didn't change significantly over the last 50 years. Among the wet season months (May to October), only the months of June, July and September show an increasing trend, with July showing the highest raise during the 50 years period (about 120 mm, or 24 mm per decade).

Temperature rise was more significant during the same period. The average annual maximum temperature increased by 2,2°C over the last 48 years, or an increase of almost 0,5°C per decade, a value significantly higher than what is considered as an average increase in the Kayin State (0.32°C per decade). July and February increased by about 4°C during the period while the other dry season months increased by 2 to 3 °C. Wet season temperature increase was only about 1°C during the same period.

5.2.4 ENVIRONMENTAL IMPACTS

The results of AWARE model were considered in the preparation of the IEE Report. In this connection, climate change and natural hazards considerations had been incorporated in the IEE. AWARE was used by the ADB to undertake an initial climate risk screening exercise. The results had rated the project as MEDIUM RISK and have identified flooding and landslide as a high level risk factor as the project is located in a region which has experienced recurring flood events in the recent past. However, the effective risk level is dependent on local geographical factors. On this basis, due to the location of Hpa-An and Myawaddy in flat or smoothly undulating areas, the risk for landslide may be considered as low. Hpa-An experiences infrequent flooding mainly localized next to the Thanlwin River where the water intake is located and around the central lake (which level might varies according to Thanlwin river level) near which the WTP is located. Myawaddy experiences also some flooding along the Thaungyin (Moei) River. Both sub-components integrate flood level constraints into their design, including a safety board for climate change risk. Following such design principles, the Project components shall not be affected or put at risk by climate change.

A screening carried out during the Interim phase of the Project (based on Rapid Environmental Assessment –REA- checklists of the ADB) confirmed that environmental impacts raised by the project were either very beneficial or mainly related to the risks of nuisances during the construction phase and easily controllable by appropriate construction site supervision and conventional mitigation measures. Consequently, the proposed categorisation of the Project was B, involving the preparation of the present IEE. The conclusions of the present report confirm this initial categorization as category B Project.

Aside from the several and undisputable beneficial impacts of the Project in Hpa-An and Myawaddy, some potential but limited risks are still to be considered should the management program anticipated be deficient:

- Appropriate operation and maintenance of the incinerator, particularly of the furnace temperature and of the stacks filters is required to ensure no hazardous air contamination results from the process. The EMP recommends long term monitoring of air emissions as part of the routine O&M activities.
- Most of the anticipated environmental and social impacts are related to nuisances which may happen during the construction activities. Because of the

project located in an urban environment, risk of nuisances is higher: traffic congestion, temporary alienation of access, temporary disruption of community facilities, noise and engine gas and dust release may temporarily disturb the nearby communities. However, recommendations formulated in the EMP combined with a solid environmental contractual framework and an effective inspection and supervision of construction sites will definitely reduce these risks to acceptable levels.

The EMP also emphasizes the low level of consideration for occupational health and safety (OHS) in Myanmar but also in Hpa-An and Myawaddy nowadays. Construction sites generally ignore safety signals, personal or collective protections for workers, safety belts, EHS awareness training, public safety measures for activities in populated areas etc. This situation is not compliant with the EHS requirements of international lending organisations as the ADB. For that reason, the EMP emphasises (i) the need for EHS capacity building for MTDC, the PMO and the PIU staff, (ii) the need for very strict and detailed EHS specifications for the tender documents and (iii) the need for strict EHS enforcement through monitoring of construction activities.

6 POVERTY AND SOCIAL ASSESSMENT

6.1 National Poverty Context

Myanmar is one of the poorest countries in the South East Asian region and has certain features that are unique to its country context. In 2013/14, the country's GDP was estimated at US$56.8 billion. Based on the preliminary population figure of 51.4 million from the census conducted in March/April 2014, the country's per capita income is therefore around US$1,105, one of the lowest in the East Asian region. Analysis of the last nationwide Integrated Household Living Conditions Assessment (IHLCA) conducted in 2009/10, found that 26 percent of the population was living below the poverty line[1].

Myanmar has been fully committed to the Millennium Declaration and its eight Millennium Development Goals (MDGs), with targets set for 2015. Following from the MDGs, seventeen Sustainable Development Goals (SDGs) have been adopted by United Nations Member States in September 2015. Achievement of the SDGs will be pursued for the next 15 years.

6.2 National Mechanisms for the Advancement of Women

Myanmar is a signatory to the Convention on the Elimination of Discrimination against Women (CEDAW) (1997), and is committed to international policy initiatives to improve the situation of women, including the Millennium Development Goals, the Beijing Declaration and Platform for Action (BPFA), and the International Conference on Population and Development (ICPD). Myanmar is an active member of ASEAN Commission on Women and Children's Rights and the ASEAN Committee on Women.

The National Strategic Plan for the Advancement of Women (NSPAW) 2013 – 2022 (NSPAW) covers key areas of the Beijing Platform for Action, and outlines a comprehensive approach for the Union Government to improve the situation of women and girls in the country. The Ministry of Social Welfare, Relief and Resettlement is the focal ministry for Women's Affairs.

6.3 Project Socio-Economic Context

6.3.1 MON STATE

According to the 2014 National Census[2], Mon State has a total population of approximately 2 million people comprised of 422,632 households with a population

[1] Integrated Household Living Conditions Survey in Myanmar (2009-2010): Poverty Profile. Prepared jointly by MNPED, UNICEF, UNDP, and SIDA, 2011.
[2]The 2014 Myanmar Population and Housing Census Mon State Census Report Volume 3 – J

density of 167 people per Km^2. There are 93 males for every 100 females. 28% of households are female headed. 62% of the population falls into the economically productive age between 15 and 64 years of age, with 31% of the population aged 14 and under. 89.5% of males and 84% of females are literate.

Mon State is the country's third wealthiest Region with a poverty incidence of 16.3% (behind Yangon Division at 16.1% and Kayah State at 11.4%) and tends to fare above the national average on social development indicators. Census figures indicate that over 400,000 residents of Mon State live outside Myanmar, with the largest percentage by far residing in Thailand. The migrants are predominantly men as shown in **Table 6-1**.

Table 6-1: Mon State Residents Living in Other Countries

	Country of residence									
	Total	**Thailand**	**Malaysia**	**Singapore**	**China**	**Japan**	**Korea**	**India**	**USA**	**Other**
MON State	**426,586**	**385,487**	**32,620**	**4,342**	**405**	**189**	**862**	**53**	**957**	**1,671**
Male	245,564	214,432	25,109	3,236	196	107	838	48	573	1,025
Female	181,022	171,055	7,511	1,106	209	82	24	5	384	646

Source: 2014 Mon State Census Report

CONFLICT[3]

With a diverse population comprising Mon, Bamar, Kayin and Pa-O people, Burmese and Mon languages are the most prominent. The security situation has stabilized following the ratification of a ceasefire agreement between the Union government and the Mon National Liberation Army (MNLA) - a non-state armed group - in 2012, and the state is now experiencing a new period of stability and engagement between government and non-state actors.

6.3.2 KAYIN STATE

According to the 2014 National Census[4], Kayin State has a total population of approximately 1.6 million people comprised of 308,041 households with a population density of 52 persons per Km. There are 97 males for every 100 females. 26% of households are female headed. 59% of the population falls into the economically productive age between 15 and 64 years of age, with 36% of the population aged 14 and under. 78% of males and 71% of females are literate. The mean household size is 4.7 persons.

Kayin State is the fifth most affluent State or Region in the country after Kayah State, Sagaing Division, Yangon Division and Mon State. Census figures indicated that over 320,000 residents of Kayin State live outside Myanmar, with the largest

[3]The State of Local Governance: Trends in Mon. UNDP Myanmar 2014
[4]Department of Population, Ministry of Immigration and Population 2014; Population and Housing Census of Myanmar. 2014.

percentage residing in Thailand. Migrants are predominantly men as shown in **Table 6-2**.

Table 6-2: Kayin State Residents Living in Other Countries

	Country of residence									
	Total	**Thailand**	**Malaysia**	**Singapore**	**China**	**Japan**	**Korea**	**India**	**USA**	**Other**
KAYIN	**322,761**	**304,980**	**12,864**	**1,150**	**57**	**56**	**167**	**44**	**2,097**	**1,346**
Male	173,430	160,935	9,764	553	29	34	159	39	1,193	724
Female	149,331	144,045	3,100	597	28	22	8	5	904	622

Source: 2014 Kayin State Census Report

CONFLICT[5]

As part of the current political changes, serious negotiations have led to a ceasefire agreement with the KNU, and an end to this long-lasting civil war seems to be in sight. The KNU has modified its stance from demanding outright independence to autonomy within "federalism". A KNU liaison office was opened in Hpa-An in 2012, where representatives from the ethnic armed organizations group interact with those of the Myanmar government. Yet, physical safety remains a key concern and the possible return of up to 100,000 refugees from Thailand presents an imminent challenge to the socio-economic infrastructure of Kayin, which may not be capable of accommodating a large increase in numbers of landless returnees.[6]

6.4 Project Towns

6.4.1 MAWLAMYINE

The 2014 Census lists the total population of Mawlamyine as 289,388 with a sex ratio of 92.5. 31.6% of conventional HHs are female-headed, which is higher than both the national and the Mon State levels as seen in **Table 6-3**

Table 6-3: Mawlamyine Population and Households (HHs)

	Both sexes	**Males**	**Females**	**Sex Ratio**
Total Population	289,388	139,026	150,362	92.5
	Number	**Male headed**	**Female Headed**	**% FHH**
Households	57,457	39,309	18,148	31.6

Source: 2014 Mon State Census Report

[5]The State of Local Governance: Trends in Kayin. UNDP 2014
[6] Ibid.

6.4.2 HPA-AN AND MYAWADDY

The 2014 Census lists the total population of Hpa-An 421,575 with a sex ratio of 93.7. 28 % of conventional HHs are female-headed, which is higher than the Kayin State levels

The 2014 Census lists the total population of Myawaddy 195,624 with a sex ratio of 104. 18 % of conventional HHs are female-headed, which is lower than the Kayin State levels.

Details are described in **Table 6-4**.

Table 6-4: Hpa-An and Myawaddy - Population and Households (HHs)

Total Population	Both sexes	Males	Females	Sex Ratio
Hpa-An	421,575	203,910	217,665	93.7
Myawaddy	195,624	99,771	95,853	104.1
Households	**Number**	**Male headed**	**Female Headed**	**% FHH**
Hpa-An	89,197	64,264	24,933	28
Myawaddy	41,258	33,759	7,499	18.2

Source: 2014 Kayin State Census Report

6.5 Health in Project Towns

Dengue is prevalent in project towns, with Mon State having the highest rate of infection in some years, followed by Yangon Region and Kayin State. The Ministry of Health has a house-to-house dengue prevention program in place, working with communities to reduce the incidence of dengue. Hpa-An has experienced relatively high rates of HIV/AIDS infections and deaths, while Mawlamyine reporting no cases. The Government of Japan has initiated a GMS HIV/AIDS reduction initiative.

6.6 Project Social Strategy

6.6.1 BACKGROUND

Due to the history of conflict and continuing distrust of Union government intentions, lack of community consultation will prove a real risk to project success and sustainability, even for obvious improvements such as water supply. For many years, Myanmar has pursued a top-down administrative model. Only recently has this been under revision, with the result that new organizational options are available, ones that build on transparency and social accountability where, recognizing the need for cost effective results and sustainability, the opinions of beneficiaries are sought, increasing agency accountability to the public.

6.6.2 BUILDING SOCIAL CAPITAL

As referenced in the Project Concept Note, care must be taken to ensure that the project is in line with the government's reform efforts in the areas of political reform, national reconciliation, transitioning to a democratic political system, achieving sustained peace with the ethnic insurgencies and addressing communal tensions. The project team will need to deepen its understanding of the complex

issues underlying ethnic tensions in the project area and apply a conflict sensitive approach in preparation and implementation of the project.

6.6.3 PROJECT SOCIAL STRATEGY

The project social strategy is based on developing a series of stakeholder participation approaches including capacity building, consultation and monitoring and evaluation (M&E). One of the challenges is the perception of government staff on the one hand and citizens on the other hand about the meaning and extent of citizen participation in public affairs[7]. While there are several practical challenges for enhancing participation in decision-making, an important contribution of the project will be to facilitate the flow of project information between state government (Development Affairs) and citizens concerning project investments and implications (potential fees, citizen's roles and responsibilities, etc.)

The project proposes to build capacity of local CSOs/NGOs to act as facilitators for consultations between Development Affairs (DA) staff and communities, as well as providing capacity building in consultation approaches and methods for DA staff/Township DA Committees/Ward elected and appointed members. The focus of the activity will be on raising public awareness about project designs and implementation as well as strengthening the capacity of DA to engage with communities in the future.

The project will introduce models of engagement to provide the basis for continued discussions between government and communities, service providers and service users. Models might include Community Scorecards or Community Dialogues to articulate shared development goals and agree on a mutual understanding of how the various parties would achieve these objectives as a first step to establishing trust between citizens, government and non-state actors to achieve sustainable development.

6.6.4 PRO-POOR DESIGN MEASURES

These (e.g. subsidies and/or socialized tariffs) have been included to ensure inclusivity of poor and vulnerable resident access to project water supply and other improved municipal services. Pro-poor livelihood support programs such as recycling will be strengthened and targeted employment opportunities (i.e. waste-pickers) made available to vulnerable residents, including women and the poor. The role of CSOs/NGOs will be enhanced through M&E capacity building to track project results on equity and inclusion of all socio-economic and ethnic groups.

6.7 The Stakeholder Communication Strategy

The Stakeholder Communication Strategy (See Appendix) provides overall guidance for the design and implementation of public information and awareness raising programs. Specific communication methods and culturally appropriate delivery mechanisms will be developed during Project implementation. These should be gender sensitive i.e. consistent with women's roles, responsibilities and interests.

[7] UNDP. Governance in Mon State.

The main project stakeholders are:

- Department of Urban Housing Department (DUHD) of the Ministry of Construction;
- Mon and Kayin State Governments, particularly Development Affairs at the State and Township level in Mawlamyine, Hpa-An, and Myawaddy;
- ward administrators/committees;
- urban residents;
- civil society organizations; and
- private sector entities where project components will be located.

The project communication strategy is based on three key elements:

- The development of appropriate methods to disseminate project information from design through implementation, seeking to increase public engagement and buy-in;
- With the support of CSO/NGO facilitators, creating a conduit for two-way flow of information between government and other stakeholders; and
- Increasing public awareness of the 3Rs and non-wasteful water use to encourage behavioral change leading to a better urban environment.

Project benefits will be maximized when the population affected by project investments is informed and engaged. Through consultation and awareness-raising, HHs can be encouraged to:

- Show a willingness-to-pay for well-managed and fully operational urban services;
- Ensure the integrity of water supply pipes and solid waste operations;
- Desist in throwing garbage into rivers, lakes and other water bodies;
- Increase recycling and reuse;
- Understand causes of water pollution and the dangers of using polluted water for HH consumption;
- Recognize the dangers of groundwater pollution especially for bore well users.

6.8 Gender and Social Action Plan

The project is classified as Effective Gender Mainstreaming (EGM). Gender equality will be integrated into the project as a crosscutting measure, especially since women are the primary users and beneficiaries of improvements in urban services, leading to improved health for their families and more time for women to expend on other activities of benefit to the household and society.

The gender and social analysis identified potential risks and mitigation measures for social issues (HIV/AIDS, human trafficking and discrimination on economic or ethnic grounds) and gender inequality. A Gender and Social Action Plan was prepared to promote women as project beneficiaries through female participation in:

- Consultations with the business community concerning Industrial Zones;
- Community discussions/consultations on the design and implementation of urban services improvements;

- Mon and Karen State government capacity building activities;
- Priority employment in solid waste management;
- Project capacity building in consultation methods, M&E, water system and solid waste management;

A Gender and Social Action Plan (GAP) is replicates the outputs of the project Design and Monitoring Framework (DMF), Identifying specific gender strategies, proposed measures and targets and implementation agency/unit responsible to achieve gender equity for each output (See Appendix 6). Gender awareness and GAP implementation training will be provided to all Project Management Unit (PMU) and Project Implementation Unit (PIU) members. An international community engagement specialist (3 pm) and a national community engagement specialist (12 pm) will integrate gender into all consultation/M&E capacity building activities through training method design and delivery. A national gender specialist (6 pm) will provide gender awareness and training in GAP implementation, monitoring and reporting.

The Summary Poverty Reduction and Social Strategy is found in the Appendix 5 of this report.

7 SOCIAL SAFEGUARDS

7.1 Land Impacts and Resettlement

Based on the preliminary design of the project's interventions, the inventory of loss has been carried out by Social Safeguard Team with participation of Engineer Team and officers of State Development Committees and Township Development Committees.

The total of land that would be affected by the Project's Components is 108.69 acres; of which, Project's Components in Mon state would acquire 49 acres while land that would be affected by Project's Components in Kayin state is 59.69 acres. Land acquisition by the Project's Components in Mon and Kayin states are as below:

- Water Supply: Total of land area that would be affected by Water Supply component is 4.69 acres (1.0 acres in Mon state and 3.69 acres in Kayin state). For the component, land is required for installing of intake facilities, storage facilities and water plants. Replacement and extension of water distribution pipe systems do-not acquire land because the systems are along the road-sides, construction period is just for few days in each ward and the width of alignment excavation is less than one-meter.
- Solid Waste Treatment Centres and Collection Disposal: The Component would require 104 acres (48 acres in Mon state and 56 acres in Kayin state). Land would be acquired for constructions of composting plants and sanitary landfills.
- Cultural Heritage Rehabilitation: The Component does not require any land as the interventions will be for the complex that consists of two existing buildings.

The summary of the affected lands is described in Table 7-1 below.

Most of affected land is owned by State Governments, State Development Committees and Township Development Committees (103.65 acres, accounting for 95.4% of the total affected land). 5.04 acres of affected land (4.6% of the total affected land) is under private ownership (4.6 acres are owned by a household near Mawlamyine existing dump site, 0.4 acres is used by a meditation centre in Hpa-An and 0.04 acres are owned by a household near Myawaddy future intake (no land acquisition but on the path of the intake pipeline)).

Table 7-1: Summary of affected land by components and by city

	Mawlamyine	Hpa-An	Myawaddy	Total
Water supply	1 ac (0.4 ha)	1.65 ac (0.67 ha)	2.037 ac (0.82 ha)	4.69 ac (1.90 ha)
Solid waste	48 ac (19.42 ha)	25 ac (10.12 ha)	31 ac (12.55 ha)	104 ac (42.09 ha)
Total	49 ac (19.82 ha)	26.65 (10.78 ha)	33.037 (13.37 ha)	108.69 ac (43.98 ha)

7.2 Resettlement Principles and Entitlements

Myanmar does not have any consolidated policy or law governing all aspects of involuntary resettlement. However, provisions of the Land Acquisition Act and other regulations cover some aspects of land acquisition and resettlement. A summary of key legal provisions relevant to land acquisition and resettlement is provided as followings:

- The 2008 State Constitution: The 2008 State Constitution of the Republic of the Union of Myanmar in Chapter I of the Basic Principles of the Constitution, Section 37, Sub-Section (a) declares that the State "is the ultimate owner of all lands and all natural resources above and below the ground, above and beneath the water and in the atmosphere in the Union". While the 2008 constitution provides for citizens the right of private property, right of inheritance, and the right to settle in any place within country, these rights are subject to "existing laws". Among other, these existing laws include: (i) The land Acquisition Act (1894) empowering the State to acquire land where it is needed for public purposes; (ii) The Lower Burma Town and Village Act 1899; (iii) The Towns (amendment) Act 1947; and (iv) The Village (amendment) Act 1961.
- The Land and Revenue Act (1879): Under the Land and Revenue Act (1879), all lands are for the first time divided into either "state land" or "non state land". The Act does not apply to land within the limits of any towns, nor to reserved forestry, fisheries land, military cantonments or specified religious sites.
- Transfer of Property Act (1882): The Transfer of Property Act (1882) provides for the transfer of property (movable and immovable), including, sales, mortgages, charges, leases, exchanges and gifts.
- The Land Acquisition Act (1894): The Land Acquisition Act of 1894 has been amended by the Government of Burma (Adaptation of Laws) Order, 1937 and The Burma Laws (Adaptation) Act – Burma Act 27, 1940 (2nd November 1940). The Land Acquisition Act 1894 regulates the land acquisition process and compensation of affected population. The law deals with matters related to the acquisition of private land and other immovable assets required for public purpose through the exercise of the right of eminent domain. The Act also contains provisions for acquisition of land and assets on an emergency basis. In a situation where a project of public purpose has to be implemented urgently, the government may acquire land on an emergency basis. This legal document provides the basis for payment of compensation when land is acquired for a public purpose. It also allows for the taking of land by the Government for a business purpose. The right to acquire land for public purposes is established when Section 4 of the Act is triggered. The Act specifies a systematic approach for acquisition and compensation of land and other properties for development projects. It stipulates various sections pertaining to notifications, surveys, acquisition, compensation and apportionment awards, along with disputes resolution, penalties and exemptions. Requirements for disclosure of information on surveys to affected persons are also stipulated in the Act.
- The Lower Myanmar Town and Village Land Act (1899): The Lower Myanmar Town and Village land Act governs the land rights in towns and villages and provides for certain rights (such as the right to cultivate and right to sell) relating to hereditary and government lands. The Act (Chapter VIA) stipulates the compensation by the government for the affected land. Whenever the rights of any owner or occupier of any land are infringed by the occupation or disturbance of the surface of the said land, either by the Government or by any

person to whom the Government may have disposed of such rights and powers in regard to the said land, the Government shall pay or cause to be paid, to such owner or occupier compensation for the infringement. The compensation shall be determined, as nearly as may be, in accordance with the provisions of the Land Acquisition Act.

- The Towns Act 1947 (Amendment): The Towns Act 1947 (Amendment) provides some regulations related to land acquisition and resettlement. The Article 7 regulates that the headman of the ward is responsible for (i) collecting any revenue or other money due to the Government or to a municipal or town committee from residents of the ward or persons holding land therein; (ii) report to officer as appointed by the Deputy Commissioner in this behalf all trespass or encroachments upon, and injuries to, State land and public property which may occur within his ward.
- The Village Act 1961 (Amendment): Under the Act, a village committee can-be established (by Deputy Commissioner) with the powers of a civil court. The headman of the village, as envisaged in the Act - is responsible for collecting revenue and other money due to the State from residents of the village-tract or persons holding land therein (Article 8).
- Farmland Law (2012): The Farmland Law (2012) effectively replaces the Tenancy Law (1963), Protection of Peasants' Rights Law (1963), and Land Nationalisation Act (1953). According to this law farmers can retain farmland use-rights (LUC), the state's power to rescind such rights, the process for settling certain land-related disputes, and basic requirements for compensation in the case the government acquires the land for public purposes. Those with LUC may transfer, lease, sell, or use as collateral their agricultural lands, provided that the government is informed about these transactions. The holder of the LUC cannot change the use of the allocated land other than what is provided in the LUC. Neither can the holder of the LUC allow the farmland to fallow for no valid reason. Violation of the conditions set in the LUC could lead to the revocation of the LUC and the confiscation of the farmland. Article 29 (Chapter 10, Utilisation of Farmland), empowers the State to utilise farmland for projects in national interest after obtaining permission from of the Union Government Cabinet and on recommendations from the Central Farmland Management Body. Members of the public can request the change in utilisation of farmland for other use.
- The Vacant, Fallow and Virgin Land Management Law (2012): The Vacant, Fallow and Virgin Lands Management Law (2012) governs the allocation and use of virgin land (i.e., land that has never before been cultivated) and vacant or fallow land (which the law characterises as for any reason "abandoned" by a tenant). The law establishes the Central Committee for the Management of Vacant, Fallow and Virgin Lands (CCVFV), which is responsible for granting and rescinding use rights for such lands. This also outlines the purposes for which the committee may grant use-rights; conditions that land users must observe to maintain their use rights; and restrictions relating to duration and size of holdings. The Central Committee is also empowered (Chapter VII, Section 19) to repossess the land from the legitimate owner, after payment of compensation calculated based on the current value to cover the actual investment cost, for infrastructure and other special projects in the interest of the State.
- Special Economic Zones Law (2014): The Special Economic Zone Law (Chapter 17 on Land Use, Para 80) provides for the developer to a) pay the agreed expenditures for transfer, resettlement and compensation if houses, buildings,

gardens, paddy fields, fruit bearing plants and plantations on the land are required to be cleared or transferred; (b) shall, as necessary, negotiate with the management committee in order to ensure that the persons who have to leave the land do not fall below their previous standard of living, their fundamental needs are fulfilled and the transfer is easy and smooth.

ADB's Policy on Involuntary Resettlement is presented in its Safeguard Policy Statement (SPS, 2009). The aim of ADB Policy on Involuntary Resettlement is to avoid or minimise the impacts on people, households, businesses and others affected by the acquisition of land and other assets, including livelihood and income. Where resettlement is not avoidable, the overall goal of the ADB policy is to help restore the living standards of the affected people to at least their pre-project levels by compensating for lost assets at replacement costs and by providing, as necessary, various forms of support. The objectives of the involuntary resettlement policy are: (i) avoid involuntary resettlement wherever possible; (ii) minimize involuntary resettlement by exploring project and design alternatives, if involuntary resettlement is unavoidable; (iii) enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and (iv) improve the standards of living of the displaced poor and other vulnerable groups.

In order to ensure that land acquisition and resettlement planning and implementation are compliant with provisions envisaged in the current legislation of Myanmar and ADB's SPS (2009), the following policy principles of involuntary resettlement will be adopted for the Project:

- No compensation shall be for the affected land that owned by Mon and Kayin State Governments, Mon and Kayin State Development Committees and Township Development Committees. However, the affected assets upon the land of the organisations, if any, shall be compensated by replacement cost, including transport costs to the new area.
- Affected land of the household (rubber-tree farm owner) and the pagoda shall be compensated by replacement cost, including the cost for investment on the land, if any.
- Affected rubber trees of rubber tree farm shall be compensated by the market rate for buying trees (seedlings), labour cost for planting and taking care-of, and other related costs, if any.
- Affected bamboo house of the officer of the Township Development Committee shall be compensated by replacement cost, including the transport cost to the new area. Mawlamyine Township Development Committee shall allocate replacement land for the officer to reconstruct the house.
- Meaningful consultations with affected organisations and affected persons shall be carried-out on the impacts and compensation and resettlement arrangements.
- Compensation and resettlement for affected persons shall be completed before acquiring land by the Project.
- Implementation of compensation and resettlement for the affected persons shall be internally monitored by the concerned State and Township Development Committees and State and Township General Administration Offices.

7.3 Resettlement and Livelihood Rehabilitation

Private land affected in Mon State

Both households who have agricultural land affected by the Project are severely affected households (one household has 40% of total production landholding affected and the other household has 74% of total production landholding acquired) - and one of two households is vulnerable household (household headed by female). Implementation of the Project would also impact on 267 rubber trees and 31 fruit-trees of these two affected households. There is no structure upon land affected by the Project.

During construction of the project in Mon State, there will be temporary impact on business of 37 local shops and kiosks and restaurants of 37 business owners. The temporary impact period would be for four weeks.
Under the Project for Mon State, the existing dumpsite in MuYaung Village would be expanded from 7.0 acres to 48 acres (19.42 ha) of land. There are 11 households (13 waste-pickers) who are picking wastes in the dumpsite as the main source of income of the households - will be affected.

Private lands affected in Kayin State

0.44 acres of land (0.18 ha) are not public taking account of 0.67% of total affected land area is the land that owned by a pagoda; and 0.037 acres (150 m2 or 0.015 ha) is agricultural land of one household. There are three (03) households (17 persons) who would be affected by land acquisition - one household who will have agricultural land partially acquired (150 m2) and two households who will have income affected as they are renting land of TDC for corn plantation and the land will be acquired for the subproject implementation.

During construction of the project in Kayin State, there will be temporary impact on business of nine (09) local shops and kiosks in Hpa-An (one gasoline retail shop in the water-intake component; eight local shops, kiosks and restaurants in water distribution pipe component) and 27 local shops and kiosks in Myawaddy (six local shops, kiosks and restaurants in the reservoir construction component will be temporarily closed during construction period as the entrance to the site will be widened for transporting of construction materials; and 21 local shops, kiosks and restaurants will have business affected during installation of the new water distribution pipe). The temporary impact period is expected for four weeks except for six local shops and kiosks in the entrance to the cemetery area in Myawaddy where the water reservoir will be constructed in - the business will be temporarily affected for three months.

Implementation of Solid waste collection and disposal subproject would effect on ten (10) persons in Hpa-An and 26 persons in Myawaddy who are picking wastes in the dumpsites and will be economically displaced.

7.4 Implementation of Land Acquisition and Resettlement

Approval of the RP and Updated RP

A resettlement plan (RP) has been produced for each Mon and Kayin State. Each RP will be submitted to Mon State Government and Kayin State

Government for approval and then forwarded to Department of Urban and Housing Development (MOC) and ADB for concurrence.

The RPs in theirs present forms are based on the preliminary design and result of IOL. The RPs will need to be updated by the PMO following detailed design of subproject components.

Resettlement Implementation Activities

1. Prior to updating each RP - the PMO will be established. There should be one or two staff within the PMO who are in-charge of social safeguard issues. Simultaneously, GRCs at township and state level as recommended in this RP will also be established.
2. After the establishment of PMO and GRCs, training workshop on involuntary resettlement and rehabilitation will be conducted for PMO, GRCs, relevant general administrations and concerned agencies on land acquisition and resettlement such as SDC, TDC and Ward Authorities. The training should be provided by the resettlement specialists of the Project Implementation Consultant (PIC), who should also oversee the implementation of the RP. The training should focus on the resettlement policy and implementation procedures, public consultation and participation procedures, and planning and delivery of rehabilitation assistance to the APs including vulnerable groups and waste-pickers.
3. PMO will together with TDC and relevant ward authorities to arrange registration of the waste-pickers on the income restoration measures.
4. Following the verification of affected land and asset upon land following the detailed design, verification of land ownership and identification of landowners, public consultation will be carried out to inform the affected population, including waste-pickers - about their entitlements, procedure and schedule for land acquisition, compensation and income restoration. During the public meetings, information to affected households, waste-pickers and communities will be provided on the schedule for validation of entitlements prior to the compensation and assistance payment. All proceedings of the public meetings including the issues raised and decision taken will be documented.
5. After unit prices have been validated and approved by Mon and Kayin State Governments, the field teams of PMO will visit each AP, including waste-picker to validate inventory, finalize entitlements and total amount of compensation and allowances payable to each AP. A Compensation and Assistance Entitlement Form for each AP would be completed and signed by the APs to indicate their agreement with the affected areas and assets shown, entitlements and compensation amounts. A copy of the signed copy of the form would be given to APs for their record. Any disagreement on the inventory details or compensation rates would be recorded and addressed in accordance with the established grievance redress procedures.

6. Upon completion of the Compensation and Assistance Entitlements for each AP, public announcements will be made to inform APs on: (a) the schedule for compensation and assistance payment; (b) timeframe of implementation of income restoration program and (c) the schedule for start-up of civil works. All payment of compensation and allowances will be made in a public place on scheduled date and time.
7. The site will be handed over for civil works when all the APs have received their full compensation and allowances due to them, and the income restoration measures are put in place.
8. Delivery of income restoration assistance to affected waste-picker, severely affected households and vulnerable groups will start as soon as the payment of compensation to the APs is completed.
9. The schedule for resettlement plan updating and implementation for subprojects in Mon State would be as below:

Table 7-2: proposed Implementation Schedule

	Activities	Timeframe
1	Capacity building/trainings for PMO, GRCs, SDC/TDC	2nd Quarter 2017
2	Conduct DMS, RCS, additional SES	3rd Quarter 2017
3	Consultation with APs, relevant agencies, and waste-pickers	Continuous
4	Prepare Updated RP	3rd Quarter 2017
5	Submit RP to MOC and ADB for review and concurrence	3rd Quarter 2017
6	Disclosure of the updated RP after being approved	4th Quarter 2017
7	Payment of compensation and assistance	4th Quarter 2017
8	Implementation of income restoration measures	4th Quarter 2017
9	Grievance Resolution	Continuous, until resolution
10	First internal monitoring	4th Quarter 2017

7.5 Indigenous Peoples

Myanmar is divided into seven states and seven regions. The seven states named after the seven largest ethnic nationalities: Chin, Kachin, Kayah, Kayin, Mon, Rakhine (former Arakan) and Shan - mainly encompass the hilly and mountainous areas and are predominantly populated by ethnic communities. The seven regions (previously called divisions): Ayeyarwaddy, Bago, Magway, Mandalay, Sagaing, Tanintharyi and Yangon - encompass the plains and are predominantly populated by people of Bamar ethnic origin. In addition, the Union Territories which cover the

capital Nay Pyi Taw has the status of a region and is under the President of the Union. Further, there are six Self-Administered Areas within the States and Regions with a prescribed limited autonomy.

Based on official data, Myanmar is made up of 135 national races, of which the main ethnic groups are Kachin, Kayah, Kayin, Chin, Bamar, Mon, Rakhine and Shan. The population of Burma comprises Bamar 68%, Shan 9%, Karen 7%, Rakhine 4%, Chinese 3%, Indian 2%, Mon 2%, and others 5%1. While these numbers are disputed by different groups, there are limitations on getting reliable information due to the displacement and shifting population.

In Mawlamyine, Hpa-An and Myawaddy the ethnicities are presented in **Table 7-3**

Table 7-3: Ethnicities in the Project Areas

Ethnic Minorities in Mawlamyine (Mon State)											
Area	**Ethnic Group**									**Total Ethnic Population**	**Total Population**
	Kachin	Kayah	Kayin	Chin	Mon	Rakhine	Shan	PaO	Bamar		
Urban	17	54	2581	26	28456	209	665	20	131515	163543	209533
Rural	17	108	2618	27	45328	215	704	24	141700	190741	240272
Total	34	162	5199	53	73784	424	1369	44	273215	354284	449805

Ethnic Minorities in Pha-An and Myawaddy (Kayin State)										
Area	**Ethnic Group**								**Total Ethnic Population**	**Total Population**
	Kachin	Kayah	Kayin	Chin	Mon	Rakhine	Shan+ PaO	Bamar		
Pha-An	54	1	211718	73	54772	394	41683	46829	308695	374707
Myawaddy	92	3	50576	145	3633	1275	10454	45904	112082	114869
Total	146	4	262292	218	58405	1669	52137	92733	420777	489576

***Source**: Township General Administration Office of Mawlamyine, Hpa-An, and Myawaddy.*

According to the Social Survey carried out by Social Team, in the Project's Area in both Mon and Kayin states, population consists mainly of Bamar peoples (55.17%) followed by Kayin Peoples (15.78%). Other ethnic groups such Mon, Chinese, India and others are present only in very small numbers (11.3%; 0.1%; 10.17%; and 1.3%, respectively). The ethnic households are dispersed and are fully integrated, socially and economically, with the mainstream population.

There are no laws or regulations specifically related to ethnic minority safeguards. While Myanmar has signed the United Nations Declaration on the Rights of Indigenous Peoples, there are no laws or regulations that provide for the recognition of customary land tenure or clear regulations to determine the ownership and extent of ancestral domains and to protect the rights of ethnic nationalities to their ancestral (customary) lands as well as for them to maintain their economic, social, and cultural well-being.

A review of current Government legal provisions that may, directly or indirectly, impact on ethnic minorities and current institutional practices that reflect treatment of ethnic minorities is summarized as below:

[1] Sophie Chao, Brief No. 8, Union of Burma

- Constitute of Myanmar (2008): The Article 22 of the Constitution provides for: (i) development of language, literature, fine arts and culture of the National races; and (ii) promotion of solidarity, mutual amity and respect and mutual assistance among the National races; and promotion of socio-economic development including education, health, economy, transport and communication, of less-developed National races. According to the Article 27 of the Constitution, the Union shall assist development, consolidation and preservation of National Culture. Article 348 also stipulates that The Union shall not discriminate any citizen of the Republic of the Union of Myanmar based on race, birth, religion, official position, status, culture, sex and wealth.
- Customary Laws: Customary law may be distinguished from statute law by being more closely attached to a people's culture Laws related to House, Land, and Property do not recognize customary rights. There is also confusion on the complex laws pertaining to land. For ethnic nationalities, the laws do not appear to reflect their actual land use. With an unclear legal framework and the tedious and costly process in claiming legitimate ownership of lands, most ethnic nationalities do not have legal land titles. There are no laws or regulations that provide for the recognition of customary land tenure or clear regulations to determine the ownership and extent of ancestral domains. The laws that relate to customary laws in Myanmar include: (i) Customary Burma Laws Act 1898 provides for Buddhist, Muslim and Hindu customary laws that pertain to succession, inheritance and marriage for their respective adherents; (ii) Buddhist Women's Special Marriage and Succession Act (1954) deals with Buddhist customary law also on succession, inheritance and marriage; (iii) Christian Marriage Act, Burma Divorce Act (which applies only to Christians) and the Succession Act (1925) provide for rules of succession, inheritance and marriage for Christians; (iv) Chin Special Division (Extension of Laws) Act (1948) and Chin Hills Regulation (1896) recognized the Chin's customs; and (v) The Kachin Hills Manual specified the customary authority of Kachin headmen to rule on land uses within the community.
- The Development of Border Areas and National Races Law (1993): The Law aims to strengthen the amity among the national races and to preserve and maintain the security, prevalence of law and peace and order of the border areas. The law also calls for the development of infrastructure for national races in the border areas and the preservation of their culture, literature, and customs. However, the law does not explicitly provide for protection of the rights of ethnic nationalities.

ADB's policy on Indigenous People is specified in its Safeguard Policy Statement (SPS, 2009). The Indigenous People's Safeguard aims to " design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they: (i) receive culturally appropriate social and economic benefits; (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them".

The term "Indigenous Peoples" in the SPS, 2009 is used in a generic sense to refer to a distinct, vulnerable, social, and cultural group possessing the following four characteristics in varying degrees:

- Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;

- Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
- Customary, cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and
- A distinct language, often different from the official language of the country or region.

With the analysis above, ADB's Indigenous Peoples Policy (SPS 2009) will not be applicable for the Project as the ethnic populations in Mon and Kayin State areas do not satisfy the above criteria.

In addition, the Project's Components do-not directly or indirectly affects the dignity, human rights, livelihood systems, or culture of local ethnic groups, neither the territories nor natural or cultural resources that local ethnic peoples own, use, occupy, or claim as their ancestral domain. Furthermore, ethnic peoples in the project's area are the great majority of direct project beneficiaries - and there is no potential negative impacts are identified with the local ethnic peoples. The Indigenous peoples plan, therefore, is not required to be prepared by the Project. Elements of an indigenous peoples plan can be included in the overall project design or in the Social Development Plan instead of preparing a separate Indigenous Peoples Plan.

7.6 Costs for Social Safeguard Implementation

7.6.1 TOTAL COSTS FOR SOCIAL SAFEGUARD IMPLEMENTATION

The total budget for resettlement is detailed in the table below.

Table 7-4: Total costs for resettlement implementation

Township	State	Costs (US$)
Mawlamyine	Mon State	**296,435.96**
Hpa-An	Kayin State	**51,738.68**
Myawaddy	Kayin State	**93,131.51**
Total resettlement costs		**441,306.15**

The budget was estimated based on the results of the IOL and consultations conducted in June 2016. It will be updated during the resettlement plan updating following the results of DMS, RCS and consultations with affected households, waste-pickers and relevant agencies.

The resettlement budget will be from the loan fund. The Project Management Office (PMO) will cooperate with relevant agencies to ensure that the resettlement budget will be transferred adequately and in a timely manner to implementation of land acquisition and resettlement.

7.6.2 COSTS IN MON STATE FOR SOCIAL SAFEGUARD IMPLEMENTATION

The overall budget for implementing the resettlement plan for Mon State was estimated at MMK 347,363,657.93 (equivalent to US$ 296,435.96). The details of the estimated resettlement budget for Mon State are as below.

Table 7-5: Details of estimated resettlement budget for Mon State

Item	Subproject	Quantity	Costs (US$)	Sub-total (US$)
1. Compensation for agricultural affected land	Solid waste	1.0 acres (0.4 ha)	170,677.00	170.677.00
		3.6 acres (1.46 ha)	4,266.00	15,357.60
2. Income Restoration Measures for two affected land households	Solid waste	02 households	12,893.00	12,893.00
3. Compensation for affected trees	Solid waste	298 trees	25.60	7,628.80
4. Compensation for affected business during construction	Water Supply	37 business owners	23.38/day for 28 days	24,221.68
5. Income Restoration Measures for waste-pickers	Solid waste	11 households		5,000.00
6. Assistance to Vulnerable Households	Solid waste	05 households		1,920.00
7. Land surveys and DMS during RP Updating	Solid waste and Water Supply		10,000.00	10,000.00
8. Additional consultation and information disclosure during RP updating and RP implementation	Solid waste and Water Supply		5,000.00	5,000.00
9. Management / administration costs	Solid waste and Water Supply	2% of total implementation costs	5,054.32	5,054.32
10. Contingency	Solid waste and Water Supply	15% of total implementation and management costs	38,665.56	38,665.56
Grand-Total Resettlement Cost for Mon State				**296,435.96**

7.6.3 COSTS IN KAYIN STATE FOR SOCIAL SAFEGUARD IMPLEMENTATION

The overall budget for implementing the resettlement plan for Kayin State was estimated at MMK 169,758,888.64 (equivalent to US$ 144,870.19). The details of the estimated budget are as below.

Table 7-6: Details of estimated resettlement budget for Kayin State

Item	Subproject	Quantity	Costs (US$)	Sub-total (US$)
Hpa-An Town				
1. Compensation for business affected of the Gasoline retail shop	Water Supply (Water Intake)	01 shop	560.00	560.00
2. Compensation for temporary income reduction of shops, kiosks, restaurants.	Water Supply (Water Distribution Pipe)	08 shops, kiosks, restaurants	4,480.00	4,480.00
3. Income Restoration Program for Waste-Pickers	Solid waste	10 waste-picking households	28,100.00	28,300.00
4. Assistance to vulnerable households	Solid waste	02 households	768.00	768.00
5. Land surveys and DMS during RP Updating	Water supply and solid waste		5,000.00	10,882.16
6. Additional consultation and information disclosure during RP updating and RP implementation	Water supply and solid waste		5,000.00	
7. Management/administration costs	Water supply and solid waste	2% of total implementation costs	882.16	
8. Contingency	Water supply and solid waste	15% of total implementation and management costs	6,748.52	6,748.52
Total resettlement estimated cost for Hpa-An Town				**51,738.68**
Myawaddy Town				
1. Compensation for affected agricultural land	Water Supply (Intake)	150 m^2	3,000.00	3,000.00
2. Trainings for two affected persons	Water Supply (Water Treatment Plant)	02 persons	3,000.00	3,000.00

Item	Subproject	Quantity	Costs (US$)	Sub-total (US$)
3. Income restoration program for waste-pickers	Solid waste	26 waste-picking households	33,200.00	33,900.00
4. Compensation for temporary income disruption of shops, kiosks and restaurants.	Water Supply (Water Reservoir)	6 shops, kiosks and restaurants	16,200.00	16,200.00
5. Compensation for temporary income reduction of shops, kiosks, restaurants.	Water Supply (Distribution Pipe)	21 shops, kiosks and restaurants	11,760.00	11,760.00
6. Assistance for vulnerable households	Solid waste	04 vulnerable households	1,536.00	1,536.00
6. Land surveys and DMS during RP Updating	Water supply and solid waste		5,000.00	11,587.92
7. Additional consultation and information disclosure during RP updating and RP implementation	Water supply and solid waste		5,000.00	
8. Management / administration costs	Water supply and solid waste	2% of total implementation costs	1,587.92	
9. Contingency	Water supply and solid waste	15% of total implementation and management costs	12,147.59	12,147.59
Total resettlement estimated cost for Myawaddy Town				**93,131.51**
Grand-Total Resettlement Cost for Kayin State				**144,870.19**

8 PROJECT IMPLEMENTATION PLAN

8.1 Implementation Arrangements

Under the Project Implementation Plan (PIP) Project Management Offices [PMO's] are to be established separately under each of the recipient State governments [i.e. Mon State or "MSG" and Kayin State Government or "KSG"]. These agencies will be supported as necessary, by experienced staff drafted in from the Ministry of Construction at the Union level.

Project implementation is to be carried out at the township level by separate Project Implementation Units (PIU's) to be created within the present Mawlamyine and Hpa-An / Myawaddy Township establishments respectively.

Contract procurement and consultant recruitment under the ADB loan will conducted in accordance with ADB's ''Procurement Guidelines (2013)'' and the ''Guidelines on the Use of Consultants by ADB and Its Borrowers (2013)'' – both documents as amended from time to time.

On all international (ICB) works, goods supply and professional services contracts, procurement will be carried out by the PMO's with subsequent implementation overseen by the PIU's in each state. The respective PMO's will sign appropriate contractual documentation and represent the ''Employer'' as may be applicable in each case. A Project Implementation Consultant [PIC] will be contracted and appointed to work directly with the PIU's and with the two PMO's who will be the primary contact channel counterpart to the Consultant.

The roles and responsibilities of the various agencies involved in implementation are shown in **Table 8-1**.

Table 8-1: Implementation Organizations – Roles and Responsibilities

Organization	Management Roles and Primary Responsibilities
Ministry of Construction [MOC / DUHD]	■ Borrower's representative and signatory to the loan agreement; ■ Provision of support staff for PMO offices; ■ Establishment of a project imprest account at the Bank of Myanmar for the disbursement of eligible expenditures. The MOC will be responsible for establishing, managing, replenishing, and liquidating the account; ■ The MOC who will establish the imprest account in the Project's name will be accountable for the proper use of advances form the account including any to sub-accounts established.
Project Management Offices [PMO's]	**Administrative** ■ Monitoring of project activities; ■ Provision of counterparts to the PIC team; ■ Planning, coordinating and supervising overall project programming, budgeting, financial planning and

Organization	Management Roles and Primary Responsibilities
Mon & Kayin State Governments	accounting; ■ Preparing terms of reference for any additional professional services required; ■ Overseeing the PIC [and any appointed sub-consultants], monitoring performance and administering consultant's contracts; ■ Assisting with setting up project management, accounting and reporting systems; ■ Performing the role of secretariat for project steering committees; ■ Establishing and maintaining regular contact with the PIU's and community groups etc.; ■ Reviewing and approving capacity development initiatives and training activities proposed by the PIC; ■ Reviewing monthly, quarterly and mid-term progress reports prepared by the PIU's and submitting consolidated versions to the ADB; ■ Preparing project completion reports for submission to the ADB; ■ Submitting consolidated versions of PPME documentation to the ADB. **Technical** ■ Approving detail design work (technical, economic, financial, institutional, social and gender, and safeguards aspects) and contract tender documents; ■ Approving procurement plans, bidding documents and contract documents and making recommendations for approvals by the EA; ■ Overseeing the procurement of ICB and NCB contracts including bid evaluation, contract negotiations, evaluations and contract awards; ■ Providing support and guidance to the PIU's on aspects relating to the definition and implementation of the sub-projects. **Financial** ■ Preparing budgeted work plans for disbursement and use of project funds; ■ Preparing budget reallocation requests for submission to the EA and the ADB for "no objection"; ■ Opening and managing a sub-account [s] at a commercial bank;

Organization	Management Roles and Primary Responsibilities
	■ Preparing withdrawal applications, submit to the **DUHD** and the ADB for approval and maintaining disbursement records; ■ Accountable for loan covenant compliance, adherence to safeguard policies, overall management and coordination of project components; ■ Setting up and maintaining consolidated project accounts, and ensuring timely completion / submission details and financial statements for auditing; ■ Preparing terms of reference for auditing of project accounts, recruiting project auditors, preparing any information required for audit purposes and following up on comments/recommendations made by the auditor; ■ Submitting annual audited project accounts &financial statements to ADB. **Safeguards** ■ Providing assistance and guidance to PIU's to ensure compliance with all safeguard policy provisions in accordance with agreed frameworks; ■ Submission of prepared IEEs for approval; ■ Approving sub-projects with relevant national and provincial government agencies on any environmental matters that may arise; ■ Approving updating and implementation of Environmental Management Plans (EMP) and ensuring that standards are monitored and maintained; ■ Submitting indigenous peoples' plans to the relevant authorities and acquiring approval.
Project Implementation Units [PIU's] **Mawlamyine and Hpa-An / Myawaddy Townships**	**Administrative** ■ Day to day management of the individual sub-projects; ■ Provision of staff for monitoring project activities and as counterparts for the PIC team; ■ Ensuring necessary internal support from corresponding PMO for: ■ Financial management of the project; ■ Environmental/Social Monitoring and Evaluation of sub-projects; ■ Preparing terms of reference for any additional professional services required; ■ Overseeing the PIC [and any appointed sub-consultants], monitoring performance and administering consultant's

Organization	Management Roles and Primary Responsibilities
	contracts; ■ Assisting with setting up of project management, accounting and reporting systems; ■ Reviewing capacity development initiatives and training activities proposed by the PIC; ■ Preparing monthly, quarterly and mid-term progress reports in association with the PIC; ■ Preparing project completion reports; ■ Developing Project Performance Management and Evaluation (PPME) indicators. **Technical** ■ Preparation of project details (technical, economic, financial, institutional, social and gender, and safeguards aspects) in association with the PIC; ■ Assembly of procurement plans, bidding documents and contract documents in association with the PIC and making submissions to PMO's; ■ Preparation of ICB and NCB contract procurement processes including bid evaluation, contract negotiations, evaluations and contract awards; ■ Providing support and guidance to the PIC on all aspects relating to the implementation of the sub-projects. **Financial** ■ Preparing draft plans for the disbursement and use of project funds; ■ Submitting draft annual audited accounts &financial statements to PMO's. **Safeguards** ■ Providing assistance and guidance to ensure compliance with all safeguard policy provisions in accordance with agreed frameworks; ■ Preparation of draft IEEs and EMPs for approval; ■ Preparation of indigenous peoples' plans for submission to the relevant authorities.
Project Steering Committee [PSC]	■ The PSC will be chaired by a senior representative of the MOC [Minister or Vice-minister level] and will include representatives from the DUHD, the ADB country representative and senior representatives from the 3 beneficiary Townships [namely Mawlamyine, Hpa-An and Myawaddy];

Organization	Management Roles and Primary Responsibilities
	■ The Steering Committee will meet twice a year during the project period or as may otherwise be necessary to respond to and provide guidance on strategic and policy issues; ■ The Steering Committee's main functions will be to: o provide project direction and guidance at the strategic level; o facilitate cooperation / coordination among concerned agencies; o solve potential major problems that may arise during project implementation; o provide a forum for discussion and progress reviews with the ADB; o learn and disseminate lessons from project implementation; o ensuring timely implementation of any agreed policy and institutional reform requirements.
Project Implementation Consultant (PIC)	■ Assisting the PMO's and PIU's in all aspects of project implementation as defined in the ToR and Consultant's Agreement.
Asian Development Bank	■ Providing financing for the project in accordance with the Loan Agreement; ■ Liaison with the Government of Myanmar on project-related activities; ■ Organizing and conducting project review missions together with the DUHD and PMO representatives; ■ Monitoring project implementation arrangements, disbursements, procurement, consultant selection, and reporting; ■ Monitoring schedules of activities, including cash flow; ■ Reviewing compliance with agreed procurement procedures and Loan Covenants; ■ Monitoring the effectiveness of safeguard procedures; ■ Monitoring project conformity with ADB anti-corruption, integrity and disclosure policies; ■ Reviewing sub-project detail design studies and reports and providing timely ADB approval; ■ Reviewing tender evaluation reports and contract award conditions and providing timely no objections to proceed;

Organization	Management Roles and Primary Responsibilities
	■ Undertaking project administration review missions twice / year; ■ Undertaking a mid-term review mission (around 30 months) together with the Government.

Table 8-2 summarizes organizational details and target dates relating to the implementation arrangements described above.

Table 8-2: Project Implementation Summary

Items	Target Timeframe / Indicative Contract Details		
Implementation period	7 years from 2017 through until early 2024		
Estimated completion date	2023-24		
Project Management Structure			
Executing Agency (EA)	Department of Urban Development and Housing of the Ministry of Construction		
Implementing Agencies (IA)	Mon State Governments (MSG) and Kayin State Government (KSG).		
Implementation units	PMO's [at State level] and PIU's [at Township level]		
Steering Committee	Minister or Vice-Minister of the MOC, senior officers from the DUHD departments, the ADB country representative and senior representatives from the beneficiary States and Townships [i.e. Mawlamyine, Hpa-An and Myawaddy].		
Procurement - Works	International Competitive Bidding - DBO format	6 contracts	US$ 88.2million
	International Competitive Bidding – FIDIC Red book	1 contract	US$ 4.9 million
	International Competitive Bidding– smaller works	1 contracts	US$ 2.0 million
	National Competitive Bidding - Goods	none	-
	International Competitive Bidding - Shopping	3 contracts	US$ 2.1 million
Procurement - Consulting Services	International (QCBS)	2 contracts for PIC [total of 150 & 210 person-months for international and national staff respectively].	US$7.2 million (Mawlamyine and Hpa-An) US$ 2.3 million

Items	Target Timeframe / Indicative Contract Details		
			(Myawaddy)
Advance Contracting	Advance action for the recruitment of the Project Implementation Consultant's services will be required		
Disbursement	The loan funds will be disbursed in accordance with ADB's *Loan Disbursement Handbook (2012, as amended from time to time);* and detailed arrangements yet to be agreed upon between the Government and the ADB.		

DD = Detailed Design, DUHD = Department of Urban Development and Housing [MoC], KSG = Kayin State Government, MSG = Mon State Government, MOC= Ministry of Construction, QCBS = Quality / Cost Based Selection, CQS = Consultant's Qualifications Selection.

9 PROJECT COSTS

9.1 Total Project costs

Project Costs are presented in the Overall Project Investment Plan in **Table 9-1** and the Financing Plan in **Table 9-2**.

Table 9-1: Project Investment Plan

($ million)

Item		Amount
A.	**Base Cost**	
1	Enhanced city competitiveness	20.47
2	Improved basic urban services	66.71
3	Strengthened Institutional Capacity	9.78
	Subtotal (A)	**96.96**
B.	**Contingencies**	**15.26**
C.	**Financing Charges During Implementation**	**4.71**
	Total (A+B+C)	**116.93**

[a] Includes taxes and duties of $4.72 to be financed from Central Government resources.

[b] In mid-2016 prices.

[c] Physical contingencies computed at 10% for civil works; and 10% for all other costs. Price contingencies computed at 0% on foreign exchange costs in 2016 and 1.5% thereafter, and 0% on local currency costs in 2016, 6% in 2017 and 5% thereafter; includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.

[d] Includes interest. Interest during construction for ADB (ADF) loan has been computed at 1% per year. There are no commitment charges for an ADF loan.

Source: PPTA Consultant's estimates

Table 9-2: Financing Plan

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank	80.00	68.41
ADB Grant	4.37	3.74
NEDA Loan	24.33	20.80
Tica Grant	0.50	0.42
Mon State	1.33	1.13
Kayin State	1.23	1.05
Central Government (Taxes & duties)	5.19	4.44
Total	**116.93**	**100.00**

Source: PPTA Consultant's estimates

9.2 Mon State / Mawlamyine Components

The project costs for Mon State cover the following components

- Enhanced city competitiveness:
  - Built heritage conservation in Mawlamyine: pilot renovation and upgrading of the existing GAD building;
  - Grant from TICA to support capacity development activities;
- Improved basic urban services:
  - Water supply system improvement in Mawlamyine (including dam rehabilitation, new WTP, new reservoir, network rehabilitation and houses connections);
  - Solid waste collection improvement and upgrading the existing dump site to a waste management centre in Mawlamyine (new sanitary landfill, waste incinerator and composting plant);
- Strengthened Institutional Capacity:
  - Project implementation consultants
  - Capacity development for DUHD
  - Capacity development for MSG
  - Public awareness program on environmental protection and public health for the residents of Mawlamyine.

The project implementation plan (PIP) and Financial Plan are summarised in the following Table 9-3 and Table 9-4.

Table 9-3: Project Implementation Plan - Mon State

Item		Amount
A.	**Base Cost**	
1	Enhanced city competitiveness	1.83
2	Improved basic urban services	37.85
3	Strengthened Institutional Capacity	4.88
	Subtotal (A)	**44.56**
B.	**Contingencies**	**7.12**
C.	**Financing Charges During Implementation**	**1.94**
	Total (A+B+C)	**53.62**

[a] Includes taxes and duties of $2.22 to be financed from Central Government resources.

[b] In mid-2016 prices.

[c] Physical contingencies computed at 10% for civil works; and 10% for all other costs. Price contingencies computed at 0% on foreign exchange costs in 2016 and 1.5% thereafter, and 0% on local currency costs in 2016, 6% in 2017 and 5% thereafter; includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.

[d] Includes interest. Interest during construction for ADB (ADF) loan has been computed at 1% per year. There are no commitment charges for an ADF loan.

Source: PPTA Consultant's estimates

Table 9-4: Financing plan - Mon State

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank	47.94	89.40
ADB Grant	1.87	3.48
NEDA Loan	0.00	0.00
Tica Grant	0.17	0.31
Mon State	1.29	2.40
Kayin State	0.00	0.00
Central Government (Taxes & duties)	2.36	4.41
Total	**53.62**	**100.00**

Source: PPTA Consultant's estimates

9.3 Kayin State Components

The project costs for Kayin State cover the following components

- Enhanced city competitiveness:
  - Joint spatial development plan for Myawaddy and Mae Sot;
  - Hpa-An Industrial Zone development Plan;
  - Waste management centre in Hpa-An Industrial Zone and Myawaddy trade zone (new sanitary landfill, waste incinerator and composting plant);
  - Grant from TICA to support capacity development activities in both cities;
- Improved basic urban services:
  - Water supply system improvement in Hpa-An and Myawaddy (including new intakes, new WTP, new reservoir, network rehabilitation and houses connections);
  - Solid waste collection improvement and closure of the existing dump site in Hpa-An and Myawaddy;
- Strengthened Institutional Capacity:
  - Project implementation consultants
  - Capacity development for DUHD
  - Capacity development for KSG
  - Public awareness program on environmental protection and public health for the residents of Hpa-An and Myawaddy.

The project implementation plan (PIP) and Financial Plan are summarised in the following Table 9-5 and Table 9-6.

Table 9-5: Project Implementation Plan - Kayin State

Item		Amount
A.	**Base Cost**	
1	Enhanced city competitiveness	17.89
2	Improved basic urban services	28.86
3	Strengthened Institutional Capacity	4.90
	Subtotal (A)	**51.66**
B.	**Contingencies**	**8.06**
C.	**Financing Charges During Implementation**	**2.77**
	Total (A+B+C)	**62.49**

[a] Includes taxes and duties of $2.5 to be financed from Central Government resources.

[b] In mid-2016 prices.

[c] Physical contingencies computed at 10% for civil works; and 10% for all other costs. Price contingencies computed at 0% on foreign exchange costs in 2016 and 1.5% thereafter, and 0% on local currency costs in 2016, 6% in 2017 and 5% thereafter; includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.

[d] Includes interest. Interest during construction for ADB (ADF) loan has been computed at 1% per year. There are no commitment charges for an ADF loan.

Source: PPTA Consultant's estimates

Table 9-6: Financial Plan - Kayin State

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank	32.06	51.31
ADB Grant	1.68	2.68
NEDA Loan	24.33	38.93
Tica Grant	0.33	0.53
Mon State	0.04	0.06
Kayin State	1.23	1.97
Central Government (Taxes & duties)	2.82	4.52
Total	**62.49**	**100.00**

Source: PPTA Consultant's estimates

9.3.1 COSTS FOR HPA-AN

The project implementation plan (PIP) and Financial Plan for Hpa-An are summarised in the following Table 9-7Table 9-5 and Table 9-8.

Table 9-7: Project Investment Plan: Hpa-An – Kayin State

($ million)

Item		Amount
A.	**Base Cost**	
1	Enhanced city competitiveness	9.05
2	Improved basic urban services	17.35
3	Strengthened Institutional Capacity	3.09
	Subtotal (A)	**29.48**
B.	**Contingencies**	**4.61**
C.	**Financing Charges During Implementation**	**1.33**
	Total (A+B+C)	**35.42**

[a] Includes taxes and duties of $1.44 to be financed from Central Government resources.

[b] In mid-2016 prices.

[c] Physical contingencies computed at 10% for civil works; and 10% for all other costs. Price contingencies computed at 0% on foreign exchange costs in 2016 and 1.5% thereafter, and 0% on local currency costs in 2016, 6% in 2017 and 5% thereafter; includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.

[d] Includes interest. Interest during construction for ADB (ADF) loan has been computed at 1% per year. There are no commitment charges for an ADF loan.

Source: PPTA Consultant's estimates

Table 9-8: Financing Plan: Hpa-An - Kayin State

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank	32.06	90.52
ADB Grant	0.55	1.55
NEDA Loan	0.75	2.13
Tica Grant	0.17	0.47
Mon State	0.00	0.00
Kayin State	1.07	3.02
Central Government (Taxes & duties)	1.57	4.44
Total	**35.42**	**100.00**

Source: PPTA Consultant's estimates

9.3.2 COSTS FOR MYAWADDY

The project implementation plan (PIP) and Financial Plan for Myawaddy are summarised in the following Table 9-9 and Table 9-10.

Table 9-9: Project Investment Plan: Myawaddy - Kayin State

($ million)

Item			Amount
A.	**Base Cost**		
	1	Enhanced city competitiveness	8.84
	2	Improved basic urban services	11.51
	3	Strengthened Institutional Capacity	1.82
		Subtotal (A)	**22.17**
B.	**Contingencies**		**3.45**
C.	**Financing Charges During Implementation**		**1.45**
	Total (A+B+C)		**27.07**

[a] Includes taxes and duties of $1.07 to be financed from Central Government resources.

[b] In mid-2016 prices.

[c] Physical contingencies computed at 10% for civil works; and 10% for all other costs. Price contingencies computed at 0% on foreign exchange costs in 2016 and 1.5% thereafter, and 0% on local currency costs in 2016, 6% in 2017 and 5% thereafter; includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.

[d] Includes interest. Interest during construction for ADB (ADF) loan has been computed at 1% per year. There are no commitment charges for an ADF loan.

Source: PPTA Consultant's estimates

Table 9-10: Financing Plan: Myawaddy - Kayin State

Source	**Amount** ($ million)	**Share of Total** (%)
Asian Development Bank	0.98	3.62
ADB Grant	1.13	4.16
NEDA Loan	24.29	89.75
Tica Grant	0.17	0.61
Mon State	0.04	0.14
Kayin State	0.16	0.59
Central Government (Taxes & duties)	1.25	4.62
Total	**27.07**	**100.00**

Source: PPTA Consultant's estimates

10 ECONOMIC JUSTIFICATION

10.1 Introduction

This economic analysis assesses the economic viability of the project through standard cost benefit analyses. The analysis is undertaken separately for each of the subprojects relating to improved basic urban services, namely:

- improved water supply systems in Mawlamyine;
- improved solid waste collection and management in Mawlamyine;
- improved water supply systems in Hpa-An;
- improved solid waste collection and management in Hpa-An;
- improved water supply systems in Myawaddy;
- improved solid waste collection and management in Myawaddy;

No economic analysis is undertaken for the three subprojects in the enhanced city competitiveness output—improvement to cultural heritage buildings in Mawlamyine, assistance for Hpa-An Industrial Zone, and spatial and development planning for Mae Sot—or the strengthened urban management capacity output. The economic costs of the urban management capacity output are included in the overall project economic assessment.

10.2 Demand Analysis

Demand analysis, from the perspective of the future demand for urban services, is presented in the technical sections of the report. This is supported from an economic perspective by the willingness-to-pay (WTP) estimates derived from the contingent valuation survey (Table 10-4).

These WTP estimates for improved urban services are generally equal to or more than the existing charges for the services, indicating a positive willingness to pay. The demand curves estimated from the contingent valuation survey further confirm the demand for improved urban services.

10.3 Major Assumptions and Methodology

The economic analysis is conducted in accordance with the ADB's Guidelines for the Economic Analysis of Projects1, Workbook on Economic Evaluation of Environmental Impacts,2 and Key Areas of Economic Analysis of Investment Projects.3 The major assumptions of the analysis are:

[1] ADB. 1997. *Guidelines for Economic Analysis of Projects,* Manila
[2] ADB. 2005. *Workbook on the Economic Evaluation of Environmental Impacts*. Manila.
[3] ADB. 2013. *Key Areas of Economic Analysis of Investment Projects: An Overview*. Economics and Research Department, Manila.

- Project investments will be undertaken over a 7-year implementation period starting in 2017.
- The project life will be 32 years for the improved water supply subprojects and 25 years for the solid waste management subprojects, both including the 7-year implementation period.4
- Financial costs are based on prevailing prices in mid-2015, are expressed in constant 2015 terms, and are the same as those used in the financial analysis.
- Economic costs and benefits are valued in Myanmar Kyats (MK) using the domestic price level numeraire.
- US dollar costs are converted to MK using an exchange rate of MK1280 per $1.00.
- economic costs and benefits for traded goods are derived by excluding taxes and duties5 and then adjusting their values by the Shadow Exchange Rate Factor (SERF), estimated at 1.026 (Table 10-1). For non-traded goods (domestic resources), economic values are the same as financial values. Skilled labour is adjusted to its economic value using an opportunity cost of scarce labour (OCSCL) of 1.0 and unskilled labour to its economic value using an opportunity cost of surplus labour (OCSL) of 0.9.6
- The economic value of land, as a part of land acquisition and resettlement costs, is based on its economic opportunity costs: that is the income forgone due to the resettlement. For agricultural land, the opportunity cost is assessed as the economic value of crops currently produced while for urban land it is the economic value of current activities.
- The economic opportunity cost of capital is assumed to be 12%.

[4] The shorter project life for the solid waste management projects reflects the expected life of the new landfills as defined by the PPTA's technical specialists
[5] Due to problems experienced with determining taxes and duties due to the lack of detailed information, taxes and duties were set at the same rates as used in the recent ADB project. As with that project, no local taxes were identified.
[6] Data were collected during the contingent valuation surveys to assess the extent of under- and un-employment of unskilled workers in the tree project towns (see Appendix 8 a). The results of these surveys suggest that an OCSL of 0.9 is appropriate.

Table 10-1: Calculation of Shadow Exchange Rate Factor

Item	Estimated value	Proportion of total trade	Taxes & Duties	Taxes & Duties	Effective exchange rate
	($ millions)	(%)	($ millions)	(% of value)	(MK/$)
Exports	9,014	41%	451	5.00%	918.41
Imports	13,010	59%	1,026	7.89%	1043.01
Total	22,024	100%	1,477		992.01
MER	MMK 967	per $			
SER	MMK 992	per $			
Premium	2.6%				
SCF	0.97				
SERF	1.026				

MER = market exchange rate, MMK = Myanmar Kyat; SCF = standard conversion factor; SER = shadow exchange rate; SERF = shadow exchange rate factor

Sources: Central Statistical Organization, 2014. *Selected Monthly Economic Indicators*. Ministry of National Planning and Economic Development, and U Thant Zaw Win, Customs Department for information on import and export taxes.

10.4 Project Costs

10.4.1 INVESTMENT COSTS

Project investment costs are estimated for each subproject based on the subproject designs and agreed package costs. Investment costs are aggregated by subproject by year over the 7-year implementation period using an Excel-based program. Additional investment costs are defined for each of the improve solid waste collection and management subprojects to cover the cost of developing new landfill cells during the project life, but outside of the project implementation period, and the cost of landfill closure in 2041.

Economic costs are estimated for each subproject using the same Excel-based program, which deducts price contingencies and financing charges during implementation before converting foreign exchange and local currency costs to their economic equivalent expressed in the domestic price level numeraire. The total economic cost for the overall project is estimated at MK72.99 billion in total with an annual distribution per year as indicated below (Table 10-2). The total economic cost, and economic cost by year, for each of the subprojects is also shown in Table 10-2. The economic costs of the new landfill cells and landfill closure were estimated based on conversion factors derived from comparison of the financial and economic costs for comparative activities during project implementation.

Table 10-2: Economic Costs of Project Investments by Output and Overall (MK Billions)

Subproject	Total Cost	2017	2018	2019	2020	2021	2022	2023
1. Mawlamyine - Water Supply	15.86	0.02	6.34	3.48	3.34	2.61	0.07	-
2. Mawlamyine Solid Waste	12.33	0.18	1.60	4.05	6.21	0.30	-	-
3. Hpa-An - Water Supply	11.80	0.01	4.83	4.34	1.28	1.28	0.07	-
4. Hpa-An Solid Waste	7.32	0.24	0.25	2.46	4.02	0.35	-	-
5. Myawaddy - Water Supply	8.38	-	3.68	2.95	0.84	0.84	0.07	-
6. Myawaddy Solid Waste	6.64	0.02	0.02	1.08	4.91	0.61	-	-
7. Mawlamyine - Heritage	-	-	-	-	-	-	-	-
8. Myawaddy - Spatial Plan	0.91	0.46	0.46	-	-	-	-	-
9. Project Management	9.75	2.64	1.59	1.10	0.81	0.77	0.53	0.57
Total	**72.99**	**3.56**	**18.77**	**19.46**	**21.40**	**6.75**	**0.75**	**0.57**

Source: Consultant's estimates

10.4.2 RECURRENT COSTS

Subproject incremental operation and maintenance (O&M) costs, the recurrent costs, comprise both the cost of maintenance required for the investments proposed under the project, and the incremental cost of operating the proposed water supply and solid waste collection and management systems. The costs were specified by the technical specialists for each of the proposed subprojects based on their prefeasibility-level designs. They are separated into civil works, materials, equipment, skilled labour, unskilled labour, and taxes and duties. Labour costs without- and with-project were projected to increase in real terms by 5% annually and this was included in the cost estimates. Financial costs are the same as used in the financial analysis and were converted to economic values in terms of the domestic price level numeraire as set out in the above assumptions.

10.5 Benefits

10.5.1 OVERVIEW

The analysis is undertaken through comparison of the without- and with-project scenarios. In the without-project scenario, there is expected to be no improvement in the currently highly deficient urban services systems for the water supply and solid waste collection and management. Specifically, for the water supply sector, the without-project scenario is expected to be a continuation of interrupted piped-water supply of poor-quality water to about 20% of the residents of Mawlamyine and a somewhat higher proportion of the households in Hpa-An and Myawaddy. Five of the

wards in Mawlamyine are expected to continue without any piped-water supply. The very slow rate of increase in water supply connections and high failure rate for water meters is also expected to continue together with an on-going very high incidence of non-revenue water (NRW). For solid waste collection and management, the without-project scenario is expected to involve a continuation dumping of solid waste throughout the towns, no solid waste collection in five of the wards in Mawlamyine, and very low rates elsewhere, resulting in a poor urban environment and pollution of both land and water. This results in addition in poor hygiene amongst the local population and acts as a disincentive to the development of tourism. Furthermore the solid waste landfills are in poor condition and expected to be filled in the near future.

With-project, the quality of urban services in all of these sectors is expected to improve. For the water supply sector, the improvement will be due to rehabilitation and expansion of water supply sources as well as reduction in NRW, which will allow for increased reliability of supply, up to 24/7, throughout the three townships, including those wards that currently without piped water. All households will receive a new piped water system and new water meters. As a result all water is considered to be incremental. For solid waste collection and treatment the with-project scenario is expected to include a vastly improved collection system with major reductions in solid waste deposited in the townships, increased recycling and conversion of organic matter to compost, which will reduce the amount of landfill. While this will have the increase the expected life of existing landfills, they will all need to be replaced with environmentally-friendly landfills. The improved system, including the landfills, is expected to result in reduced ground and surface water pollution, reduced flooding, an improved urban environment and reduced incidence of water borne diseases.

10.5.2 CONTINGENT VALUATION SURVEY

Since most of the benefits provided by the project investments cannot be valued within traditional markets, and others cannot be allocated between the different types of investment, project benefits are measured in terms of willingness-to-pay (WTP) using a contingent valuation survey approach. A contingent valuation survey was undertaken for assessing beneficiaries' WTP for the improved water supply and solid waste collection and treatment to be provided under the project. At the same time assessments were made of WTP for new piped water connections and improved septage services. In addition to the general respondent and household data that could be used as explanatory variables in the WTP estimates, more specific data about the sectors were collected to clarify the current situation; and specific WTP questions were posed. The WTP questions covered (i) connections to the piped water supply; (ii) improvements to the water supply system; and (iii) sanitation systems and services; and (iv) improvements to solid waste collection and treatment services.

The survey was implemented using a stratified two-stage random sample procedure covering the urban areas of the three townships—Mawlamyine, Hpa-An, and Myawaddy—that will benefit from project investments. The basis for the sampling was the total population of urban households in three townships as reported in the GAD statistics (Table 10-3). There were 53,262 urban households in 42 wards in the three townships in 2015 with the average number of households per ward ranging from 1,030 in Hpa-An to 1,403 in Myawaddy and an overall average of 1,268 households per ward. Based on the reviews of the technical specialists Mawlamyine was divided into three strata, the north and south zones being areas that benefitted from different water supplies and the unserved being 5 wards that have no piped water or solid waste collection. Hpa-An was divided into two zones, an east and a west, based on the source of water supply. The first stage of the sampling procedure

was to sample wards randomly from each stratum, with the number of wards selected proportional to the number of households in the stratum. Initial sampling was of 17 wards but an additional two were added due to uncertainties about the subprojects in Myawaddy. Eventually these two were also surveyed so that the total sample size was 19 wards. Second stage sampling was then conducted within each ward where 60 households were selected at random from the entire area of the ward. This selection was undertaken in association with ward officials to ensure that there was not undue focus on particular types of households or locations. The eventual sample size was 1,140 respondents including replacement of non-willing respondents by alternatives in the same ward.7 The locations of the sampled wards for Mawlamyine, Hpa-An, and Myawaddy are shown in Figure 10-1, Figure 10-2, Figure 10-3, respectively.

Table 10-3: Population, Households and Wards by Town and sampling Stratum

Township/ Sampling Strata	Wards (no.)	Households (no.)	Population (persons)	HH/ ward	Sample wards (no.)
Mawlamyine	28	36,980	209,404	1,321	11
-North Zone	12	18,272	106397	1,523	5
-South Zone	11	14,796	84,420	1,345	4
-Unserved Zone	5	3,912	18587	782	2
Hpa-An	9	9,268	53,089	1,030	5
-West Zone	4	4,789	27,305	1,197	2
-East Zone	5	4,479	25,784	896	3
Myawaddy	5	7,014	38,765	1,403	3
Total	**42**	**53,262**	**301,258**	**1,268**	**19**

Source: General Administration Department (2015).

[7] Respondents proved extremely willing to participate and there was no need for replacements.

Figure 10-1: Location of the Sample Wards for Mawlamyine

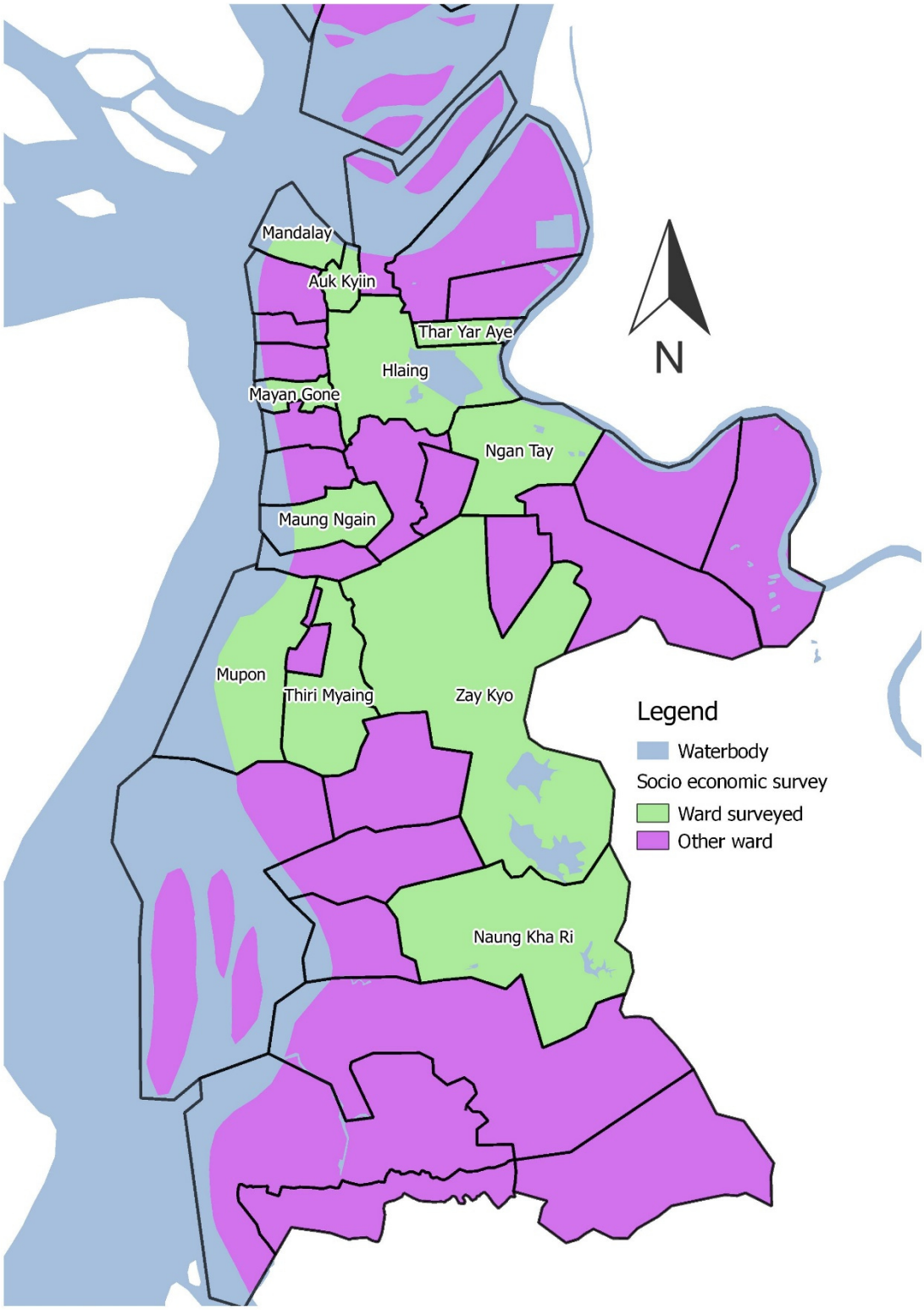


Figure 10-2: Location of the Sample Wards for Hpa-An

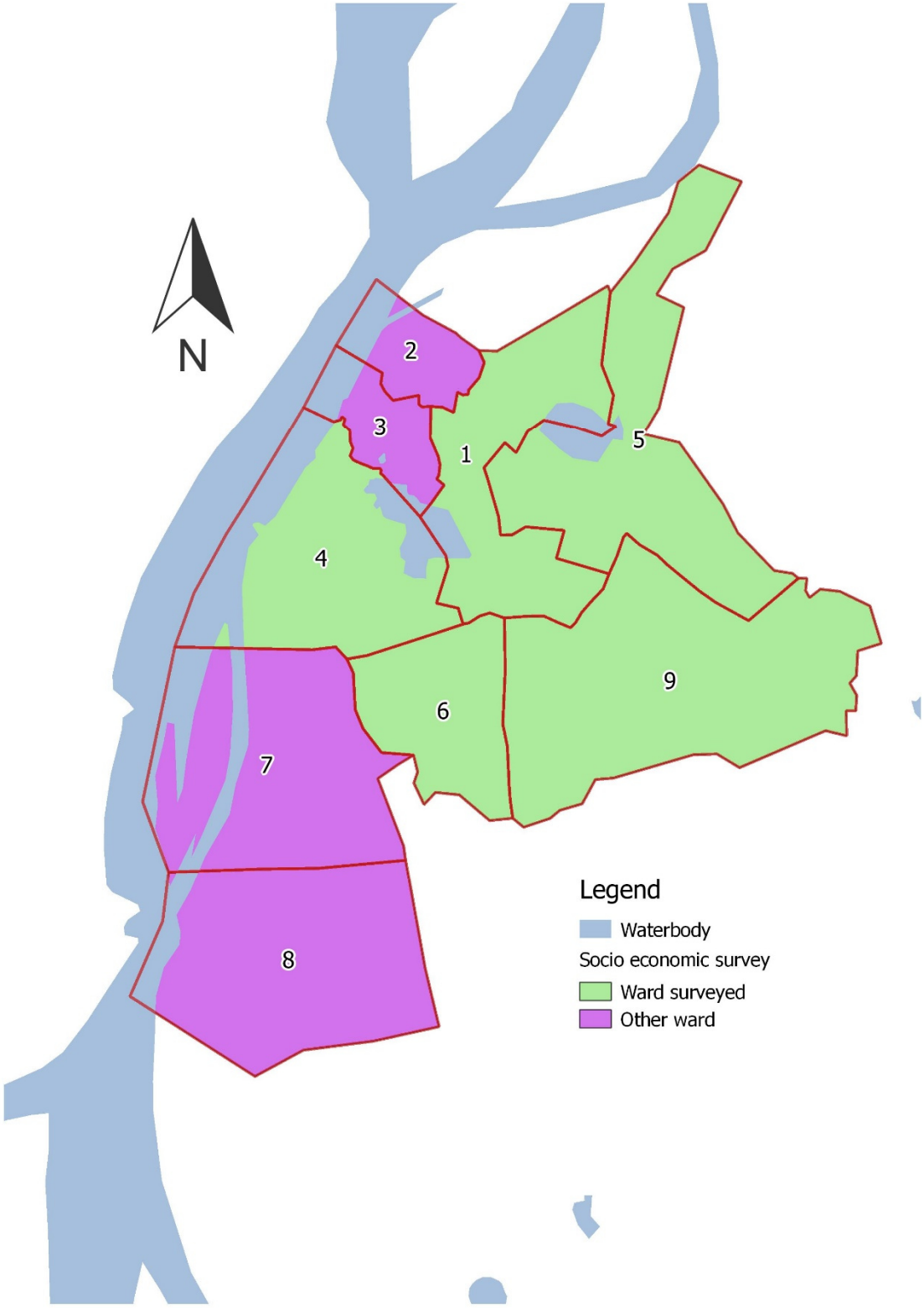
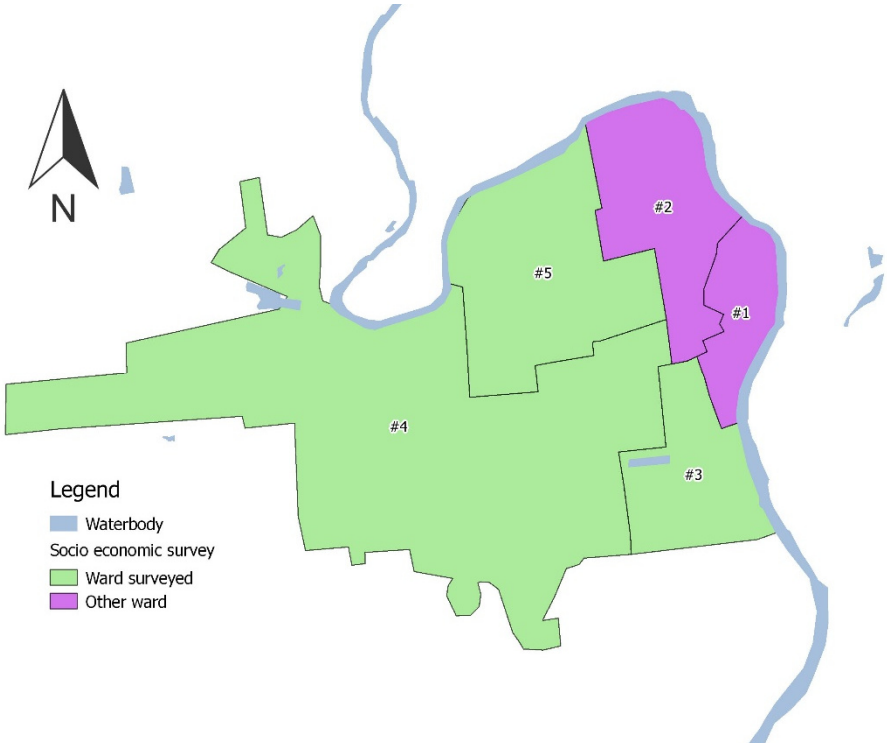


Figure 10-3: Location of the Sample Wards for Myawaddy



The questionnaire was field-tested and modified based on findings to ensure collection of the required information. The initial field testing was undertaken by national consultants and subsequent field tests were performed by the survey team as a part of their training. Following field testing, minor changes were made to the questionnaires. The final questionnaire used for the survey is shown in Appendix 8 a. An issue that was not identified until the data analysis stage was that the range of bid-values for all WTP questions was too narrow.

Data were entered into an Excel workbook after which consistency checks were performed and errors resolved by checking back against the questionnaires. While it was not possible to identify every error, an acceptably clean dataset is considered to have been achieved. Tabulations were then undertaken to generate background data required for the analysis of WTP (Appendix 8 b). Probit analysis was undertaken using a standard econometric program to generate demand equations for estimation of WTP (Appendix 8 c). The WTP amounts used in the economic analysis and the sample sizes used for their estimation are shown in Table 10-4. The income elasticity of willingness-to-pay was generally not significantly different to zero, which is most likely due to the use of cross-sectional rather than time-series data, and is not considered to reflect the actual situation.

Table 10-4: Estimated Willingness-to-pay for Improved Urban Services

Urban Improvement for which Willingness–to-pay Estimated	Mawlamyine	Hpa-An	Myawaddy
Improved water supply (MK/cubic meter)	266.4	119.4	230.7
Improved solid waste collection and management (MK/household/month)	2,949.5	3,259.5	4,430.1

Source: Consultant's estimates based on contingency valuation surveys

10.5.3 ESTIMATION OF TOTAL BENEFITS FROM CONTINGENT VALUATION RESULTS

Improved Water Supply Systems. Total benefits for this output were estimated based on the benefits from (i) improved domestic water supply services, and (ii) improved non-domestic water supply services. The first was based on the estimated WTP as determined from the contingent valuation survey while the second was based on an assumption of benefit transfer between domestic and non-domestic users. Other benefits that could be included in the analysis include:

- time savings from not having to collect water from a source outside of the house or from a tubewell;
- cost savings having to pay a lower unit cost for the water;
- cost savings due to reduced need to purchase bottled water;
- cost savings due to reduced disease incidence from polluted water.

The results of the contingent valuation survey indicated that additional costs for water collection from non-piped sources are minimal and are therefore not included in the analysis. Finally, neither the household socio-economic survey nor the contingent valuation survey identified a significant incidence of drinking water borne diseases. Neither was it possible to identify significant incidences from available medical information. This might be because most households consider these diseases as minor, and a part of life, and do not use medical services unless the disease becomes severe, or they might actually be very low due to the predominant use of bottled water for drinking. Irrespective of the actual situation, these benefits are considered to be most likely captured within the WTP estimates. Non-quantifiable benefits from improved water supply would include the increased growth in tourism and general environmental benefits.

Improved Domestic Water Supply Services. WTP for improved water supply services was estimated based on the complete contingent valuation survey sample of 1,140 respondents. After evaluation of several equations (Appendix 8.c) the values adopted for the economic analysis were MK266.4/m3 for Mawlamyine, MK119.4/m3 for Hpa-An and MK230.7/m3 for Myawaddy analysis (Table 10-4). Due to the current poor quality of the water supply system, all water consumption was assumed to be incremental. Since the survey sought the WTP for all respondents irrespective of whether or not they were currently connected, or would be connected during project implementation, the population of the subproject town was used to raise the WTP per litre to the total WTP. An average consumption of 120 lpcd was used for each of the towns.

A review of available literature suggested that the income elasticity of WTP is likely within the range of zero to one.(8) Based on the analysis of data collected in

[8] See for example, Berbier, E. B., C. Mikolaj, and N. Hanley. 2015. *Is the Income Elasticity to Pay for Pollution Control Constant*. Working Paper No. 7/2015 (155), University of Warsaw, faculty of Economic Sciences, and Khan, H., 2014. *Estimating elasticities of demand and willingness to pay for clean drinking water: empirical evidence from a household level survey in northern Pakistan,* Water and Environmental Journal 28, pp145-152.

Peshawar, Khan estimated the WTP for clean water at 0.7. Given the similarities in the level of development of these two areas, this value is considered appropriate for the project area and was incorporated into the analysis. In the absence of location-specific information, the growth in household incomes was assumed to be similar to the growth in national per capita GDP.

Improved Non-Domestic Water Supply Services. Improved non-domestic water supply services refer to the services received by commercial business in the three townships, predominantly hotels, wholesale and retail enterprises, and other small businesses. Based on the demand analysis non-domestic water consumption is about 10% of domestic consumption. WTP for non-domestic water is assumed to be the same as for domestic water so that the benefit can be computed as a percentage of the total benefit.

Improved Solid Waste Collection and Management Systems. A similar approach was used for the solid waste collection and management subprojects with the improved services considered to be all incremental due to the poor quality of the existing systems. The elasticity of WTP was assumed to be slightly lower, at 0.5. WTP for improved solid waste collection and management services was estimated based on the complete contingent valuation survey sample of 1,140 respondents. After evaluation of several equations (Appendix 8.c) the values adopted for the economic analysis were MK2,949.5/household/month for Mawlamyine, MK3,259.5/household/month for Hpa-An and MK4,430.1/household/month for Myawaddy analysis (Table 10-4).

10.5.4 NON-QUANTIFIABLE BENEFITS

Substantial non-quantifiable benefits are identified for the project in all three towns, particularly with respect to increased tourism and development of trade activities. Without the project, the prevalence of rubbish throughout the project towns, and the unsightly and unhealthy landfill sight close to Mount ZweKabin, in Hpa-An, have a negative impact on tourism. With-project the removal of the environmental eyesores, combined with the improvement to water supply and promotion of heritage sights, will all benefit the development of tourism. However, the limited availability of related data hinders the estimation of the magnitude of these benefits. With respect to development of trade activities, project activities in both Hpa-An and Myawaddy are likely to have substantial benefits, which again cannot be quantified.

10.6 Economic Viability

The economic analysis is conducted for each of the subprojects as well as for the three townships and the overall project using the estimated financial costs of mid-2015 converted to their economic values. Incremental O&M costs are estimated based on current and projected future, with-project, costs prepared by the technical specialists. Benefit estimates for all of the subprojects are derived predominantly from analysis of willingness-to-pay based on the contingent valuation survey. WTP for improved water supply services are considered to capture all of the benefits relating to water supply. The WTP for improved solid waste collection and management services are considered to capture most of the benefits relating to improved health, environment, etc. However, there is an additional benefit for these subprojects based on the value of compost produced from the organic part of waste. WTP estimates are considered to be a non-tradable good so that, consistent with the assumption of a domestic price level numeraire, the economic value of WTP is the same as its financial value.

The results of the economic analysis are summarized in Table 10-5 and are presented in detail in the remainder of this section. The EIRRs of the solid waste collection and management subprojects in Hpa-An and Myawaddy are higher than those of the improved water supply projects, while the EIRR of the water supply subproject in Mawlamyine is higher than the EIRR of the solid waste collection and management subproject. All subprojects except Hpa-An water supply are economically viable. Consequently Hpa-An is also the only project town where the overall project is not economically viable. The overall project has an EIRR of 12.6%, which shows it is marginally viable from an economic perspective. However, the considerable non-quantitative economic benefits outlined above should justify the overall project.

Table 10-5: Summary of Economic Analysis by Subproject, Town, and Overall Project

Town/Subproject	EIRR (%)	ENPV (MK millons)
Mawlamyine	15.9	6,738
Improved Water Supply	17.6	6,181
Improved Solid Waste Collect and Management	13.0	557
Hpa-An	8.0	(4,660)
Improved Water Supply	3.0	(6,386)
Improved Solid Waste Collect and Management	15.9	1,726
Myawaddy	16.8	5,263
Improved Water Supply	14.8	1,822
Improved Solid Waste Collect and Management	18.7	2,714
Overall Project	12.6	2,495

EIRR = economic internal rate of return; ENPV = economic net present value; (.) = negative

Source: PPTA Consultant's estimates

10.6.1 MAWLAMYINE

Improved Water Supply. The results of the base economic analysis of the improved water supply subproject for Mawlamyine are shown in Table 10-6. The EIRR of the subproject is estimated at 17.6% and the ENPV at MK6,181 million, indicating that the subproject is economically viable.

Table 10-6: Economic Analysis of Mawlamyine Improved Water Supply Subproject (in MK million)

	Costs			Benefits			
Year	Investment	Recurrent	Total	Domestic Consumption	Non-domestic Consumption	Total	Net Benefits
2017	19	-	19	-	-	-	(19)
2018	6,337	-	6,337	-	-	-	(6,337)
2019	3,481	202	3,682	1,744	174	1,918	(1,764)
2020	3,336	357	3,693	1,859	186	2,045	(1,648)
2021	2,614	330	2,944	1,980	198	2,178	(766)
2022	73	400	472	2,109	211	2,320	1,848
2023	-	405	405	2,248	225	2,472	2,067
2024		424	424	2,396	240	2,636	2,212
2025		553	553	2,555	255	2,810	2,257
2026		578	578	2,714	271	2,985	2,407
2027		646	646	2,882	288	3,171	2,524
2028		720	720	3,062	306	3,368	2,647
2029		735	735	3,256	326	3,581	2,846
2030		804	804	3,463	346	3,809	3,005
2031		941	941	3,671	367	4,038	3,097
2032		941	941	3,892	389	4,282	3,341
2033		941	941	4,127	413	4,540	3,599
2034		941	941	4,377	438	4,815	3,874
2035		941	941	4,642	464	5,106	4,166
2036		941	941	4,908	491	5,398	4,458
2037		941	941	5,189	519	5,708	4,767
2038		941	941	5,487	549	6,036	5,095
2039		941	941	5,803	580	6,383	5,443
2040		941	941	6,138	614	6,751	5,811
2041		941	941	6,354	635	6,990	6,049
2042		941	941	6,578	658	7,236	6,295
2043		941	941	6,809	681	7,490	6,549
2044		941	941	7,048	705	7,753	6,812
2045		941	941	7,296	730	8,025	7,084
2046		941	941	7,552	755	8,307	7,366
2047		941	941	7,817	782	8,598	7,658
2048		941	941	8,091	809	8,900	7,960
ENPV =	11,185	3,599	14,785	19,060	1,906	20,966	6,181
EIRR =							17.6%

EIRR = economic internal rate of return; ENPV = economic net present value; WTP = willingness-to-pay.

Source: PPTA Consultant's estimates

Improved Solid Waste Collection and Management. The results of the base economic analysis of the improved solid waste collection and management subproject for Mawlamyine are shown in Table 10-7. The EIRR of the subproject is estimated at 13.0% and the ENPV at MK557 million, indicating that the subproject is economically viable.

Table 10-7: Economic Analysis of Mawlamyine Improved Solid Waste Collection and Management Subproject (in MK millions)

	Costs			Benefits				
				Solid waste Collection				
Year	Investment	Recurrent	Total	Domestic	Non-domestic	Compost	Total	Net Benefits
2017	175	-	175	-	-	-	-	(175)
2018	1,595	-	1,595	-	-	-	-	(1,595)
2019	4,055	-	4,055	-	-	-	-	(4,055)
2020	6,208	-	6,208	1,825	365	61	2,251	(3,957)
2021	295	566	861	1,857	371	63	2,291	1,430
2022	-	566	566	1,889	378	66	2,333	1,767
2023	-	566	566	1,922	384	69	2,376	1,810
2024	1,083	566	1,649	1,957	391	72	2,420	771
2025	3,311	566	3,876	1,992	398	119	2,510	(1,366)
2026	-	566	566	2,025	405	124	2,554	1,989
2027	-	566	566	2,059	412	129	2,600	2,034
2028	1,083	566	1,649	2,094	419	134	2,647	998
2029	-	566	566	2,130	426	139	2,695	2,129
2030	-	566	566	2,166	433	145	2,744	2,179
2031	-	566	566	2,203	441	151	2,795	2,229
2032	1,083	566	1,649	2,242	448	156	2,846	1,197
2033	-	566	566	2,281	456	162	2,900	2,334
2034	-	566	566	2,321	464	168	2,954	2,388
2035	-	566	566	2,363	473	175	3,010	2,444
2036	1,083	566	1,649	2,405	481	181	3,067	1,418
2037	-	566	566	2,449	490	188	3,126	2,561
2038	-	566	566	2,493	499	195	3,187	2,621
2039	-	566	566	2,539	508	202	3,249	2,683
2040	-	566	566	2,586	517	209	3,313	2,747
2041	862	566	1,427	2,586	517	209	3,313	1,885
ENPV =	10,677	2,719	13,395	11,130	2,226	596	13,952	557
EIRR =								13.0%

EIRR = economic internal rate of return; ENPV = economic net present value; WTP = willingness-to-pay.

Source: PPTA Consultant's estimates

Overall Mawlamyine Subprojects. The results of the base economic analysis of the combined Mawlamyine subprojects are shown in Table 10-8. The overall EIRR of the subprojects is estimated at 15.9% and the ENPV at MK6,738 million, indicating that the combined investment in Mawlamyine is economically viable.

Table 10-8: Economic Analysis of Overall Mawlamyine Subprojects (MK millions)

	Costs			Benefits			
Year	Investment	Recurrent	Total	Water supply	Solid waste	Total	Net Benefits
2017	194	-	194	-	-	-	(194)
2018	7,932	-	7,932	-	-	-	(7,932)
2019	7,536	202	7,737	1,918	-	1,918	(5,819)
2020	9,544	357	9,901	2,045	2,251	4,296	(5,605)
2021	2,909	896	3,805	2,178	2,291	4,469	664
2022	73	965	1,038	2,320	2,333	4,653	3,615
2023	-	971	971	2,472	2,376	4,848	3,877
2024	1,083	989	2,073	2,636	2,420	5,055	2,983
2025	3,311	1,119	4,430	2,810	2,510	5,320	890
2026	-	1,144	1,144	2,985	2,554	5,539	4,395
2027	-	1,212	1,212	3,171	2,600	5,771	4,559
2028	1,083	1,286	2,369	3,368	2,647	6,015	3,645
2029	-	1,301	1,301	3,581	2,695	6,276	4,976
2030	-	1,369	1,369	3,809	2,744	6,553	5,184
2031	-	1,507	1,507	4,038	2,795	6,833	5,326
2032	1,083	1,506	2,590	4,282	2,846	7,128	4,538
2033	-	1,506	1,506	4,540	2,900	7,440	5,933
2034	-	1,506	1,506	4,815	2,954	7,769	6,262
2035	-	1,506	1,506	5,106	3,010	8,116	6,610
2036	1,083	1,506	2,590	5,398	3,067	8,466	5,876
2037	-	1,506	1,506	5,708	3,126	8,834	7,328
2038	-	1,506	1,506	6,036	3,187	9,223	7,716
2039	-	1,506	1,506	6,383	3,249	9,632	8,126
2040	-	1,506	1,506	6,751	3,313	10,064	8,557
2041	862	1,506	2,368	6,990	3,313	10,302	7,934
2042	-	941	941	7,236	-	7,236	6,295
2043	-	941	941	7,490	-	7,490	6,549
2044	-	941	941	7,753	-	7,753	6,812
2045	-	941	941	8,025	-	8,025	7,084
2046	-	941	941	8,307	-	8,307	7,366
2047	-	941	941	8,598	-	8,598	7,658
2048	-	941	941	8,900	-	8,900	7,960
ENPV =	21,862	6,318	28,180	20,966	13,952	34,918	6,738
EIRR =							15.9%

EIRR = economic internal rate of return; ENPV = economic net present value; WTP = willingness-to-pay.

Source: PPTA Consultant's estimates

10.6.2 HPA-AN

Improved Water Supply. The results of the base economic analysis of the improved water supply subproject for Hpa-An are shown in Table 10-9. The EIRR of the subproject is estimated at 3.0% and the ENPV at a 12% discount rate is negative MK6,386 million, well below the required rate for economic viability. The main factors contributing to the low EIRR are the small benefitting population and the relatively low WTP.

Table 10-9: Economic Analysis of Hpa-An Improved Water Supply Subproject (in MK millions)

	Costs			Benefits				
Year	Investment	Recurrent	Total	Domestic Consumption	Non-domestic Consumption	Connection Fees	Total	Net Benefits
2017	6	-	6	-	-		-	(6)
2018	4,829	-	4,829	-	-	21	-	(4,829)
2019	4,340	7	4,347	184	18	22	224	(4,122)
2020	1,275	196	1,471	254	25	23	303	(1,169)
2021	1,275	290	1,566	370	37	25	431	(1,134)
2022	73	291	363	420	42	26	488	125
2023	-	342	342	448	45	27	519	177
2024		366	366	476	48	30	554	188
2025		370	370	507	51	31	589	219
2026		436	436	545	54	33	632	197
2027		436	436	587	59	35	681	244
2028		457	457	633	63	36	733	276
2029		537	537	680	68	13	761	224
2030		594	594	730	73	14	817	223
2031		594	594	794	79	14	888	294
2032		594	594	864	86	15	965	371
2033		594	594	939	94	15	1,048	454
2034		594	594	1,016	102	22	1,139	546
2035		594	594	1,099	110	23	1,232	638
2036		594	594	1,189	119	24	1,331	738
2037		594	594	1,285	129	25	1,438	844
2038		594	594	1,388	139	26	1,553	959
2039		594	594	1,499	150	27	1,676	1,082
2040		594	594	1,619	162	28	1,808	1,215
2041		594	594	1,667	167	29	1,862	1,269
2042		594	594	1,716	172	30	1,918	1,324
2043		594	594	1,767	177	32	1,975	1,382
2044		594	594	1,819	182	32	2,033	1,439
2045		594	594	1,873	187	32	2,092	1,499
2046		594	594	1,929	193	32	2,153	1,560
2047		594	594	1,986	199	32	2,216	1,623
2048		594	594	2,045	205	32	2,281	1,687
ENPV =	8,515	2,386	10,900	3,956	396	201	4,515	(6,386)
EIRR =								3.0%

EIRR = economic internal rate of return; ENPV = economic net present value; WTP = willingness-to-pay.

Source: PPTA Consultant's estimates

Improved Solid Waste Collection and Management. The results of the base economic analysis of the improved solid waste collection and management subproject for Hpa-An are shown in Table 10-10. The EIRR of the subproject is estimated at 15.9% and the ENPV at MK1,726 million, indicating that the subproject is economically viable.

Table 10-10: Economic Analysis of Hpa-An Improved Solid Waste Collection and Management Subproject (in MK millions)

	Costs			Benefits				
				Solid Waste Collection				Net
Year	Investment	Recurrent	Total	Domestic	Non-domestic	Compost	Total	Benefits
2017	238	-	238	-	-	-	-	(238)
2018	250	-	250	-	-	-	-	(250)
2019	2,459	-	2,459	-	-	-	-	(2,459)
2020	4,024	-	4,024	873	175	24	1,071	(2,953)
2021	353	295	648	929	186	25	1,140	492
2022	-	295	295	990	198	26	1,214	919
2023	-	295	295	1,055	211	27	1,293	997
2024	-	295	295	1,122	224	28	1,375	1,079
2025	2,016	295	2,311	1,194	239	48	1,480	(831)
2026	-	295	295	1,266	253	50	1,568	1,273
2027	697	295	993	1,345	269	52	1,666	674
2028	-	295	295	1,430	286	54	1,770	1,475
2029	-	295	295	1,515	303	57	1,875	1,579
2030	-	295	295	1,605	321	59	1,986	1,690
2031	-	295	295	1,701	340	62	2,104	1,808
2032	-	295	295	1,803	361	65	2,228	1,933
2033	-	295	295	1,911	382	68	2,360	2,065
2034	697	295	993	2,019	404	70	2,493	1,500
2035	-	295	295	2,133	427	73	2,633	2,337
2036	-	295	295	2,253	451	77	2,781	2,485
2037	-	295	295	2,381	476	80	2,937	2,641
2038	-	295	295	2,516	503	83	3,102	2,807
2039	-	295	295	2,659	532	86	3,277	2,982
2040	-	295	295	2,810	562	90	3,462	3,167
2041	434	295	729	2,893	579	90	3,562	2,833
ENPV =	5,962	1,420	7,383	7,388	1,478	243	9,108	1,726
EIRR =								15.9%

EIRR = economic internal rate of return; ENPV = economic net present value; WTP = willingness-to-pay.

Source: PPTA Consultant's estimates

Overall Hpa-An Subprojects. The results of the base economic analysis of the overall Hpa-An subprojects are shown in Table 10-11. The EIRR of the combined subprojects is estimated at 8.0% and the ENPV at negative MK4,660 million, indicating that the combined overall subproject is not economically viable. However, there are considered to be substantial non-quantifiable benefits associated with

improving urban services in Hpa-An including promotion of the tourism industry, which is developing but will likely be negatively affected without the project.[9]

Table 10-11: Economic Analysis of Overall Hpa-An Subprojects (MK millions)

	Costs			Benefits			
Year	Investment	Recurrent	Total	Water supply	Solid waste	Total	Net Benefits
2017	244	-	244	-	-	-	(244)
2018	5,079	-	5,079	-	-	-	(5,079)
2019	6,798	7	6,805	224	-	224	(6,581)
2020	5,299	196	5,495	303	1,071	1,374	(4,122)
2021	1,628	586	2,214	431	1,140	1,571	(643)
2022	73	586	659	488	1,214	1,702	1,043
2023	-	638	638	519	1,293	1,812	1,174
2024	-	661	661	554	1,375	1,929	1,267
2025	2,016	665	2,681	589	1,480	2,069	(612)
2026	-	731	731	632	1,568	2,201	1,470
2027	697	732	1,429	681	1,666	2,347	918
2028	-	752	752	733	1,770	2,503	1,751
2029	-	833	833	761	1,875	2,636	1,804
2030	-	889	889	817	1,986	2,803	1,914
2031	-	889	889	888	2,104	2,992	2,102
2032	-	889	889	965	2,228	3,193	2,304
2033	-	889	889	1,048	2,360	3,408	2,519
2034	697	889	1,586	1,139	2,493	3,632	2,046
2035	-	889	889	1,232	2,633	3,864	2,975
2036	-	889	889	1,331	2,781	4,112	3,223
2037	-	889	889	1,438	2,937	4,375	3,486
2038	-	889	889	1,553	3,102	4,655	3,766
2039	-	889	889	1,676	3,277	4,953	4,064
2040	-	889	889	1,808	3,462	5,270	4,381
2041	434	889	1,323	1,862	3,562	5,424	4,102
2042	-	594	594	1,918	-	1,918	1,324
2043	-	594	594	1,975	-	1,975	1,382
2044	-	594	594	2,033	-	2,033	1,439
2045	-	594	594	2,092	-	2,092	1,499
2046	-	594	594	2,153	-	2,153	1,560
2047	-	594	594	2,216	-	2,216	1,623
2048	-	594	594	2,281	-	2,281	1,687
ENPV =	14,477	3,806	18,283	4,515	9,108	13,623	(4,660)
EIRR =							8.0%

EIRR = economic internal rate of return; ENPV = economic net present value; WTP = willingness-to-pay. Source: PPTA Consultant's estimates

[9] In particular this includes replacement of the existing landfill site which is close to Mount ZweKabin.

10.6.3 MYAWADDY

Improved Water Supply. The results of the base economic analysis of the improved water supply subproject for Myawaddy are shown in Table 10-12. The EIRR of the subproject is estimated at 14.8% and the ENPV at MK1,822 million, indicating that the subproject is economically viable.

Table 10-12: Economic Analysis of Myawaddy Improved Water Supply Subproject (MK millions)

	Costs			Benefits			
Year	Investment	Recurrent	Total	Domestic Consumption	Non-domestic Consumption	Total	Net Benefits
2017	-	-	-	-	-	-	-
2018	3,682	-	3,682	-	-	-	(3,682)
2019	2,946	-	2,946	-	-	-	(2,946)
2020	842	265	1,106	1,081	90	1,171	65
2021	842	346	1,188	1,147	92	1,239	51
2022	73	350	423	1,218	93	1,311	888
2023	-	384	384	1,292	94	1,387	1,003
2024		388	388	1,370	96	1,466	1,078
2025		485	485	1,452	97	1,550	1,065
2026		529	529	1,555	100	1,655	1,125
2027		554	554	1,665	102	1,767	1,213
2028		589	589	1,770	105	1,875	1,286
2029		678	678	1,877	108	1,984	1,307
2030		717	717	1,990	110	2,100	1,383
2031		717	717	2,109	113	2,223	1,506
2032		717	717	2,237	116	2,353	1,636
2033		717	717	2,372	119	2,491	1,774
2034		717	717	2,507	122	2,629	1,912
2035		717	717	2,649	125	2,775	2,058
2036		717	717	2,801	129	2,929	2,212
2037		717	717	2,960	132	3,093	2,376
2038		717	717	3,130	136	3,265	2,548
2039		717	717	3,309	139	3,448	2,731
2040		717	717	3,498	143	3,641	2,924
2041		717	717	3,600	143	3,743	3,026
2042		717	717	3,704	143	3,848	3,131
2043		717	717	3,812	143	3,955	3,238
2044		717	717	3,922	143	4,066	3,349
2045		717	717	4,036	143	4,180	3,463
2046		717	717	4,154	143	4,297	3,580
2047		717	717	4,274	143	4,417	3,700
2048		717	717	4,398	143	4,541	3,824
ENPV =	6,082	2,893	8,975	10,197	600	10,797	1,822
EIRR =							14.8%

EIRR = economic internal rate of return; ENPV = economic net present value; WTP = willingness-to-pay. Source: PPTA Consultant's estimates

Improved Solid Waste Collection and Management. The results of the base economic analysis of the improved solid waste collection and management subproject for Myawaddy are shown in Table 10-13. The EIRR of the subproject is estimated at 18.7% and the ENPV is MK5,715 million, indicating that the subproject is economically viable.

Table 10-13: Economic Analysis of Myawaddy Improved Solid Waste Collection and Management Subproject (MK millions)

	Costs			Benefits				
				Solid Waste Collection				Net
Year	Investment	Recurrent	Total	Domestic	Non-domestic	Compost	Total	Benefits
2017	24	-	24	-	-	-	-	(24)
2018	24	-	24	-	-	-	-	(24)
2019	1,077	-	1,077	-	-	-	-	(1,077)
2020	4,908	-	4,908	-	-	-	-	(4,908)
2021	605	335	941	1,216	243	39	1,498	558
2022	-	335	335	1,268	254	41	1,562	1,227
2023	-	335	335	1,321	264	43	1,628	1,293
2024	-	335	335	1,375	275	45	1,696	1,360
2025	2,945	335	3,280	1,432	286	76	1,794	(1,486)
2026	-	335	335	1,505	301	80	1,885	1,550
2027	-	335	335	1,585	317	84	1,985	1,650
2028	-	335	335	1,669	334	88	2,090	1,755
2029	-	335	335	1,754	351	92	2,196	1,861
2030	929	335	1,264	1,843	369	97	2,308	1,044
2031	-	335	335	1,936	387	101	2,425	2,090
2032	-	335	335	2,035	407	106	2,549	2,213
2033	-	335	335	2,139	428	112	2,678	2,343
2034	-	335	335	2,243	449	117	2,809	2,473
2035	929	335	1,264	2,352	470	122	2,945	1,681
2036	-	335	335	2,467	493	128	3,089	2,754
2037	-	335	335	2,588	518	134	3,240	2,904
2038	-	335	335	2,715	543	141	3,398	3,063
2039	-	335	335	2,848	570	147	3,564	3,229
2040	-	335	335	2,987	597	154	3,739	3,403
2041	602	335	937	3,050	610	154	3,814	2,877
ENPV =	5,665	1,612	7,277	8,018	1,604	369	9,991	2,714
EIRR =								18.7%

EIRR = economic internal rate of return; ENPV = economic net present value; WTP = willingness-to-pay.

Source: PPTA Consultant's estimates

Overall Myawaddy Subprojects. The results of the base economic analysis of the combined Myawaddy subprojects are shown in Table 10-14. The EIRR is estimated at 16.8% and the ENPV is MK5,263 million, indicating that the combine subproject is economically viable.

Table 10-14: Economic Analysis of Overall Myawaddy Subprojects (MK millions)

	Costs			Benefits			
Year	Investment	Recurrent	Total	Water supply	Solid waste	Total	Net Benefits
2017	24	-	24	-	-	-	(24)
2018	3,707	-	3,707	-	-	-	(3,707)
2019	4,023	-	4,023	-	-	-	(4,023)
2020	5,749	265	6,014	1,171	-	1,171	(4,843)
2021	1,447	681	2,128	1,239	1,498	2,737	609
2022	73	685	758	1,311	1,562	2,873	2,115
2023	-	719	719	1,387	1,628	3,015	2,296
2024	-	719	719	1,466	1,696	3,162	2,443
2025	2,945	719	3,664	1,550	1,794	3,344	(320)
2026	-	719	719	1,655	1,885	3,540	2,821
2027	-	719	719	1,767	1,985	3,752	3,033
2028	-	719	719	1,875	2,090	3,966	3,247
2029	-	719	719	1,984	2,196	4,181	3,462
2030	929	719	1,648	2,100	2,308	4,408	2,760
2031	-	719	719	2,223	2,425	4,648	3,929
2032	-	719	719	2,353	2,549	4,901	4,182
2033	-	719	719	2,491	2,678	5,169	4,450
2034	-	719	719	2,629	2,809	5,437	4,718
2035	929	719	1,648	2,775	2,945	5,720	4,073
2036	-	719	719	2,929	3,089	6,018	5,299
2037	-	719	719	3,093	3,240	6,332	5,613
2038	-	719	719	3,265	3,398	6,663	5,944
2039	-	719	719	3,448	3,564	7,012	6,293
2040	-	719	719	3,641	3,739	7,380	6,661
2041	602	719	1,321	3,743	3,814	7,557	6,237
2042	-	719	719	3,848	-	3,848	3,129
2043	-	719	719	3,955	-	3,955	3,236
2044	-	719	719	4,066	-	4,066	3,347
2045	-	719	719	4,180	-	4,180	3,461
2046	-	719	719	4,297	-	4,297	3,578
2047	-	719	719	4,417	-	4,417	3,698
2048	-	719	719	4,541	-	4,541	3,823
ENPV =	11,747	3,778	15,525	10,797	9,991	20,787	5,263
EIRR =							16.8%

EIRR = economic internal rate of return; ENPV = economic net present value; WTP = willingness-to-pay.

Source: PPTA Consultant's estimates

10.6.4 OVERALL PROJECT

The economic analysis of the overall project is accomplished by combining the investment costs, recurrent costs, and benefits of the six above subprojects. The combined costs and benefits are shown in Table 10-15. The results of the base economic analysis of the overall project indicate an EIRR of 12.6% and an ENPV of MK2,495 million, indicating that the overall project is economically viable, although marginal. However, there are considered to be substantial non-quantifiable benefits, which further justify its implementation.

Table 10-15: Economic Analysis of Overall Project (MK millions)

	Costs					Benefits			
	Investment		Recurrent						
Year	Water supply	Solid waste	Water supply	Solid waste	Total	Water supply	Solid waste	Total	Net Benefits
2017	24	438	-	-	462	-	-	-	(462)
2018	14,848	1,869	-	-	16,717	-	-	-	(16,717)
2019	10,766	7,591	209	-	18,566	1,937	-	1,937	(16,629)
2020	5,453	15,139	817	-	21,410	3,241	3,322	6,563	(14,847)
2021	4,731	1,253	966	1,197	8,147	3,454	4,930	8,384	237
2022	218	-	1,040	1,197	2,454	3,673	5,109	8,782	6,328
2023	-	-	1,131	1,197	2,327	3,904	5,297	9,201	6,873
2024	-	1,083	1,178	1,197	3,458	4,149	5,490	9,639	6,182
2025	-	8,271	1,408	1,197	10,875	4,411	5,784	10,195	(681)
2026	-	-	1,544	1,197	2,740	4,694	6,008	10,702	7,962
2027	-	697	1,636	1,197	3,530	4,996	6,252	11,248	7,718
2028	-	1,083	1,766	1,197	4,046	5,306	6,508	11,814	7,768
2029	-	-	1,950	1,197	3,146	5,634	6,766	12,400	9,254
2030	-	929	2,114	1,197	4,239	5,982	7,038	13,020	8,780
2031	-	-	2,252	1,197	3,448	6,340	7,323	13,664	10,215
2032	-	1,083	2,251	1,197	4,531	6,721	7,623	14,344	9,812
2033	-	-	2,251	1,197	3,448	7,125	7,938	15,063	11,615
2034	-	697	2,251	1,197	4,145	7,545	8,255	15,800	11,655
2035	-	929	2,251	1,197	4,377	7,991	8,588	16,579	12,202
2036	-	1,083	2,251	1,197	4,531	8,447	8,937	17,384	12,852
2037	-	-	2,251	1,197	3,448	8,929	9,303	18,232	14,784
2038	-	-	2,251	1,197	3,448	9,440	9,687	19,127	15,679
2039	-	-	2,251	1,197	3,448	9,981	10,090	20,071	16,623
2040	-	-	2,251	1,197	3,448	10,555	10,513	21,068	17,620
2041	-	1,897	2,251	1,197	5,345	10,899	10,689	21,588	16,243
2042	-	-	2,251	-	2,251	11,255	-	11,255	9,004
2043	-	-	2,251	-	2,251	11,622	-	11,622	9,370
2044	-	-	2,251	-	2,251	12,001	-	12,001	9,749
2045	-	-	2,251	-	2,251	12,392	-	12,392	10,141
2046	-	-	2,251	-	2,251	12,797	-	12,797	10,545
2047	-	-	2,251	-	2,251	13,214	-	13,214	10,963
2048	-	-	2,251	-	2,251	13,646	-	13,646	11,395
ENPV =	25,782	22,304	8,878	5,750	62,715	32,159	33,051	65,210	2,495
EIRR =									12.6%

EIRR = economic internal rate of return; ENPV = economic net present value. Source: PPTA Consultant's estimates

10.7 Sensitivity Analysis

Sensitivity tests have been conducted for the six subprojects, the combined subprojects for each township, and for the overall project.

They include:

(i) a 10% investment cost increase;

(ii) a 10% benefit decrease;

(iii) a 10% investment cost increase combined with a 10% benefit decrease;

(iv) a 1-year lag in benefits,

(v) a 10% increase in investment costs;

(vi) a 10% overall cost increase; and

(vii) a 10% overall cost increase combined with a 10% benefit decrease.

Switching values and sensitivity indicators are estimated for each of the tests involving either a cost increase or a benefit decrease. No sensitivity tests are included for individual cost of benefit risks since these are considered to be sufficiently captured by the generic tests.

The results of the sensitivity tests are presented in Table 10-16 for Mawlamyine, Table 10-17 for Hpa-An, Table 10-18 for Myawaddy, and Table 10-19 for the overall project. The sensitivity tests for the overall project indicate that a 10% increase in investment costs would reduce the EIRR to 11.4%, while a 10% decrease in benefits would reduce it to 10.9%. The switching values indicate that either overall investment costs would have to increase by 5.2% or benefits decrease 3.8% to affect the economic viability of the project. The sensitivity indexes indicate that the project is highly sensitive to both investment cost increases and benefit decreases, and is marginal. A 10% investment cost increase combined with a 10% benefit decrease would reduce the EIRR to 9.8%, well below the cur-off point, while a 1-year benefit lag would reduce it to 11.0%. A 10% increase in O&M costs would reduce the EIRR to 12.3%, which would still be economically viable.

Table 10-16: Mawlamyine: Sensitivity Tests for Individual Subprojects and Overall

Town/ Sensitivity Test	Subproject		Combined Subprojects
	Improved Water Supply	Improved Solid Waste Management	
Mawlamyine			
a) 10% investment cost increase			
EIRR (%)	16.2	11.2	14.4
ENPV (MK millions)	5,063	(511)	4,552
Switching Value (%)	55.3	5.2	30.8
Sensitivity Indicator	1.8	19.2	3.2
b) 10% benefit decrease			
EIRR (%)	15.7	10.5	13.9
ENPV (MK millions)	4,085	(838)	3,247
Switching Value (%)	29.5	4.0	19.3
Sensitivity Indicator	3.4	25.0	5.2
c) a) and b) combined			
EIRR (%)	14.5	8.9	12.6
ENPV (MK millions)	2,966	(1,906)	1.060
d) 1-year benefit lag			
EIRR (%)	15.1	10.7	13.7
ENPV (MK billions)	3,757	(799)	3,132
e) 10% recurrent cost increase			
EIRR (%)	17.3	12.5	15.6
ENPV (MK millions)	5,821	285	6,107
Switching Value (%)	171.7	20.5	106.7
Sensitivity Indicator	0.6	4.9	0.9

EIRR = economic internal rate of return; ENPV = economic net present value; (.) = negative

Source: PPTA Consultant's estimates

Table 10-17: Hpa-An: Sensitivity Tests for Individual Subprojects and Overall

Town/ Sensitivity Test	Subproject		Combined Subprojects
	Improved Water Supply	Improved Solid Waste Management	
Hpa-An			
f) 10% investment cost increase			
EIRR (%)	2.5	14.4	7.1
ENPV (MK millions)	(7,237)	1,129	(6,108)
Switching Value (%)	(75.0)	28.9	(32.2)
Sensitivity Indicator	1.3	3.5	3.1
g) 10% benefit decrease			
EIRR (%)	2.0	13.9	6.6
ENPV (MK millions)	(6,837)	815	(6,023)
Switching Value (%)	(141.5)	18.9	(34.2)
Sensitivity Indicator	0.7	5.3	2.9
h) a) and b) combined			
EIRR (%)	1.5	12.5	5.8
ENPV (MK millions)	(7,689)	219	(7,470)
i) 1-year benefit lag			
EIRR (%)	2.3	14.3	7.2
ENPV (MK billions)	(6,913)	988	(5,739)
j) 10% recurrent cost increase			
EIRR (%)	2.6	15.6	7.6
ENPV (MK millions)	(6,624)	1,584	(5,041)
Switching Value (%)	(267.7)	121.5	(122.5)
Sensitivity Indicator	0.4	0.8	0.8

EIRR = economic internal rate of return; ENPV = economic net present value; (.) = negative

Note: A negative switching value indicates that either the cost must decrease or benefits increase for the investment to achieve economic viability.

Source: PPTA Consultant's estimates

Table 10-18: Myawaddy: Sensitivity Tests for Individual Subprojects and Overall

Town/ Sensitivity Test	Subproject		Combined Subprojects
	Improved Water Supply	Improved Solid Waste Management	
Myawaddy			
k) 10% investment cost increase			
EIRR (%)	13.7	16.9	15.5
ENPV (MK millions)	1,214	2,147	4,088
Switching Value (%)	30.0	47.9	44.8
Sensitivity Indicator	3.3	2.1	2.2
l) 10% benefit decrease			
EIRR (%)	13.2	16.3	15.0
ENPV (MK millions)	742	1,715	3,184
Switching Value (%)	16.9	27.1	25.3
Sensitivity Indicator	5.9	3.7	3.9
m) a) and b) combined			
EIRR (%)	12.2	14.7	13.8
ENPV (MK millions)	134	1,148	2,009
n) 1-year benefit lag			
EIRR (%)	12.8	15.3	14.5
ENPV (MK billions)	557	1,486	2,971
o) 10% recurrent cost increase			
EIRR (%)	14.3	18.3	16.5
ENPV (MK millions)	1,533	2,553	4,885
Switching Value (%)	63.0	168.4	139.3
Sensitivity Indicator	1.6	0.6	0.7

EIRR = economic internal rate of return; ENPV = economic net present value; (.) = negative

Source: PPTA Consultant's estimates

Table 10-19: Sensitivity Tests for Overall Project

Sensitivity Test	EIRR (%)	ENPV (MK millions)	SV (%)	SI
10% investment cost increase	11.4	(2,314)	5.2	19.3
10% benefit decrease	10.9	(4,026)	3.8	26.1
10% investment cost increase + 10% benefit decrease	9.8	(8,835)		
1-year benefit lag	11.0	(3,991)		
10% recurrent cost increase	12.3	1,032	17.1	5.9

EIRR = economic internal rate of return; ENPV = economic net present value; (.) = negative

Source: PPTA Consultant's estimates

11 FINANCIAL ANALYSIS OF SUBPROJECTS

This chapter includes the component required by the Terms of Reference for financial analysis of proposed water supply system improvement and solid waste management facilities, with the level of delivery corresponding to the final report stage of the PPTA.

In order to facilitate reading, the chapter are organized as follow:

1. Overview of Approach and Methodology
2. Mon State Financial Analysis
3. Mawlamyine Solid Waste Management
4. Mawlamyine Water Supply System
5. Kayin State Financial Analysis
6. Hpa An Solid Waste Management
7. Hpa An Water Supply System
8. Myawaddy Solid Waste Management
9. Myawaddy Water Supply System

11.1 Evaluation overview

The government of Myanmar requested the Asian Development Bank to support the three project cities of Mawlamyine and Hpa-An as the capital of Mon and Kayin States respectively, and Myawaddy for its special role as a border town. The proposed three project cities are located along the Greater Mekong Sub-region East-West Economic Corridor (GMS-EWEC) to serve as dynamic centres of investments and economic growth.

Solid waste management and water supply systems were identified as priority needs in the project sites. Technical studies were undertaken and the financial evaluation will determine the viability of these proposals. The financial analysis followed the guidelines described in ADB's *Financial Management and Analysis of Project* (2005).

11.1.1 CRITERIA FOR EVALUATION

Three indicators for the financial viability of the subproject were identified:

- **Financial Internal Rate of Return (FIRR).** It is the discount rate wherein the net revenue generated by the subproject is equal to zero. A subproject is considered financially viable if the computed FIRR is at least equal to the weighted average cost of capital (WACC) applicable to the proposed subproject. Evaluation is done on incremental basis – with project situation against without project situation.
- **Tariff Affordability.** The proposed fees (garbage fee and water tariff) should be affordable to low income households. In accordance with international

standards, the monthly minimum charge for household utilities shall be within 5% of income of the low-income group (LIG).

- **Subproject Sustainability.** The funds will be on-granted to the townships; however, the subproject should still demonstrate sufficient revenue generation from tariffs collection to cover annual operations and maintenance requirements. The projected income statement should show a positive cumulative net income throughout the projection period.

11.1.2 ASSUMPTIONS USED IN THE EVALUATION

The key financial and technical assumptions used in the projections are the following:

- Cost estimates were based on constant midyear 2015 prices.
- Domestic and foreign cost escalations[1] are as follows:

	2015	2016	2017	2018 onwards
Domestic cost escalation	5.1%	4.8%	6.0%	5.0%
Foreign cost escalation	0.5%	0.5%	0.5%	0.5%

- Exchange rate at MK1,280 to US$1.00.
- Physical contingencies at 10% of basic costs.
- Constant costs were used in the computation of FIRR while current costs were used in the financial statements.
- Operation and maintenance (O&M) expenses were based on technical projections.
- Number of property connections and coverage areas were based on system or facility capacity as presented in the technical evaluation.
- Start of construction is 2017 and project completion by 2023.

It is further assumed that loan proceeds from ADB and Neighboring Countries Economic Development Cooperation Agency (NEDA) will be passed-on by the Central Government to the townships as a grant (i.e. the Central Government will pay all principal and interest due on the loan).

[1] ADB SERD, Domestic Cost Escalation Factors Update, July 2015 and World Bank projections as of September 2012 for international cost escalation factors.

11.2 Mon State Financial Analysis

Financial analysis for Mon State subprojects includes viability evaluation of the two proposed revenue-generating subprojects in the Township of Mawlamyine:(i)solid waste management and (ii) water supply system.

The evaluation was conducted with the following objectives:

- Confirm the viability and sustainability of the subprojects;
- Fix the performance benchmark in terms of cost recovery for the subprojects
- Determine whether a subsidy will be required from the implementing entities (Mon State and Mawlamyine Township) to cover operating costs.

11.2.1 MAWLAMYINE SOLID WASTE MANAGEMENT

The main goal of the subproject is to enhance solid waste management through improved solid waste collection, expanded service coverage; availability of disposal facility, and efficient recycling and composting.

11.2.1.1 Existing Situation

The Mawlamyine Town Development Committee (MTDC) provides solid waste collection service to 23 of the 28 wards, covering about 90% of the total population. Assuming a population of 258,809 with a waste generation of 0.55 kg/capita/day, total waste is estimated to be 142 ton/day. About 50% of waste is reportedly collected and dumped at the designated dumpsite. The MTDC has only 7 waste vehicles for the 23 wards with collection done twice weekly.

Inadequate and uncontrolled waste disposal causes groundwater pollution, unpleasant odour, air pollution due to unauthorised burning of the waste, drain clogging and breeding of mosquitoes. These hazards have negative impact on the city's health and environment. While the majority of the city is generally kept clean, there are often accumulation of solid waste near the promenade area while others are washed away to the sea.

Cost recovery: The township's Cleaning Department is responsible for garbage collection, street cleaning and night soil. About 50% of generated waste (50 tons/day) is collected and dumped at open landfill sites. The rest of the generated wastes is dumped by people at unauthorized places. Total solid waste budget in 2014-15 was almost MMK200 million, as compared to MMK37 million of revenues collected through cleaning tax and a garbage fee. Consequently, about 80% of the costs is being subsidized from the general operating budget of the township (fiscal revenues). The level of service provided is bad and needs urgent improvement but this would need more than double the current operating budget for solid waste.

Tax and fee performance:

- Cleaning tax is equivalent to 10% of the rental value of the housing, same percentage as the housing tax and 2 points more than the water tax (8%). Total collection is slightly lower than the housing tax, because several quarters are not being served (Hpar out, San Gyi, Ngan Tay and Yogo quarters);
- Garbage fee is collected from commercial and business activities such as restaurants, market places and other small businesses.

Compared to total expenses, revenue collection from solid waste was only about 25%. This means that the township subsidizes 75% of total operational expenses. Financial data for years 2012 to 2015 are shown in the following **Table 11-1**

Table 11-1: Solid waste Budget (2012 - 2015)

in thousand Kyats	2012-13 Actual	2013-14 Actual	2014-15 Actual	2015-16 Estimate
Revenue	**35.492**	**36.226**	**37.309**	**35.700**
- Cleaning Tax	22.947	23.546	23.974	22.500
- Garbage fee	12.545	12.680	13.335	13.200
Charges	**77.528**	**150.325**	**191.368**	**160.399**
- Salaries & wages (permanent staff)	16.640	18.589	22.581	44.164
- Daily workers wages	28.114	86.900	121.451	70.975
- Transport charges				
- Taxes				
- Fuel	30.825	*42.836*	*42.836*	43.060
- Business equipment	1.949	2.000	2.500	2.200
- Equipement				
- Repairs & maintenance			2.000	
Operating balance	**-42.036**	**-114.099**	**-154.058**	**-124.699**
Capital investment expenditures	0	0	0	0
Overall balance (fiscal contribution if negative)	**-42.036**	**-114.099**	**-154.058**	**-124.699**

Ratios **Population = 253.734**	2012-13 *Actual*	2013-14 *Actual*	2014-15 *Actual*	2015-16 *Estimate*
- % of fiscal balance / Current Fiscal Revenues	2%	7%	8%	8%
- % of tariffs and tax / OPEX	46%	24%	19%	22%
- % of fiscal revenue requested / OPEX	54%	76%	81%	78%
- OPEX / Population (in Kyats per year)	**306**	**592**	**754**	**632**
- Tariffs & tax proceeds / Population (in Kyats)	**140**	**143**	**147**	**141**
- Need for Water Tariff/Tax increase	118%	315%	413%	349%
- Salaries & wages / OPEX	58%	70%	75%	72%
- Fuel charges / OPEX	40%	28%	22%	27%

11.2.1.2 Proposed Sub-Project

The proposed new ISWM system for Mawlamyine consists of:

- Improving primary collection system in the town and transport system to the landfill and composting site;
- More efficient separation and collecting of recyclables e.g. like ferro, plastic bottles, glass, aluminium cans and paper, both through the informal sector and formal sector;
- Implementation of a small hospital waste incinerator;
- Introducing source separating organics (SSO) system for diverting large amounts of organic waste to the new planned composting plant;

- Upgrading of the existing dumpsite to a controlled landfill with bottom liner and leachate collection and treatment.

Above measures are included in the investment plans of the town and proposed for ADB financing.

SUBPROJECT COSTS AND FINANCING PLAN

Total subproject cost for Mawlamyine Solid Waste Management is $18.5 million equivalent. This was based on the direct costs estimated in the technical study. The subproject cost includes civil works, vehicles and equipment; land acquisition and resettlement; detailed engineering survey and design; construction supervision; physical and price contingencies: taxes and duties; and financing charges during implementation. Details of the estimates are shown in the following Table 11-2.

Table 11-2: Detailed Cost Estimates by Expenditure Category

Mawlamyine Solid Waste Management

Item	In MK Millions			In $ millions			% of Base Cost
	Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total	
A. Investment Costs							
1. Civil works	7,602	8,354	15,956	5.94	6.53	12.47	81.9%
2. Equipment	2,257	136	2,393	1.76	0.11	1.87	12.3%
3. Vehicles	692	106	798	0.54	0.08	0.62	4.1%
4. Survey, Design and Supervision	-	47	47	-	0.04	0.04	0.2%
5. Land Acquisition and Resettlement	-	289	289	-	0.23	0.23	1.5%
Subtotal (A)	**10,551**	**8,931**	**19,483**	**8.24**	**6.98**	**15.22**	**100.0%**
B. Contingencies							
Physical Contingency	1,117	841	1,958	0.87	0.66	1.53	10.0%
Price Contingency	1,519	1,385	2,905	0.43	0.59	1.02	6.7%
Sub-total (B)	**2,636**	**2,226**	**4,863**	**1.30**	**1.25**	**2.55**	**16.8%**
C. Financing Charges	**1,062**	-	**1,062**	**0.73**	-	**0.73**	**4.8%**
Total Project Cost (A+B+C)	**14,249**	**11,158**	**25,407**	**10.27**	**8.23**	**18.50**	**121.5%**

ADB loan will finance $17.28 million equivalent while Union Government will shoulder all taxes and duties of $0.91 million equivalent and Mon State will provide for land acquisition and resettlement costs. The distribution of fund sources is detailed in the following Table 11-3.

Table 11-3: Detailed Cost Estimate by Financier – Mawlamyine Solid Waste Management

Item	ADB		Mon State		Central Government			Total Cost
	Amount	% of Cost Category	Amount	% of Cost Category	Amount (Taxes and duties)	Amount (Total)	% of Cost Category	
A. Investment Costs								
1. Civil works	11.88	95%	-	0%	0.59	0.59	5%	12.47
2. Equipment	1.76	94%	-	0%	0.11	0.11	6%	1.87
3. Vehicles	0.54	87%	-	0%	0.08	0.08	13%	0.62
4. Survey, Design and Supervision	0.04	100%	-	0%	-	-	0%	0.04
5. Land Acquisition and Resettlement	-	0%	0.23	100%	-	-	0%	0.23
Subtotal (A)	**14.22**	**93%**	**0.23**	**1%**	**0.78**	**0.78**	5%	**15.22**
B. Contingencies								
Physical Contingency	1.42	93%	0.03	2%	**0.08**	0.08		1.53
Price Contingency	0.96	94%	0.01	1%	**0.05**	0.05	5%	1.02
Sub-total (B)	**2.38**	93%	**0.05**	2%	**0.13**	**0.13**	5%	**2.55**
C. Financing Charges	**0.69**	**95%**	**-**	**0%**	**-**	**-**	0%	**0.73**
Total Project Cost (A+B+C)	**17.28**	**93%**	**0.27**	**1%**	**0.91**	**0.91**	5%	**18.50**
% of Total Project Cost	**93%**		**1%**			**5%**		

The subproject is proposed to be implemented over five years commencing in 2017 and to be completed by 2021. Operation of the subproject is targeted to start as soon as works are completed and full operation is expected by 2022. The indicative implementation schedule is shown in the following Table 11-4.

Table 11-4: Detailed Cost Estimates by Year – Mawlamyine ISWM ($ million)

Item	Total Cost	2017	2018	2019	2020	2021	2022	2023
A. Investment Costs								
1. Civil works	11.17	-	2.12	5.43	3.60	0.02	-	-
2. Equipment	1.96	-	-	0.28	1.60	0.08	-	-
3. Vehicles	0.41	-	-	-	0.25	0.15	-	-
4. Survey, Design & Supervision	0.91	0.12	0.13	0.22	0.26	0.13	0.04	-
Subtotal (A)	**14.45**	**0.12**	**2.25**	**5.94**	**5.71**	**0.39**	**0.04**	**-**
B. Contingencies								
Physical Contingency	1.35	-	0.21	0.57	0.54	0.03	-	-
Price Contingency	0.89	-	0.10	0.36	0.41	0.02	-	-
Sub-total (B)	**2.24**	**-**	**0.31**	**0.93**	**0.96**	**0.05**	**-**	**-**
C. Financing Charges During Implementation	**0.67**	**0.00**	**0.01**	**0.06**	**0.12**	**0.16**	**0.16**	**0.16**
Total Project Cost (A+B+C)	**17.37**	**0.12**	**2.57**	**6.92**	**6.79**	**0.59**	**0.20**	**0.16**
% Total Project Cost		**1%**	**15%**	**40%**	**39%**	**3%**	**1%**	**1%**

REVENUE PROJECTIONS

It is expected that the Township Government will gradually extend its coverage areas from the current 40% to 98% by 2040 in order to have an effective and sustainable environmental project in the township. A local regulation shall stipulate that all households and commercial establishments provided with collection service pay mandatory weekly or monthly fees and that these fees may be collected either by the township or through community organizations or village leaders.

The ADB loan proceeds will be on-granted to the State of Mon and Township of Mawlamyine from the Central Government. The proposed garbage fees are expected to at least cover O&M costs for sustainability.

The proposed tariff structure classifies consumers as either domestic (i.e. households) or non-domestic (i.e. commercial and industrial connections), with non-domestic connections to be charged more to boost revenues. The proposed monthly fee is MK1,400 per domestic connection and MK8,000 per non-domestic connection. Tariffs are expected to be implemented in 2020 when operation commences, increasing by 5% every five years to keep pace with real growth. The projected revenues were based on the projected increase in the number of domestic and non-domestic beneficiaries multiplied by the monthly service fees.

Details of operation are provided in the following Table 11-5.

Table 11-5: Solid Waste Management Revenue Projection – Mawlamyine

		2017	2018	2019	2020	2025	2030	2035	2040
Population									
Mawlamyine - urban areas		274,650	280,143	285,746	291,461	321,796	355,289	392,268	433,096
annual growth (%)		2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Number of households	HH size 5.0	54,930	56,029	57,149	58,292	64,359	71,058	78,454	86,619
Number of business establishments	Annual 2%	2,566	2,617	2,670	2,723	3,006	3,319	3,665	4,046
Per Capita Waste Generation									
per capita per day (kg)		0.58	0.59	0.61	0.62	0.69	0.76	0.83	0.90
annual increase (%)		2.5%	2.4%	2.4%	2.3%	2.1%	1.9%	1.7%	1.7%
OPERATIONS DATA									
Waste Generation									
Total waste generated (kg/day)		158,748	165,845	173,162	180,706	222,040	270,020	325,583	389,786
Additional waste from market (kg/day	20%	31,750	33,169	34,632	36,141	44,408	54,004	65,117	77,957
Total annual waste generated (tons/yr)		69,532	72,640	75,845	79,149	97,253	118,269	142,605	170,726
Collection Coverage									
Annual coverage (%)		48.6%	49.4%	50.3%	90.0%	92.0%	94.0%	96.0%	98.0%
Annual increase (%)		0.9%	0.9%	0.9%	39.7%	12.4%	0.4%	0.4%	0.4%
Waste Collection					58.35				
Total waste collected per day (kg)		92,488	98,331	104,454	195,171	245,129	304,583	375,083	458,390
Total waste collected per year (tons)		33,758	35,891	38,126	71,238	89,472	111,173	136,905	167,312
Collected Waste Composition (%)	Annual +/-								
Organics & greens		0.0%	0.0%	0.0%	25.0%	40.0%	40.0%	40.0%	40%
Recyclables	+ 0.8%	21.5%	22.2%	23.0%	20.0%	20.0%	20.0%	20.0%	20%
Residuals	+ 0.4%	27.1%	27.2%	27.3%	45.0%	32.0%	34.0%	36.0%	38%
Total (%)		**48.6%**	**49.4%**	**50.3%**	**90.0%**	**92.0%**	**94.0%**	**96.0%**	**98.0%**
Operations plan (tons/day)									
Days of operation		365	365	365	365	365	365	365	365
Organic material (tons/day)		0.0	0.0	0.0	54.2	106.6	129.6	156.3	187.1
Recycling production (tons/day)		41.0	44.3	47.8	43.4	53.3	64.8	78.1	93.5
Waste to landfill (tons/day)		51.5	54.1	56.7	97.6	85.3	110.2	140.7	177.7
Total (tons/day)		**92.5**	**98.3**	**104.5**	**195.2**	**245.1**	**304.6**	**375.1**	**458.4**

OPERATING COSTS

O&M costs were estimated by the technical engineers and were based on the capacity of the system. Included in O&M costs are personnel costs, chemicals and power cost. At 2015 constant prices, O&M costs were estimated to be $0.78 million annually when full operation of the facility is achieved by 2020. O&M costs were likewise escalated to current prices in the financial income statement.

Table 11-6: Operations and Maintenance Costs – Mawlamyine ISWM

Particulars		2017	2018	2019	2020	2025	2030	2035	2040
OPERATIONS & MAINTENANCE									
O&M - waste collection ($ million)					0.18	0.18	0.18	0.18	0.18
O&M - composting plant ($ million)					0.16	0.16	0.16	0.16	0.16
O&M - sanitary landfill ($ million)					0.44	0.44	0.44	0.44	0.44
Total O&M with Project					**0.78**	**0.78**	**0.78**	**0.78**	**0.78**
Total O&M without Project	5%	0.16	0.17	0.18	0.19	0.24	0.30	0.39	0.49

RESULTS OF EVALUATION

A subproject is considered financially viable if the resulting FIRR of the proposed subproject is higher than the WACC that was used in financing the subproject. An FIRR higher than the WACC implies that the incremental net revenues generated by the project will be enough to recover the implementation and operating costs.

On the basis of the financing mix and the loan interest of 1.0% and the assumed cost of equity of 13%, the computed WACC for the subproject is 0.5%. Details of the computation is shown in the following Table 11-7.

Table 11-7: Computation of Weighted Average Cost of Capital (WACC) – Mawlamyine ISWM

	Loan	Equity	TOTAL
Weight (%)	93.4%	6.6%	100%
Nominal Cost (%)	1.00%	13.00%	
Tax Rate (%)	5.00%	0.00%	
Tax Adjusted Nominal Cost (%)	0.95%	13.00%	
Inflation Rate (%)	1.50%	5.00%	
Real Cost (%)	-0.54%	7.62%	
Weighted Component of WACC (%)	0.00%	0.50%	
Weighted Average Cost of Capital (Real Terms)			**0.50%**

The summary results of FIRR computation is provided in Table 11-8 and detailed computation is shown in Table 11-10.

Table 11-8: Summary Result of Financial Analysis – Mawlamyine ISWM

FIRRs	Change	NPV	FIRR	SI (IRR)	SV (IRR)
Base Case		5.6	3.05%		
Case 1 - Increase in Capital Costs	10%	4.0	2.19%	3.36	30%
Case 2 - Increase in O&M Costs	10%	4.8	2.67%	1.50	67%
Case 3 - Decrease in Revenues	10%	2.6	1.70%	5.27	19%
Case 4 - Project Delay	1 Year Delay	3.6	2.07%	NPV lower by	37%

FIRR = financial internal rate of return
NPV = net present value
SI = sensitivity indicator (ratio of percentage change in IRR above the cut-off rate to percentage change in selected variable).

The projected income statement shows that the proposed fees can adequately cover the costs of annual O&M

Table 11-9: Projected Income and Expenditures – Mawlamyine ISWM ($ million)

Particulars	2020	2021	2022	2023	2024	2025	2030	2035	2040
Revenue									
Garbage fees	0.72	0.71	0.70	0.69	0.69	0.85	1.01	1.19	1.41
Tipping fees	0.31	0.32	0.34	0.35	0.36	0.38	0.46	0.56	0.67
Income from composting	0.06	0.06	0.07	0.07	0.07	0.12	0.15	0.18	0.21
Total Revenue	**1.09**	**1.10**	**1.11**	**1.11**	**1.12**	**1.35**	**1.62**	**1.93**	**2.29**
O&M Expenses									
Waste collection	0.21	0.22	0.23	0.24	0.25	0.26	0.32	0.38	0.46
Composting plant	0.20	0.21	0.22	0.22	0.23	0.24	0.30	0.36	0.43
Sanitary landfill	0.53	0.55	0.58	0.60	0.63	0.66	0.80	0.97	1.15
Total O&M Expenses	**0.93**	**0.98**	**1.02**	**1.07**	**1.11**	**1.16**	**1.42**	**1.71**	**2.04**
Net Income	**0.15**	**0.12**	**0.08**	**0.05**	**0.01**	**0.19**	**0.20**	**0.21**	**0.25**

AFFORDABILITY OF TARIFFS

Setting of tariffs is a key factor which affects the subproject's viability as well as the sustainability of subproject operations. While tariffs need to recover costs, they also need to be affordable.

Results of the socio-economic survey conducted under the project indicated that average household monthly income is about MK 237,900. Given a proposed monthly garbage fee of MK 1,400 per household, this is about 0.6% only of household income. For the low income group with average household monthly income of MK76,933, the proposed rate is about 1.8% of income. Hence, the proposed level of tariff was deemed affordable and reasonable to the household beneficiaries

Table 11-10: Financial Evaluation – Mawlamyine ISWM ($ million)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Incremental Costs												
Capital Costs	0.14	2.43	6.16	7.75	0.26	-	-	-	-	-	-	-
O&M Costs	(0.16)	(0.17)	(0.18)	0.60	0.59	0.58	0.57	0.56	0.55	0.48	0.40	0.29
Total Costs	(0.02)	2.26	5.99	8.35	0.85	0.58	0.57	0.56	0.55	0.48	0.40	0.29
Incremental Revenue	-	0.27	0.28	1.07	1.08	1.08	1.09	1.10	1.32	1.57	1.85	2.17
Net Cash Flow (Base Case)	0.02	(1.99)	(5.71)	(7.28)	0.23	0.51	0.52	0.54	0.78	1.09	1.46	1.88
Sensitivity Tests:												
Case 1 - Increase in Capital Costs	0.01	(2.24)	(6.32)	(8.05)	0.20	0.51	0.52	0.54	0.78	1.09	1.46	1.88
Case 2 - Increase in O&M Costs	0.04	(1.98)	(5.69)	(7.34)	0.17	0.45	0.47	0.49	0.72	1.04	1.42	1.85
Case 3 - Decrease in Revenues	0.02	(2.02)	(5.73)	(7.38)	0.12	0.40	0.42	0.43	0.64	0.93	1.27	1.67
Case 4 - Project Delay	0.02	(2.26)	(5.72)	(8.07)	0.22	0.50	0.52	0.54	0.55	1.00	1.35	1.76

FIRRs:	**Change**	**NPV**	**FIRR**	**SI (IRR)**	**SV (IRR)**
Base Case		5.6	3.05%		
Case 1 - Increase in Capital Costs	10%	4.0	2.19%	3.36	30%
Case 2 - Increase in O&M Costs	10%	4.8	2.67%	1.50	67%
Case 3 - Decrease in Revenues	10%	2.6	1.70%	5.27	19%
Case 4 - Project Delay	Delay	3.6	2.07%	lower by	37%

SI = sensitivity indicator (ratio of percentage change in IRR above the cut-off rate to percentage change in selected variable).
SV = switching value (percentage change in selected variable to reduce the IRR to cut-off rate).

11.2.2 MAWLAMYINE WATER SUPPLY SYSTEM

11.2.2.1 Existing Situation

Water supply is being operated by the township's Department of Water Supply, Electricity and Gardens. This department undertakes maintenance of the network, commercial management and collection of the water tariff from users.

Two projects are currently under implementation: JICA-financed project that is part of an overall JICA grant to the Union of Myanmar covering several towns; and Thai Tap Water (TTWP) that will be privately-operated covering the northern part of the city.

The water source for the northern zone covering wards 1 to 12 is currently partially served from the Attran River.

The southern zone is the major expansion area currently partially served by two reservoirs. This covers urban wards 13 to 23. The remaining wards (24 to 28) are not connected to the current system.

Recording of water supply revenues and expenditures are separate from the other cost centers (i.e. street lighting and gardens) managed by the department. In the absence of official reports, estimates were based on information gathered from interviews with the chief engineer. It is obviously under-estimated because of hidden costs and revenues, mainly on capital investment expenditures. Proceeds from connection fee could not be identified in the township accounts, probably because it was mixed with other accounting entries and could not be identified separately. The same for the charges linked to this activity. Portion of those costs is reportedly internal costs assumed by other departments and not invoiced to the water, electricity and gardens department.

Water charges. In 2014-15, water-operating expenditures accounted for 30% of the total current expenditure of the township, as compared to 19% in 2013-14 and 16% the year before. It is one of the more important departments of the township administration in terms of budget. Expenditures have been increasing rapidly due to increasing electricity charges that represent 77% of the operating costs (53% in 2013-14)[2].

The Department has 34 staff of which 20 people are working on water supply. Of these, 13 are meter readers with 2 water readers assigned solely within the market place. Meters readers read the meters and collect cash directly from users. They remit their collection to the department office every end of the day for recording and cash transfer to the finance department.

[2] Electricity charges to operate water supply facilities have been estimated up to 80% of the total electricity charges assumed by the township.

Water revenues. Water revenues are classified into three categories: water tax, water tariff and private wells license. Excluded are connection fees since these are spent for actual cost of connection[3].

- Water tax. All households situated within the limits of the town have to pay a water tax. This is calculated based on the rental value of the house with a tax rate of 8%. Initially, this water tax was set up as a contribution to the cost of water consumed at public water stands. There are 92 water stands still operating in Mawlamyine, distributed in 9 wards. Piped water has been more or less provided with specific price (volumetric tariff), but the water tax has been maintained as a surcharge to the housing tax. About 80% of the households living in Mawlamyine pay the housing and water tax. However, the total proceeds are modest (less than MMK20 million) which gives an annual average of MMK575 per household. The water tax is collected by the Revenue Department together with the housing tax.
- Water tariff: Since 2003-04, the tariff for piped water has been MMK150/m3 plus MMK200 per month as a flat rate. There is only one tariff rate for both domestic and non-domestic users. Based on the number of meters, the service coverage for piped water is estimated at 22%. Most of the residents are still using private wells. The water tariff proceeds are expected to reach MMK200 million in 2015-16. Average monthly invoice for a household is MMK1,200 equivalent to an average consumption of about 7 m3. Billing is under the direct responsibility of the Water Supply Department. Billing system is done manually and is not yet computerized.
- Private wells license: The township annual budget reflects the same amount of revenue from private well licenses amounting to MMK80.000.

Cost recovery. The significant Increase in electricity cost in 2014 changed significantly the net income from water operation in Mawlamyine. While water tariff and tax collection used to be sufficient to cover operating costs, it is not any more the case beginning 2014. There is a need to increase current water tariff to fully cover operating costs. The other option would consists in increasing the rental value on which the water tax is based, or a mix of the two options. This decision however, needs the approval of the State government.

The Table 11-11 below present the water supply budget from 2012 to 2016.

[3] Connection fee includes: (i) from MMK25.000 to MMK35.000 for the meter, (ii) civil works (pipe) based on MMK150 /feet. The average cost for a connection (domestic) is MMK100.000.

Table 11-11: Water supply budget (2012 - 2015)

in thousand Kyats	2012-13 Actual	2013-14 Actual	2014-15 Actual	2015-16 Estimate
Revenue	**160.294**	**143.350**	**175.625**	**218.000**
- Water Tax	18.477	18.914	19.257	17.900
- Water Tariffs	141.737	124.356	156.288	200.000
- Private wells license	80	80	80	100
Charges	**94.000**	**149.967**	**325.774**	**233.784**
- Salaries & wages (permanent staff)	11.135	14.468	15.981	22.075
- Daily workers wages	6.766	10.382	19.327	16.920
- Transport charges	11.574	11.426		5.200
- Taxes			5.390	
- Fuel	10.275	28.665	26.300	26.300
- Electricity	54.250	85.026	258.776	163.290
- Equipement				
Operating balance	**66.294**	**-6.617**	**-150.148**	**-15.784**
Capital investment expenditures	0	0	0	0
Overall balance (fiscal contribution if negative)	**66.294**	**-6.617**	**-150.148**	**-15.784**
Fiscal contribution to water supply financing	**0**	**6.617**	**150.148**	**15.784**

Ratios **Population = 253.734**	2012-13 *Actual*	2013-14 *Actual*	2014-15 *Actual*	2015-16 *Estimate*
Number of water meters = 8.000				
- % of fiscal balance / Current Fiscal Revenues	0%	0%	8%	1%
- % of tariffs and tax / OPEX	171%	96%	54%	93%
- % of fiscal revenue requested / OPEX	-71%	4%	46%	7%
- OPEX / Population (in Kyats)	**370**	**591**	**1.284**	**921**
- Tariffs & tax proceeds / Population (in Kyats)	**631**	**565**	**692**	**859**
- OPEX / number of users (HH) (in Kyats)	**11.750**	**18.746**	**40.722**	**29.223**
- Tariffs & tax proceeds / number of users (HH) (in	**20.037**	**17.919**	**21.953**	**27.250**
- Need for Water Tariff/Tax increase	0%	5%	86%	7%
- Salaries & wages / OPEX	19%	17%	11%	17%
- Electricity charges / OPEX	58%	57%	79%	70%

Table 11-12: Water tariffs and served population

Water tariff	Flat rate	Exemptions	Last increase
Single tariff: MMK150/m3	MMK200/month	- Staff housing - Military members (2)	2003-2004
In MyaingThaYar: MMK75/m3 (1)	MMK200/month		
Number of meters	**Number of active meters**	**% of HH served by piped water**	**Number of new connections since April 2015**
9,150 meters	About 8.000. Meter can serve several families living in the same house.	22% (about 10.000 HH)	800. In coordination with the Urban Development Dept (old quarter served + urban extension)

(1) 1.850 houses in a new settlement, with only one central meter paid with the community contribution of the inhabitants of the quarter.

(2) Monasteries are charged.

11.2.2.2 Proposed Sub-Project

The proposed option for financing (developed as a first phase of the long term strategy would cover):

- Rehabilitation of the existing dams and reinforcement of the water transfers
- Rehabilitation, reinforcement and extension of the existing networks
- Improved operational and financial management

SUBPROJECT COSTS AND FINANCING PLAN

Total subproject cost for Mawlamyine Water Supply System is $27.17 million equivalent. This was based on the direct costs estimated in the technical study. The subproject cost includes civil works, equipment, land acquisition, resettlement costs, detailed engineering design, construction supervision, and physical and price contingencies. Applicable taxes and duties are included in the total costs. Details of the estimates are shown in the following table:

Table 11-13: Detailed Cost Estimates by Expenditure Category – Mawlamyine WSS

Item	In MK Millions			In $ millions			% of Base Cost
	Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total	
A. Investment Costs							
1. Civil works	11,997	13,197	25,194	9.37	10.31	19.68	87.9%
2. Equipment	1,966	119	2,085	1.54	0.09	1.63	7.3%
3. Land Acquisition & Resettlement	-	32	32	-	0.03	0.03	0.1%
Subtotal (A)	**13,963**	**13,348**	**27,312**	**10.91**	**10.43**	**21.34**	**95.3%**
B. Recurrent Costs							
Subproject O&M	-	1,361	1,361	-	1.06	1.06	4.7%
Subtotal (B)	**-**	**1,361**	**1,361**	**-**	**1.1**	**1.1**	**4.7%**
Total Base Cost (A+B)	**13,963**	**14,709**	**28,672**	**10.91**	**11.49**	**22.40**	**100.0%**
C. Contingencies							
Physical Contingency	1,468	1,401	2,869	1.15	1.09	2.24	10.0%
Price Contingency	1,735	2,235	3,971	0.51	0.94	1.45	6.5%
Sub-total (C)	**3,204**	**3,636**	**6,840**	**1.66**	**2.04**	**3.70**	**16.5%**
D. Financing Charges	**1,572**	-	**1,572**	**1.08**	-	**1.08**	**4.8%**
Total Project Cost (A+B+C+D)	**18,739**	**18,345**	**37,084**	**13.64**	**13.53**	**27.17**	**121.3%**

ADB will finance $25.75 million equivalent while Central Government will shoulder all taxes and duties amounting to $1.20 million equivalent. Mon State will shoulder cost of land acquisition and resettlement. The distribution of fund sources is detailed in the following table:

Table 11-14: Detailed Cost Estimate by Financier – Mawlamyine WSS ($ million)

Item	ADB		Mon State		Central Government				Total Cost
	Amount	% of Cost Category	Amount	% of Cost Category	Amount (Costs)	Amount (Taxes and duties)	Amount (Total)	% of Cost Category	
A. Investment Costs									
1. Civil works	18.75	95%	-	0%	0.00	0.94	0.94	5%	19.68
2. Equipment	1.41	86%	-	0%	0.13	0.09	0.22	14%	1.63
3. Land Acquisition & Resettlement	-	0%	0.03	100%	-	-	-	0%	0.03
Subtotal (A)	**20.15**	**94%**	**0.03**	**0%**	**0.13**	**1.03**	**1.16**	5%	**21.34**
B. Recurrent Costs									
Subproject O&M	1.06	100%	-	0%	-	-	-	0%	1.06
Subtotal (B)	1.06	100%	-	0%	-	-	-	0%	1.06
Total Base Cost (A+B)	**21.21**	**95%**	**0.03**	**0%**	**0.13**	**1.03**	**1.16**	5%	**22.40**
C. Contingencies									
Physical Contingency	2.12	95%	0.00	0%	0.01	**0.10**	0.12		2.24
Price Contingency	1.38	95%	0.00	0%	0.00	**0.07**	0.07	5%	1.45
Sub-total (C)	**3.50**	95%	**0.01**	0%	**0.02**	**0.17**	**0.19**	5%	**3.70**
D. Financing Charges	**1.04**	**96%**	**-**	**0%**	**-**	**-**	**-**	0%	**1.08**
Total Project Cost (A+B+C+D)	**25.75**	**95%**	**0.03**	**0%**	**0.15**	**1.20**	**1.35**	5%	**27.17**
% Total Project Cost	**95%**		**0%**				**5%**		

The subproject is proposed to be implemented over six years commencing in 2017 and to be completed by 2022. Operation of the subproject is targeted to start as

soon as works are completed and full operation is expected by 2023. The indicative implementation schedule is shown in the Table 11-15.

Table 11-15: Detailed Cost Estimates by Year – Mawlamyine WSS ($ million)

Item	Total	2017	2018	2019	2020	2021	2022	2023
A. Investment Costs								
1. Civil works	24.59	-	6.62	6.66	6.12	4.58	0.62	-
2. Equipment	3.54	-	1.81	0.61	0.56	0.56	-	-
3. Survey, Design & Supervision	3.29	0.99	0.66	0.33	0.33	0.33	0.33	0.33
Subtotal (A)	**31.42**	**0.99**	**9.09**	**7.60**	**7.01**	**5.46**	**0.94**	**0.33**
B. Contingencies								
Physical Contingency	2.81	-	0.84	0.73	0.67	0.51	0.06	-
Price Contingency	1.93	-	0.36	0.45	0.55	0.52	0.05	-
Sub-total (B)	**4.74**	**-**	**1.20**	**1.18**	**1.21**	**1.03**	**0.11**	**-**
C. Financing Charges During Implementation	**1.43**	**0.00**	**0.06**	**0.15**	**0.23**	**0.30**	**0.34**	**0.34**
Total Project Cost (A+B+C)	**37.59**	**0.99**	**10.35**	**8.92**	**8.45**	**6.80**	**1.39**	**0.67**
% Total Project Cost		**3%**	**28%**	**24%**	**22%**	**18%**	**4%**	**2%**

REVENUE PROJECTIONS

Mandatory connection is necessary to ensure maximum capacity utilization of the system and the realization of assumed benefits in public health and environment.

The present tariff structure for the piped system is not based on any classification of consumers. It is proposed that tariffs be classified into residential and commercial/industrial. The proposal will likely improve the revenue collection because commercial consumers will be charged higher rate compared to residential rate. Implementation of the tariff restructuring is expected prior to full operation.

The study recommends an increase of 18% from the current rate of MK150/m3. Furthermore, regular tariff adjustment of 18% needs to be implemented every two years after full operation to demonstrate financial sustainability. The proposed tariff increases, as well as other data relative to operation, are presented in Table 11-16.

Table 11-16: Revenue Projection – Mawlamyine Water Supply System

Water Revenues (without Project)	2017	2018	2019	2020	2025	2030	2040
Domestic							
No. of Connections	14,686	14,715	14,744	14,774	14,922	15,072	15,376
Ave. Consumption (m3/conn/month)	15	15	15	15	15	15	15
Revenue Water (m^3'000)	2,643	2,649	2,654	2,659	2,686	2,713	2,768
Effective Water Tariff ($/cum)	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Water Revenues in $ million	-	0.31	0.31	0.31	0.31	0.32	0.32
Commercial							
No. of Connections	1,099	1,102	1,104	1,106	1,117	1,128	1,151
Ave. Consumption (m3/conn/month)	19	19	19	20	21	22	26
Revenue Water (m^3'000)	249	253	257	261	281	302	353
Effective Water Tariff ($/cum)	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Water Revenues in $ million	0.03	0.03	0.03	0.03	0.03	0.04	0.04
Total							
No. of Connections	15,785	15,816	15,848	15,880	16,039	16,200	16,527
Revenue Water (m^3'000)	2,892	2,901	2,911	2,920	2,967	3,015	3,121
Effective Water Tariff ($/cum)	0.01	0.12	0.12	0.12	0.12	0.12	0.12
Water Revenues in $ million	0.03	0.34	0.34	0.34	0.35	0.35	0.37
Water Revenues Net of Bad Debts	0.03	0.34	0.34	0.34	0.34	0.35	0.36
Total Revenues ($ million)	**0.16**	**0.17**	**0.18**	**0.19**	**0.24**	**0.31**	**0.50**

Water Revenues (with Project)	2017	2018	2019	2020	2025	2030	2040
Domestic							
No. of Connections	14,686	15,855	17,118	18,482	29,040	35,397	50,884
Water Consumption (lpcd)	100	100	100	100	100	100	100
Ave. Consumption (m3/conn/month)	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Average Water Demand, (m^3/day)	7,343	7,928	8,559	9,241	14,520	17,699	25,442
Revenue Water (m^3'000)	2,680	2,894	3,124	3,373	5,300	6,460	9,286
Average Water Fee ($/connection/month)	1.76	1.76	1.76	2.07	2.89	4.75	9.20
Revenue from Connection Fees	0.03	0.03	0.03	0.04	0.07	0.04	0.03
Total Water Revenues ($ million)	0.339	0.366	0.396	0.497	1.075	2.053	5.650
Commercial							
No. of Connections	1,169	1,245	1,325	1,412	2,077	2,381	2,987
Water Consumption (ltrs/connection/day)	628	637	646	655	699	743	852
Ave. Consumption (m3/conn/month)	18.9	19.1	19.4	19.6	21.0	22.3	25.6
Average Water Demand, (m^3/day)	734	793	856	924	1,452	1,770	2,544
Revenue Water (m^3'000)	268	289	312	337	530	646	929
Average Water Fee ($/connection/month)	2.21	4.48	4.54	5.43	8.08	14.11	31.35
Revenue from Connection Fees	0.00	0.00	0.00	0.002	0.00	0.00	0.00
Water Revenues in $ million	0.033	0.069	0.074	0.094	0.206	0.405	1.124
Total Number of Connections	15,854	17,100	18,444	19,894	31,117	37,778	53,870
Revenue Water (m^3'000)	2,948	3,183	3,437	3,710	5,830	7,106	10,215
Water Revenues in $ million	0.372	0.435	0.470	0.592	1.281	2.458	6.774
Effective Water Rate ($/cum)	0.13	0.14	0.14	0.16	0.22	0.35	0.66
Water Revenues ($ million)	0.372	0.435	0.470	0.592	1.281	2.458	6.774
Net of Bad Debts ($ million)	0.369	0.431	0.465	0.586	1.268	2.433	6.707
Other Revenues ($ million)	0.032	0.034	0.037	0.040	0.073	0.039	0.033
Total Revenues ($ million)	**0.400**	**0.465**	**0.502**	**0.625**	**1.341**	**2.472**	**6.740**

OPERATING COSTS

O&M costs were estimated by the technical engineers and were based on the capacity of the system. Included in O&M costs are personnel costs, chemicals and power cost, classified into fixed and variable costs. At current prices, O&M costs were estimated annually when full operation is achieved by 2023. O&M costs were likewise presented at constant price for the computation of FIRR

Table 11-17: Operations and Maintenance Costs – Mawlamyine WSS ($ million)

	2017	2018	2019	2020	2025	2030	2035	2040
Fixed Costs	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Variable Costs	0.05	0.05	0.22	0.27	0.47	0.73	0.95	0.95
Total OPEX	0.14	0.15	0.32	0.37	0.57	0.83	1.05	1.05

RESULTS OF EVALUATION

The WACC is calculated as the weighted average cost of equity and debt used to fund the project. The cost of equity is calculated based on benchmarking against the cost of equity of several less-developed countries including Bangladesh, Indonesia, and Viet Nam, and adding a premium of 2.5% to reflect Myanmar's higher country risk.[4] The nominal cost of debt is taken as the ADB loan's fixed interest rate of 1.5% over the longer term. The loan does not have a maturity premium or commitment fee, and the government has indicated that it will not be charging an on-lending margin. The inflation rate used to adjust the nominal values to real values is based on the long-term price escalation factors used by ADB. Given the estimated costs of equity and debt, and the relative proportions of equity and debt in the project capital structure, the WACC is calculated to be 0.4%

Table 11-18: Computation of Weighted Average Cost of Capital (WACC)

	Financing Component		
	ADB	Govt	Total
1. Amount ($ million)	26.40	1.38	27.78
2. Weighing	95.0%	5.0%	100.0%
3. Nominal cost	1.5%	13.0%	
4. Tax Rate	5.0%	0.0%	
5. Tax-adjusted nominal cost	1.4%	13.0%	
6. Inflation rate	1.5%	5.0%	
7. Real cost	-0.1%	7.6%	
8. Weighted component of WACC	0.0%	0.4%	0.4%
Weighted Average Cost of Capital (Real)	**0.4%**		

The FIRR of the project is a summary measure of the return on investments from the viewpoint of the project itself. It indicates the maximum interest rate the

[4] ADB, MYA-46390: Power Distribution Imrpovement Project, Report and Recommendation of the President. October 2015.

project could pay on the invested capital and still break-even financially. The FIRR is measured as the discount rate that equalizes the present value cost stream associated with the project to the present value of the project's benefit stream.

The results of analysis show that in all scenarios, the computed FIRRs are greater than the computed WACC. For the base case scenario, FIRR is 1.7%. Even at worse case conditions, the FIRRs are higher than the WACC which means that the proposed subproject is financially viable. The FIRR and NPV for all scenarios are summarized in Table 11-19 while details are presented in Table 11-22.

Table 11-19: Summary Result of Financial Analysis – Mawlamyine WSS

	NPV ($ m)	FIRR (%)	SI	% Change	SV
Base case	7.76	1.7%			
1-Year Delay in Operation	2.83	0.9%	4.82	10%	21%
Capital cost plus 10%	4.44	1.1%	3.56	10%	28%
O & M costs plus 10%	5.88	1.4%	1.84	10%	54%
Revenues less 10%	1.85	0.7%	5.82	10%	17%

FIRR = financial internal rate of return
NPV = net present value
SI = sensitivity indicator (ratio of percentage change in IRR above the cut-off rate to percentage change in selected variable).
SV = switching value (percentage change in selected variable to reduce the IRR to cut-off rate).

Affordability of Tariffs

A major consideration in the development of the water tariff schedule is the ability of target beneficiaries, specifically from the low income group (LIG), to pay for their monthly bill. Indicative affordability benchmark for water rates ranging from 3 to 5% has been adopted by many government and international funding institutions.

The estimated average monthly income of the LIG is MK76,933 based on the results of the socio-economic survey undertaken as part of this study. Using the affordability criterion and an assumption of 10 m3 average monthly consumption by the LIG, the computed average monthly bill of MK1,770 in 2020 is only 2.0% of their income. Considering the proposed increases in water rates in subsequent years, the average charge is less than 5% for all years. Hence, the proposed level of tariff is deemed affordable and reasonable to the household beneficiaries.

Table 11-20: Water Rates and Affordability

	2015	2020	2021	2022	2023	2024	2025	2030	2035	2040
Domestic/Residential										
MK/m3	150	177	177	209	209	246	246	405	564	785
$ per m3	0.12	0.14	0.14	0.16	0.16	0.19	0.19	0.32	0.44	0.61
Commercial	-									
MK/m3	150	354	354	418	418	493	493	810	1,128	1,570
$ per m3	0.12	0.28	0.28	0.33	0.33	0.39	0.39	0.63	0.88	1.23
Increase in Water Rates		18%		18%		18%		18%		
Affordability of Proposed Water Rates										
Average Income of LIG (MK/month) [a]	76,933	89,186	91,862	94,618	97,456	100,380	103,392	119,859	138,950	161,081
Minimum Monthly Charge (Mk/month) [b]		1,770	1,770	2,089	2,089	2,465	2,465	4,049	5,638	7,851
Share of Monthly Charge to Average Income (%)		2.0%	1.9%	2.2%	2.1%	2.5%	2.4%	3.4%	4.1%	4.9%

a Income data for 2015 is from the socio-economic survey. Annual increase in income is asumed to be 3%

b Based on average monthly water consumption for the Low Income Group (m3 per month) = 10

Table 11-21: Projected Income and Expenditures–Mawlamyine Water Supply System ($million)

	2015	2016	2017	2018	2019	2020	2025	2030	2035	2040
Operating Revenues										
Water tax	19	18	19	19	20	21	25	31	38	46
Water Sales	156	200	477	557	602	757	1,639	3,146	5,322	8,671
Domestic	156	200	434	469	506	637	1,376	2,628	4,443	7,232
Commercial	0	0	42	88	95	121	263	518	879	1,439
Total Revenues	**176**	**218**	**495**	**577**	**622**	**778**	**1,665**	**3,177**	**5,360**	**8,717**
Operating Expenses										
Fixed Costs			138	145	153	160	205	261	333	425
Variable Costs			112	129	387	491	1,097	2,181	3,360	4,288
Total	**326**	**234**	**251**	**275**	**540**	**651**	**1,301**	**2,443**	**3,693**	**4,714**
Net Income	**-150**	**-16**	**244**	**302**	**82**	**127**	**363**	**735**	**1,666**	**4,003**

Table 11-22: Financial Evaluation - Mawlamyine WSS ($ million)

Year	Base Hypothesis				Sensitivity Analyses													
	Incremental		Project Cost	Net	1 Year Delay in Operation		Project Cost	Net	Incremental		Project Cost (+10%)	Net	Incremental		Project Cost	Net	Incremental		Project Cost	Net
	Revenues	O&M			Revenues	O&M			Revenues	O&M			Revenues	O&M (+10%)			Revenues (-10%)	O&M		
2017	0.236	0.178	1.087	(1.028)			1.087	(1.087)			1.195	(1.195)			1.087	(1.087)			1.087	(1.087)
2018	0.293	0.185	9.539	(9.431)	0.236	0.178	9.539	(9.480)	0.293	0.185	10.493	(10.385)	0.293	0.204	9.539	(9.450)	0.264	0.185	9.539	(9.461)
2019	0.321	0.347	7.968	(7.994)	0.293	0.185	7.968	(7.861)	0.321	0.347	8.765	(8.790)	0.321	0.381	7.968	(8.028)	0.289	0.347	7.968	(8.026)
2020	0.435	0.398	7.354	(7.316)	0.321	0.347	7.354	(7.379)	0.435	0.398	8.089	(8.052)	0.435	0.438	7.354	(7.356)	0.392	0.398	7.354	(7.360)
2021	0.500	0.407	5.734	(5.641)	0.435	0.398	5.734	(5.697)	0.500	0.407	6.308	(6.215)	0.500	0.448	5.734	(5.682)	0.450	0.407	5.734	(5.691)
2022	0.674	0.481	1.007	(0.814)	0.500	0.407	1.007	(0.914)	0.674	0.481	1.108	(0.915)	0.674	0.529	1.007	(0.862)	0.607	0.481	1.007	(0.881)
2023	0.747	0.493	0.362	(0.108)	0.674	0.481	0.362	(0.169)	0.747	0.493	0.398	(0.144)	0.747	0.542	0.362	(0.157)	0.672	0.493	0.362	(0.182)
2024	0.994	0.515		0.479	0.747	0.493	-	0.255	0.994	0.515	-	0.479	0.994	0.566	-	0.428	0.895	0.515	-	0.380
2025	1.098	0.624		0.475	0.994	0.515	-	0.479	1.098	0.624	-	0.475	1.098	0.686	-	0.412	0.988	0.624	-	0.365
2026	1.280	0.651		0.629	1.098	0.624	-	0.475	1.280	0.651	-	0.629	1.280	0.717	-	0.564	1.152	0.651	-	0.501
2027	1.330	0.759		0.571	1.280	0.651	-	0.629	1.330	0.759		0.571	1.330	0.835		0.495	1.197	0.759		0.438
2028	1.667	0.829		0.838	1.330	0.759	-	0.571	1.667	0.829		0.838	1.667	0.912		0.755	1.500	0.829		0.671
2029	1.732	0.853		0.879	1.667	0.829	-	0.838	1.732	0.853		0.879	1.732	0.938		0.794	1.559	0.853		0.706
2030	2.163	0.917		1.246	1.732	0.853	-	0.879	2.163	0.917		1.246	2.163	1.009		1.154	1.947	0.917		1.030
2031	2.251	1.037		1.215	2.163	0.917	-	1.246	2.251	1.037		1.215	2.251	1.140		1.111	2.026	1.037		0.990
2032	2.807	1.087		1.720	2.251	1.037	-	1.215	2.807	1.087		1.720	2.807	1.195		1.612	2.526	1.087		1.440
2033	2.917	1.087	-	1.831	2.807	1.087	-	1.720	2.917	1.087	-	1.831	2.917	1.195	-	1.722	2.626	1.087	-	1.539
2034	3.628	1.087		2.541	2.917	1.087	-	1.831	3.628	1.087		2.541	3.628	1.195		2.433	3.265	1.087		2.178
2035	3.769	1.087		2.682	3.628	1.087	-	2.541	3.769	1.087		2.682	3.769	1.195		2.574	3.392	1.087		2.305
2036	4.676	1.087		3.590	3.769	1.087	-	2.682	4.676	1.087		3.590	4.676	1.195		3.481	4.208	1.087		3.122
2037	4.856	1.087		3.770	4.676	1.087	-	3.590	4.856	1.087		3.770	4.856	1.195		3.661	4.371	1.087		3.284
2038	6.013	1.087		4.927	4.856	1.087	-	3.770	6.013	1.087		4.927	6.013	1.195		4.818	5.412	1.087		4.325
2039	6.103	1.087		5.016	6.013	1.087	-	4.927	6.103	1.087		5.016	6.103	1.195		4.908	5.493	1.087		4.406
2040	6.236	1.087		5.149	6.103	1.087	-	5.016	6.236	1.087		5.149	6.236	1.195		5.041	5.612	1.087		4.526
2041	6.356	1.087		5.269	6.236	1.087	-	5.149	6.356	1.087		5.269	6.356	1.195		5.161	5.720	1.087		4.634
	FIRR			**1.70%**	**FIRR**			**0.88%**	**FIRR**			**1.09%**	**FIRR**			**1.38%**	**FIRR**			**0.71%**
	NPV			**7.76**	**NPV**			**2.83**	**NPV**			**4.44**	**NPV**			**5.88**	**NPV**			**1.85**

11.3 Kayin State Financial Analysis

Financial analysis for Kayin State includes viability evaluation of the proposed revenue-generating subprojects for the Townships of Hpa-An and Myawaddy. This includes the solid waste management and water supply system for both townships.

The evaluation was conducted with the following objectives:

- Confirm the viability and sustainability of the subprojects;
- Fix the performance benchmark in terms of cost recovery for the subprojects; and
- Determine whether a subsidy will be required from the implementing entities (Kayin State and Hpa An and Myawaddy townships) to cover full operating costs.

11.3.1 HPA-AN SOLID WASTE MANAGEMENT

The main goal of the subproject is to enhance solid waste management through improved solid waste collection, expanded service coverage; availability of disposal facility, and efficient recycling and composting

11.3.1.1 Existing Situation

Hpa-An is the capital of Kayin State located on the eastern bank of the Thanlwin river. It has an urban population of 75,141 (2014). The city is expected to develop as a logistics centre along the EWEC to support cross-border trade.

Present solid waste management in Hpa-an is being undertaken by the Hpa-An Township Cleansing Department. It operates 4 garbage trucks for collection. However, these are not enough to cover all the wards, which results in illegal dumping along roads and in nearby watercourses. It is estimated that only about 25% of the generated waste is being collected. The collected waste is dumped at Htan Koe Pin dumpsite near ZweKabin Hill that is a tourist destination. The uncontrolled dump is sometimes burned to reduce its volume. Several scavengers are on the dumpsite to gather the remaining recyclables. There is no soil and groundwater protection and the dumpsite, with a total area of 1.8 hectares, is much too small for future operation.

Cost recovery: Total budget for solid waste is about MMK50 million per year, which is only about 15% of the current annual expenditures of the township. The level of service is poor, even if the Department reports daily garbage collection.

The cleaning tax and a garbage fee totalling about MMK20 million represents 40% of the total costs of the department for solid waste. Consequently, the remaining 60% of the costs are financed through subsidy from the general operating budget of the township.

Some services, like pre-collection of garbage, are being undertaken by the communities in selected wards specifically Wards 1 and 7. The replication of this system to other wards would be favourable to the township so that its intervention would be more focusing on waste transfer and treatment.

Tax and Fee Collection:

- Cleaning tax is charged at 10% of the house rental value, same as the housing tax and 4 points more than the water tax (6%). Until 2013, it is the only revenue collected from domestic users for solid waste service. An increase in solid waste tariff was implemented in 2013.
- Garbage fee is collected from commercial and business establishments like restaurants, market stalls, hotels, hospitals, clinics and other small businesses. It is also collected from households.

The tariff/tax system implemented in Hpa An needs to be rationalized to avoid any double taxation for the same service being provided. The current situation is still transitional with the combination of tax system and tariff policy for the same purpose. This could be simplified in the future. There is a significant difference between the rationale of each system. Cleaning tax doesn't take into account the real cost of the service. Moreover, it is raised only on domestic users as an addition to the housing tax and is constrained by a maximum rate of 10% of the housing rental value. Garbage fee is based on the cost of the service. The budget for solid waste from 2012 to 2016 is shown in the following table.

Table 11-23: Solid waste budget (2012 - 2016)

in thousand Kyats	2012-13 Actual	2013-14 Actual	2014-15 Actual	2015-16 Estimate
Revenue	**17.358**	**17.913**	**20.186**	**17.361**
- Cleaning Tax	17.219	17.526	18.654	17.161
- Garbage fee	139	387	1.532	200
Charges	**28.951**	**36.565**	**46.743**	**47.528**
- Salaries & wages (permanent staff)	4.354	4.597	5.580	9.528
- Daily workers wages	11.598	17.104	21.468	24.000
- Transport charges				
- Taxes				
- Fuel	10.999	13.665	17.995	12.000
- Business equipment	2.000	1.199	1.700	2.000
- Equipement				
- Repairs & maintenance				
Operating balance	**-11.593**	**-18.652**	**-26.557**	**-30.167**
Capital investment expenditures	0	0	0	0
Overall balance (fiscal contribution if ne	**-11.593**	**-18.652**	**-26.557**	**-30.167**

Ratios **Population = 75141**	2012-13 *Actual*	2013-14 *Actual*	2014-15 *Actual*	2015-16 *Estimate*
- % of fiscal balance / Current Fiscal Reve	2%	2%	3%	4%
- % of tariffs and tax / OPEX	60%	49%	43%	37%
- % of fiscal revenue requested / OPEX	40%	51%	57%	63%
- OPEX / Population (in Kyats per year)	**385**	**487**	**622**	**633**
- Tariffs & tax proceeds / Population (in Ky	**231**	**238**	**269**	**231**
- Need for Tariff/Tax increase	67%	104%	132%	174%
- Salaries & wages / OPEX	55%	59%	58%	71%
- Fuel charges / OPEX	38%	37%	38%	25%

11.3.1.2 Proposed Sub-Project

The proposed new ISWM system for Hpa-An consists in:

- Improving primary collection system in the towns and transport system to the landfills and composting sites;
- More efficient separation and collecting of recyclables e.g. like ferro, plastic bottles, glass, aluminium cans and paper, both through the informal sector and formal sector;
- Implementation of small hospital waste incinerator;
- Introducing source separating organics (SSO) system for diverting large amounts of organic waste to the new planned composting plant;
- Implementation of a new controlled landfill with bottom liner, leachate collection and treatment.

Above measures are included in the investment plans of the town and are proposed for ADB financing.

SUBPROJECT COSTS AND FINANCING PLAN

Total subproject cost for Hpa An Solid Waste Management is $10.99 million equivalent. This was based on the direct costs estimated in the technical study. The subproject cost includes civil works, vehicle, equipment, land acquisition and resettlement, detailed engineering design, construction supervision, physical and price contingencies and applicable taxes and duties. Details of the estimates are shown in the following table.

Table 11-24: Detailed Cost Estimates by Expenditure Category – Hpa-An ISWM

Item	In MK Millions			In $ millions			% of Base Cost
	Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total	
A. Investment Costs							
1. Civil works	4,488	4,937	9,425	3.51	3.86	7.36	81.6%
2. Equipment	1,562	94	1,656	1.22	0.07	1.29	14.3%
3. Vehicles	333	52	384	0.26	0.04	0.30	3.3%
4. Survey, Design and Supervision	-	45	45	-	0.04	0.04	0.4%
5. Land Acquisition and Resettlement	-	44	44	-	0.03	0.03	0.4%
Subtotal (A)	**6,383**	**5,172**	**11,555**	**4.99**	**4.04**	**9.03**	**100.0%**
B. Contingencies							
Physical Contingency	675	478	1,153	0.53	0.37	0.90	10.0%
Price Contingency	970	834	1,804	0.27	0.35	0.62	6.9%
Sub-total (B)	**1,645**	**1,311**	**2,957**	**0.80**	**0.72**	**1.52**	**16.8%**
C. Financing Charges	**642**	-	**642**	**0.44**	-	**0.44**	**4.9%**
Total Project Cost (A+B+C)	**8,670**	**6,484**	**15,153**	**6.23**	**4.76**	**10.99**	**121.7%**

The total investment cost will be financed from ADB loan and the Union Government of Myanmar. ADB will finance $10.36 million equivalent while Union Government will shoulder all taxes and duties of $0.54 million equivalent. The Mon

State will provide for land acquisition and resettlement costs. The distribution of fund sources is detailed in the following table.

Table 11-25: Detailed Cost Estimate by Financier – Hpa-An ISWM

Item	ADB		Kayin State		Central Government			Total Cost
	Amount	% of Cost Category	Amount	% of Cost Category	Amount (Taxes and duties)	Amount (Total)	% of Cost Category	
A. Investment Costs								
1. Civil works	7.01	95%	-	0%	0.35	0.35	5%	7.36
2. Equipment	1.22	94%	-	0%	0.07	0.07	6%	1.29
3. Vehicles	0.26	87%	-	0%	0.04	0.04	13%	0.30
4. Survey, Design and Supervision	0.04	100%	-	0%	-	-	0%	0.04
5. Land Acquisition and Resettlement	-	0%	0.03	100%	-	-	0%	0.03
Subtotal (A)	**8.53**	**94%**	**0.03**	0%	**0.46**	**0.46**	5%	**9.03**
B. Contingencies								
Physical Contingency	0.85	94%	0.01	1%	**0.05**	0.05		0.90
Price Contingency	0.58	94%	0.00	0%	**0.03**	0.03	5%	0.62
Sub-total (B)	**1.43**	94%	**0.01**	0%	**0.08**	**0.08**	5%	**1.52**
C. Financing Charges	**0.40**	**91%**	**-**	0%	**-**	**-**	0%	**0.44**
Total Project Cost (A+B+C)	**10.36**	**94%**	**0.04**	0%	**0.54**	**0.54**	5%	**10.99**
% Total Project Cost	**94%**		**0%**			**5%**		

The subproject is proposed to be implemented over five years commencing in 2017 and to be completed by 2021. Operation of the subproject is targeted to start as soon as works are completed and full operation is expected by 2022. The indicative implementation schedule is shown in the following table.

Table 11-26: Detailed Cost Estimates by Year – Hpa-An ISWM ($ million)

Item	Total Cost	2017	2018	2019	2020	2021	2022	2023
A. Investment Costs								
1. Civil works	7.36	0.32	0.32	3.51	3.08	0.14	-	-
2. Equipment	1.29	-	-	-	1.24	0.05	-	-
3. Vehicles	0.30	-	-	-	0.15	0.15	-	-
4. Survey, Design and Supervision	0.04	-	0.01	0.03	-	-	-	-
5. Land Acquisition and Resettlement	**0.03**	**0.01**	**0.01**	**0.00**	**0.00**	**-**	**-**	**-**
Subtotal (A)	9.03	0.33	0.34	3.54	4.48	0.34	-	-
B. Contingencies								
Physical Contingency	**0.90**	**0.03**	**0.03**	**0.35**	**0.45**	**0.03**	**-**	**-**
Price Contingency	0.62	0.01	0.02	0.22	0.34	0.03	-	-
Sub-total (B)	**1.52**	**0.04**	**0.05**	**0.58**	**0.79**	**0.06**	**-**	**-**
C. Financing Charges	**0.44**	**0.04**	**0.01**	**0.03**	**0.07**	**0.10**	**0.10**	**0.10**
Total Project Cost (A+B+C)	10.99	0.41	0.39	4.14	5.34	0.50	0.10	0.10
% Total Project Cost		4%	4%	38%	49%	5%	1%	1%

REVENUE PROJECTIONS

It is assumed that the Township Government will gradually extend its service coverage from the current 26% to 98% by 2040 in order to have an effective and sustainable environmental project in the township. A local regulation must stipulate that all households and commercial establishments provided with collection service will pay mandatory weekly or monthly fees and that these fees will be collected either by the township or through community organizations or village leaders**.**

The ADB loan proceeds will be on-granted by the Central Government to Mawlamyine. It is proposed that tariffs should at least cover O&M costs for sustainability. The proposed tariff structure classifies consumers as either domestic (i.e. households) or non-domestic (i.e. commercial and industrial connections), with non-domestic connections to be charged more to boost revenues. The proposed monthly fee is MK2,000 per domestic connection and MK10,000 per non-domestic connection.

Tariffs are expected to be implemented in 2020 when full operation commences, increasing by 10% every five years to keep pace with real growth. The projected revenues were based on the projected increase in the number of connections multiplied by the monthly service fees.

Details of operation are provided in the following table.

Table 11-27: Projected Income and Expenditures – Hpa-An ISWM ($ million)

			2017	2018	2019	2020	2025	2030	2035	2040
BASIC DATA										
Population										
Hpa An - urban areas			80,919	82,942	85,015	87,141	98,592	111,547	126,205	142,790
annual growth (%)			2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Number of households	HH size	5.0	16,184	16,588	17,003	17,428	19,718	22,309	25,241	28,558
Number of business establishments	Annual +	2%	2,767	2,822	2,878	2,936	3,241	3,579	3,951	4,363
Per Capita Waste Generation										
per capita per day (kg)			0.58	0.59	0.61	0.62	0.69	0.76	0.83	0.90
annual increase (%)			2.5%	2.4%	2.4%	2.3%	2.1%	1.9%	1.7%	1.7%
			2017	**2018**	**2019**	**2020**	**2025**	**2030**	**2035**	**2040**
OPERATIONS DATA										
Waste Generation										
Total waste generated (kg/day)			46,771	49,101	51,519	54,027	68,028	84,776	104,751	128,511
Additional waste from market (kg/day)	20%		9,354	9,820	10,304	10,805	13,606	16,955	20,950	25,702
Total annual waste generated (tons/yr)			20,486	21,506	22,565	23,664	29,796	37,132	45,881	56,288
						64.83				
Collection Coverage										
Annual coverage			27.2%	27.9%	28.7%	90.0%	92.0%	94.0%	96.0%	98.0%
Annual increase			0.8%	0.8%	0.8%	61.3%	12.4%	0.4%	0.4%	0.4%
Waste Collection						58.35				
Total waste collected (kg/day)			15,239	16,463	17,762	58,352	75,103	95,631	120,680	151,133
Total waste collected (ton/year)			5,562	6,009	6,483	#####	27,413	34,905	44,048	55,164
Collected Waste Composition	Annual +/-									
Organics & greens			0.0%	0.0%	0.0%	25.0%	40.0%	40.0%	40.0%	40%
Recyclables	+	0.8%	17.5%	18.2%	19.0%	20.0%	20.0%	20.0%	20.0%	20%
Residuals	+	0.4%	9.7%	9.7%	9.7%	45.0%	32.0%	34.0%	36.0%	38%
Total			**27.2%**	**27.9%**	**28.7%**	**90.0%**	**92.0%**	**94.0%**	**96.0%**	**98.0%**
Operations plan (tons/day)										
Days of operation			365	365	365	365	365	365	365	365
Organic material			0.0	0.0	0.0	16.2	32.7	40.7	50.3	61.7
Recycling production			9.8	10.7	11.7	13.0	16.3	20.4	25.1	30.8
Waste to landfill			5.4	5.7	6.0	29.2	26.1	34.6	45.3	58.6
Total			**15.2**	**16.5**	**17.8**	**58.4**	**75.1**	**95.6**	**120.7**	**151.1**

OPERATING COSTS

O&M costs were estimated by the technical engineers and were based on the capacity of the system. Included in O&M costs are personnel costs, chemicals and power cost. At 2015 constant prices, O&M costs are estimated to be $0.49 million annually when full operation is achieved by 2020. Incremental O&M costs (e.g. "with project" less "without project" situation) were used in the calculation of FIRR. O&M costs are likewise shown at current prices in the income and expenditure statement.

Table 11-28: Operations and Maintenance Costs – Hpa-An ISWM ($ million)

OPERATIONS & MAINTENANCE						**2020**	**2025**	**2030**	**2035**	**2040**
Waste Collection						0.05	0.05	0.05	0.05	0.05
Composting Plant						0.11	0.11	0.11	0.11	0.11
Sanitary Landfill						0.33	0.33	0.33	0.33	0.33
Total O&M with Project						**0.49**	**0.49**	**0.49**	**0.49**	**0.49**
Total O&M without Project	5%		0.05	0.05	0.05	0.06	0.07	0.09	0.11	0.15
Incremental O&M						0.43	0.42	0.40	0.37	0.34

RESULTS OF EVALUATION

A subproject is considered financially viable if the resulting FIRR of the proposed subproject is higher than the WACC that was used in financing the subproject. An FIRR higher than the WACC implies that the incremental net revenues generated by the project will be enough to recover the implementation and operating costs.

On the basis of the financing mix and the loan interest of 1.0% and the assumed cost of equity of 13%, the WACC is computed at 0.43%.

Table 11-29: Computation of Weighted Average Cost of Capital (WACC) – Hpa-An ISWM

	Loan	Equity	TOTAL
Weight (%)	94.3%	5.7%	100%
Nominal Cost (%)	1.0%	13.0%	
Tax Rate (%)	5.0%	0.0%	
Tax Adjusted Nominal Cost (%)	1.0%	13.0%	
Inflation Rate (%)	1.5%	5.0%	
Real Cost (%)	-0.5%	7.6%	
Weighted Component of WACC (%)	0.0%	0.4%	
Weighted Average Cost of Capital (Real Terms)			**0.43%**

The summary result of FIRR computation is provided in Table 11-30 and detailed computation is shown in Table 11-32.

Table 11-30: Summary Result of Financial Analysis – Hpa-An SWM

FIRRs	Change	NPV	FIRR	SI (IRR)	SV (IRR)	SI (NPV)	SV (NPV)
Base Case		2.61	2.3%				
Case 1 - Increase in Capital Costs	10%	1.63	1.5%	4.12	24%	3.75	27%
Case 2 - Increase in O&M Costs	10%	1.84	1.8%	2.89	35%	2.94	34%
Case 3 - Decrease in Revenues	10%	0.60	0.9%	7.58	13%	7.69	13%
Case 4 - Project Delay	1 Year Delay	1.11	1.2%	NPV lower by	57%		

SI = sensitivity indicator (ratio of percentage change in IRR above the cut-off rate to percentage change in selected variable).

SV = switching value (percentage change in selected variable to reduce the IRR to cut-off rate)

The projected income statement shows that the proposed fees can adequately cover the costs of O&M but excluding depreciation costs.

Table 11-31: Projected Income and Expenditures – Hpa-An SWM ($ million)

Particulars	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Revenue												
Garbage fees				0.46	0.46	0.45	0.45	0.44	0.58	0.72	0.91	1.14
Tipping fees				0.15	0.16	0.17	0.18	0.19	0.19	0.24	0.30	0.37
Income from composting				0.02	0.02	0.02	0.02	0.02	0.04	0.05	0.06	0.07
Total Revenue				**0.63**	**0.64**	**0.64**	**0.65**	**0.65**	**0.81**	**1.01**	**1.27**	**1.58**
O&M Expenses												
Waste collection				0.06	0.07	0.07	0.07	0.08	0.08	0.10	0.12	0.14
Composting plant				0.13	0.14	0.14	0.15	0.16	0.16	0.20	0.24	0.29
Sanitary landfill				0.39	0.41	0.43	0.44	0.46	0.48	0.59	0.71	0.85
Total O&M Expenses				**0.58**	**0.61**	**0.64**	**0.67**	**0.70**	**0.73**	**0.89**	**1.07**	**1.28**
Net Income				0.05	0.03	0.00	(0.02)	(0.05)	0.08	0.12	0.20	0.30

Affordability of Tariffs

Setting of tariffs is a key factor which affects the subproject's viability as well as the sustainability of subproject operations. While tariffs need to recover costs, they also need to be affordable.

Results of the socio-economic survey conducted under the project indicated that average household monthly income is about MK 246,373. Given a proposed monthly garbage fee of MK 2,000 per household, this is only about 0.8% of household income. For the low-income group with household monthly income of MK 79,567, the proposed rate is about 2.5% of their income. Hence, the proposed level of tariff is deemed affordable and reasonable to the household beneficiaries

Table 11-32: Financial Evaluation – Hpa-An ISWM ($ million)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Incremental Costs												
Capital Costs	0.36	0.37	3.89	4.93	0.37	-	-	-	-	-	-	-
O&M Costs	(0.05)	(0.05)	(0.05)	0.43	0.43	0.43	0.43	0.42	0.42	0.40	0.37	0.34
Total Costs	0.31	0.32	3.84	5.36	0.80	0.43	0.43	0.42	0.42	0.40	0.37	0.34
Incremental Revenue	-	0.14	0.15	0.63	0.64	0.64	0.64	0.65	0.81	1.01	1.26	1.57
Net Cash Flow (Base Case)	(0.31)	(0.18)	(3.69)	(4.73)	(0.17)	0.21	0.22	0.23	0.39	0.61	0.89	1.23
Sensitivity Tests:												
Case 1 - Increase in Capital Costs	(0.35)	(0.22)	(4.08)	(5.23)	(0.21)	0.21	0.22	0.23	0.39	0.61	0.89	1.23
Case 2 - Increase in O&M Costs	(0.31)	(0.18)	(3.69)	(4.78)	(0.21)	0.17	0.18	0.19	0.35	0.57	0.85	1.20
Case 3 - Decrease in Revenues	(0.31)	(0.20)	(3.71)	(4.80)	(0.23)	0.15	0.16	0.16	0.31	0.51	0.76	1.07
Case 4 - Project Delay	(0.31)	(0.32)	(3.70)	(5.22)	(0.17)	0.21	0.21	0.22	0.23	0.52	0.77	1.08

FIRRs:	**Change**	**NPV**	**FIRR**	**SI (IRR)**	**SV (IRR)**	**SI (NPV)**	**SV (NPV)**
Base Case		2.61	2.3%				
Case 1 - Increase in Capital Costs	10%	1.63	1.5%	4.12	24%	3.75	27%
Case 2 - Increase in O&M Costs	10%	1.84	1.8%	2.89	35%	2.94	34%
Case 3 - Decrease in Revenues	10%	0.60	0.9%	7.58	13%	7.69	13%
Case 4 - Project Delay	Delay	1.11	1.2%	lower by	57%		

SI = sensitivity indicator (ratio of percentage change in IRR above the cut-off rate to percentage change in selected variable).
SV = switching value (percentage change in selected variable to reduce the IRR to cut-off rate).

11.3.2 HPA-AN WATER SUPPLY SYSTEM

11.3.2.1 Existing Situation

The provision of urban environmental services in Hpa An is the responsibility of the Hpa An Town Development Committee (HTDC) which covers a service area of 9 wards with a total population of 52,365. The water source of Hpa-An comes mostly from the Thanlwin River via direct pumping or via tubewells along the river. The water supply system is composed of four intakes along Thanlwin River (Bare Mae, Kha Yae, Khu Sate and Lay Thar kyaung) and 13 TDC tubewells.

The service areas are divided into two zones: the western zone composed of wards 1 to 4 and partially served by the Thanlwin River intakes; and the eastern zone composed of wards 5 to 9 and partially served by groundwater/tube-wells and the proposed expansion area for the subproject.

Two other projects are proposed in the same area: a JICA-financed project that is part of an overall JICA grant to the Union of Myanmar covering several towns; and a Union Government financed water supply project for the Hpa An Industrial Zone (IZ).

Piped water system is very recent in Hpa-An with the first connections implemented in 2012. As in Mawlamyine, water supply in Hpa-An is operated directly by the Department of Water Supply, Electricity and Gardens. The department is in-charged of maintenance of the network, new connections, and commercial management including tariff collection.

Water supply revenues and expenditures are separated from the other cost centers managed by the Department. In the absence of official accounting, historical data were based on information received from interviews with the chief engineer. It is obviously under-estimated because of some hidden costs and revenues like capital investment expenditures. Connection fee proceeds are likewise excluded. A portion of these costs is internal costs assumed by other departments and not invoiced to the Department of Water, Electricity and Gardens.

Water charges. Water operating expenditures account for less than 10% of the total expenditure of the township. Apparently, It is one of the less important departments of the township administration in terms of budget, far behind the allocation for the other departments like Urban Development, Roads Maintenance, or even of the Cleaning Department.

The Department has a total of 21 staff of which 7 are in-charge of water supply operations. There are 3 water meter readers who aside from meter reading also directly collects cash payment from users. They remit to the Department their collection at the end of the day and then transfers the cash collection to the Finance Department.

Water revenues. There are three categories of revenues: water tax, water tariff and connection fee..

- Water tax: The water tax is collected by the Revenue Department together with the housing tax. All households situated within the limits of the town have to pay a water tax. This is calculated at 6% of the rental value of the house. The average annual charge is MMK1,365 per household.
- Water tariff: Current water tariff for piped water is MMK250/m3. Billing and collection are done monthly. There is no difference between domestic and non-domestic rates. Based on the number of meters, the served population is only about 13% of the total service area, which leaves a great scope for expansion. Most of the residents are still using private wells. The water tariff proceeds are expected to reach MMK8 million in 2015-16. The calculation, based on 2014-15 actual data shows that average monthly invoice for a household connected to piped water is MMK600 representing an average consumption of about 2.5 m3 which is very low. This also indicates that physical and commercial non-revenue water (NRW) are high. Billing is under the direct responsibility of the Water Supply Department. It is not computerized thus information on the billing system and water consumption are not reliable. About 134 households pay for tap water with a flat rate from MMK1,200 to MMK2,000 per month. The total receipt from tap water is about MMK3 million per year.

Connection fee: New connections are charges a connection fee equivalent to MMK5.000 per connection. This amount is used for actual connection expenses but is obviously subsidized since average cost of connection is about MMK25.000.

Cost recovery. Deficient service performance and high NRW are the main constraints to an acceptable cost recovery. Tariff rate level appears adequate but efforts have to focus on management to include billing system, metering and maintenance of the network.

Table 11-33:WATER SUPPLY BUDGET 2012-2016

in thousand Kyats	2012-13 Actual	2013-14 Actual	2014-15 Actual	2015-16 Estimate
Revenue	**19.610**	**18.864**	**21.367**	**17.237**
- Water Tax	10.285	10.468	11.145	10.237
- Water Tariffs	9.325	8.311	9.977	7.000
- Connection fees		85	245	
Charges	**26.757**	**28.428**	**31.970**	**40.508**
- Salaries & wages (permanent staff)	1.369	2.264	812	3.552
- Daily workers wages	3.914	6.666	7.282	9.214
- Fuel	2.895	1.399	3.499	1.400
- Electricity	15.080	15.601	15.928	24.000
- Equipement	3.499	2.498	4.449	2.342
Operating balance (fiscal contribution if	**-7.147**	**-9.564**	**-10.603**	**-23.271**
Capital investment expenditures		**0**	**29.244**	
Overall balance (fiscal contribution if ne	**-7.147**	**-9.564**	**-39.847**	**-23.271**
Ratios	2012-13	2013-14	2014-15	2015-16
Population = 75.141				
Number of water meters = 914				
- % of fiscal balance / Current revenues H	1%	1%	1%	3%
- % of tariffs and tax / OPEX	73%	66%	67%	43%
- % of fiscal revenue requested / OPEX	27%	34%	33%	57%
- OPEX / Population (in Kyats per year)	356	378	425	539
- Tariffs & tax proceeds / Population (in Ky	261	251	284	229
- OPEX / users (HH)	29.274	31.103	34.978	44.320
- Tariffs & tax proceeds / users (HH)	21.455	20.639	23.377	18.859
- Need for Water Tariff/Tax increase	36%	51%	50%	135%
- Salaries & wages / OPEX	20%	31%	25%	32%
- Electricity charges / OPEX	56%	55%	50%	59%

11.3.2.2 Proposed Sub-Project

The proposed option for financing (developed as a first phase of the long-term strategy) includes the following:

- Development of a new long-term intake upstream of the main town area with additional treatment facility;
- Rehabilitation, reinforcement and extension of the existing network; and
- Improvement of operational and financial management.

It is assumed that the future service area of the urban water supply will be extended to cover all of the urban wards of Hpa An.

SUBPROJECT COSTS AND FINANCING PLAN

Total subproject cost for Hpa An Water Supply System is $20.95 million equivalent. This was based on the direct costs estimated in the technical study. The subproject cost includes civil works and equipment, land acquisition and resettlement, detailed engineering design, construction supervision, physical and price contingencies, financing charges during implementation and applicable taxes and duties. Details of the estimates are shown in the following table:

Table 11-34: Detailed Cost Estimates by Expenditure Category – Hpa-An WSS

Item	In MK Millions			In $ millions			% of Base Cost
	Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total	
A. Investment Costs							
1. Civil works	8,581	9,439	18,020	6.70	7.37	14.08	84.9%
2. Equipment	1,822	110	1,932	1.42	0.09	1.51	9.1%
3. Land Acquisition & Resettlement	-	10	10	-	0.01	0.01	0.0%
Subtotal (A)	**10,403**	**9,559**	**19,962**	**8.13**	**7.47**	**15.60**	**94.1%**
B. Recurrent Costs							
Subproject O&M	-	1,254	1,254	-	0.98	0.98	5.9%
Subtotal (B)	**-**	**1,254**	**1,254**	**-**	**1.0**	**1.0**	**5.9%**
Total Base Cost (A+B)	**10,403**	**10,814**	**21,216**	**8.13**	**8.45**	**16.58**	**100.0%**
C. Contingencies							
Physical Contingency	1,094	1,028	2,122	0.85	0.80	1.66	10.0%
Price Contingency	1,153	1,423	2,575	0.35	0.63	0.98	5.9%
Sub-total (C)	**2,247**	**2,450**	**4,697**	**1.20**	**1.43**	**2.63**	**15.9%**
D. Financing Charges	**1,231**	-	**1,231**	**0.85**	-	**0.85**	**5.1%**
Total Project Cost (A+B+C+D)	**13,880**	**13,264**	**27,144**	**10.17**	**9.88**	**20.05**	**121.0%**

The total investment will be financed from ADB loan and counterpart from the Union Government of Myanmar. ADB will finance $18.99 million equivalent while Union Government will shoulder all taxes and duties of $1.01 million equivalent. The distribution of fund sources is detailed in the following table

Table 11-35: Detailed Cost Estimate by Financier – Hpa-An Water Supply System ($ million)

Item	ADB		Central Government				Total Cost
	Amount	% of Cost Category	Amount (Costs)	Amount (Taxes and duties)	Amount (Total)	% of Cost Category	
A. Investment Costs							
1. Civil works	13.39	95%	0.02	0.67	0.69	5%	14.08
2. Equipment	1.32	88%	0.10	0.09	0.19	12%	1.51
3. Land Acquisition & Resettlement	-	0%	-	-	-	0%	0.01
Subtotal (A)	**14.71**	**94%**	**0.12**	0.76	0.88	6%	15.60
B. Recurrent Costs							
Subproject O&M	0.98	100%	-	-	-	0%	0.98
Subtotal (B)	0.98	100%	-	-	-	0%	0.98
Total Base Cost (A+B)	**15.69**	**95%**	0.12	0.76	0.88	5%	16.58
C. Contingencies							
Physical Contingency	1.57	95%	0.01	0.08	0.09		1.66
Price Contingency	0.93	95%	0.00	0.05	0.05	5%	0.98
Sub-total (C)	**2.49**	95%	**0.02**	0.12	0.14	5%	2.63
D. Financing Charges	**0.81**	**96%**	**-**	-	-	0%	0.85
Total Project Cost (A+B+C+D)	**18.99**	**95%**	**0.13**	0.88	1.01	5%	20.05
% Total Project Cost	95%				5%		

The subproject is proposed to be implemented over five years commencing in 2018 and to be completed by 2022. Operation of the subproject is targeted to start as soon as works are completed and full operation is expected by 2023. The indicative implementation schedule is shown in the following table

Table 11-36: Detailed Cost Estimates by Year – Hpa-An WSS ($ million)

Item	Total Cost	2017	2018	2019	2020	2021	2022	2023
A. Investment Costs								
1. Civil works	14.08	-	5.50	4.78	1.85	1.85	0.11	-
2. Equipment	1.51	-	0.75	0.76	-	-	-	-
3. Land Acquisition & Resettlem	0.01	-	0.00	-	-	-	-	-
Subtotal (A)	**15.60**	**-**	**6.25**	**5.54**	**1.85**	**1.85**	**0.11**	**-**
B. Recurrent Costs								
Subproject O&M	0.98	-	-	0.39	0.29	0.20	0.10	-
Subtotal (B)	**0.98**	**-**	**-**	**0.39**	**0.29**	**0.20**	**0.10**	**-**
Total Base Cost (A+B)	**16.58**	**-**	**6.25**	**5.93**	**2.14**	**2.04**	**0.20**	**-**
C. Contingencies								
Physical Contingency	1.66	-	0.63	0.59	0.21	0.20	0.02	-
Price Contingency	0.98	-	0.28	0.34	0.15	0.19	0.01	-
Sub-total (C)	**2.63**	**-**	**0.91**	**0.93**	**0.37**	**0.40**	**0.03**	**-**
D. Financing Charges	**0.85**	**-**	**0.03**	**0.10**	**0.14**	**0.17**	**0.18**	**0.18**
Total Project Cost (A+B+C+D)	**20.05**	**-**	**7.19**	**6.96**	**2.65**	**2.61**	**0.41**	**0.18**
% Total Project Cost		0%	36%	35%	13%	13%	2%	1%

REVENUE PROJECTIONS

Mandatory connection is necessary to ensure maximum capacity utilization of the system and the realization of revenue collection targets to cover the required funds for operations and maintenance.

The present tariff structure for the piped system (MMK250/m3) is not based on any classification of consumers. It is proposed that tariffs be classified into residential and commercial/industrial. The proposal will likely improve the revenues because commercial consumers will be charged a higher rate than the residential. Implementation of the tariff restructuring is expected prior to full operation.

The study likewise recommends a regular tariff adjustment of 20% every two years starting 2020 to 2024 and 15% from 2026 onwards to achieve financial sustainability. The proposed tariff increases, as well as other data relative to operation, are presented in the following table

Table 11-37: Revenue Projection – Hpa-An Water Supply System

	2017	2018	2019	2020	2025	2030	2035	2040
Total Population	81,016	83,074	85,185	87,350	99,594	112,033	126,025	141,765
Number of households	16,203	16,615	17,037	17,470	19,919	22,407	25,205	28,353
Number of commercial establishment	2,686	2,713	2,740	2,767	2,909	3,057	3,213	3,377
Served Population	17,414	22,324	28,618	36,687	69,716	89,626	100,820	113,412
Service Coverage (%)	21%	27%	34%	42%	70%	80%	80%	80%

Water Revenues (without Project)	**2017**	**2018**	**2019**	**2020**	**2025**	**2030**	**2035**	**2040**	**2041**
Domestic									
No. of Connections	3,483	3,552	3,623	3,696	4,081	4,505	4,974	5,492	5,602
Ave. Consumption (m3/conn/month)	15	15	15	15	15	15	15	15	15.00
Revenue Water (m^3'000)	627	639	652	665	735	811	895	989	1,008
Effective Water Tariff ($/cum)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Water Revenues in $ million	-	0.12	0.13	0.13	0.14	0.16	0.17	0.19	0.20
Commercial									
No. of Connections	466	476	485	495	546	603	666	735	750
Ave. Consumption (m3/conn/month)	9	9	9	9	10	11	12	13	13
Revenue Water (m^3'000)	51	52	54	56	67	80	94	111	115
Effective Water Tariff ($/cum)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Water Revenues in $ million	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
Total									
No. of Connections	3,949	4,028	4,109	4,191	4,627	5,109	5,640	6,227	6,352
Revenue Water (m^3'000)	678	692	707	721	802	891	989	1,100	1,123
Effective Water Tariff ($/cum)	0.01	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Water Revenues in $ million	0.01	0.14	0.14	0.14	0.16	0.17	0.19	0.21	0.22
Water Revenues Net of Bad Debts	0.01	0.13	0.14	0.14	0.16	0.17	0.19	0.21	0.22
Total Revenues ($ million)	**0.01**	**0.13**	**0.14**	**0.14**	**0.16**	**0.17**	**0.19**	**0.21**	**0.22**

	2017	2018	2019	2020	2025	2030	2035	2040
Total Population	81,016	83,074	85,185	87,350	99,594	112,033	126,025	141,765
Number of households	16,203	16,615	17,037	17,470	19,919	22,407	25,205	28,353
Number of commercial establishment	2,686	2,713	2,740	2,767	2,909	3,057	3,213	3,377
Served Population	17,414	22,324	28,618	36,687	69,716	89,626	100,820	113,412
Service Coverage (%)	21%	27%	34%	42%	70%	80%	80%	80%
Water Revenues (with Project)	**2017**	**2018**	**2019**	**2020**	**2025**	**2030**	**2035**	**2040**
Domestic								
No. of Connections	3,483	4,465	5,724	7,337	13,943	17,925	20,164	22,682
Water Consumption (lpcd)	100	100	100	100	100	100	100	100
Ave. Consumption (m3/conn/month)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Average Water Demand, (m^3/day)	1,741	2,232	2,862	3,669	6,972	8,963	10,082	11,341
Revenue Water (m^3'000)	636	815	1,045	1,339	2,545	3,271	3,680	4,140
Average Water Fee ($/connection/mon	2.93	2.93	2.93	3.52	5.06	7.70	10.18	13.47
Revenue from Connection Fees	0.02	0.02	0.03	0.04	0.04	0.02	0.01	0.01
Total Water Revenues ($ million)	0.140	0.180	0.231	0.347	0.886	1.677	2.475	3.678
Commercial								
No. of Connections	577	729	920	1,162	2,036	2,446	2,570	2,701
Water Consumption (ltrs/connection/d	302	306	311	316	342	366	392	420
Ave. Consumption (m3/conn/month)	9.0	9.2	9.3	9.5	10.3	11.0	11.8	12.6
Average Water Demand, (m^3/day)	174	223	286	367	697	896	1,008	1,134
Revenue Water (m^3'000)	64	81	104	134	254	327	368	414
Average Water Fee ($/connection/mon	1.77	3.59	3.64	4.44	6.93	11.29	15.98	22.61
Revenue from Connection Fees	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
Water Revenues in $ million	0.015	0.035	0.045	0.068	0.174	0.333	0.493	0.734
Total								
Total Number of Connections	4,060	5,194	6,644	8,500	15,979	20,371	22,734	25,384
Revenue Water (m^3'000)	699	896	1,149	1,473	2,799	3,598	4,048	4,553
Water Revenues in $ million	0.155	0.215	0.275	0.415	1.061	2.010	2.968	4.411
Effective Water Rate ($/cum)	0.22	0.24	0.24	0.28	0.38	0.56	0.73	0.97
Water Revenues ($ million)	0.155	0.215	0.275	0.415	1.061	2.010	2.968	4.411
Net of Bad Debts ($ million)	0.154	0.213	0.273	0.411	1.050	1.990	2.939	4.367
Other Revenues ($ million)	0.021	0.027	0.034	0.043	0.044	0.023	0.012	0.013
Total Revenues ($ million)	**0.175**	**0.239**	**0.307**	**0.454**	**1.095**	**2.013**	**2.950**	**4.380**

OPERATING COSTS

O&M costs were estimated by the technical engineers and were based on the capacity of the system. Included in O&M costs are personnel costs, chemicals and power cost. At current prices, O&M costs were estimated annually when full operation is achieved by 2023. O&M costs were likewise de-escalated to constant prices for the computation of FIRR.

Table 11-38: Operations and Maintenance Costs – Hpa-An WSS ($ million)

	2017	2018	2019	2020	2025	2030	2035	2040
Fixed Costs	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Variable Costs	0.08	0.09	0.11	0.30	0.44	0.68	0.68	0.68
Total OPEX	0.18	0.18	0.21	0.39	0.54	0.78	0.78	0.78

RESULTS OF EVALUATION

The WACC is calculated as the weighted average cost of equity and debt used to fund the project. The cost of equity is calculated based on benchmarking against the cost of equity of several less-developed countries including Bangladesh, Indonesia, and Viet Nam, and adding a premium of 2.5% to reflect Myanmar's higher country risk.5 The nominal cost of debt is taken as the ADB loan's fixed interest rate of 1.5% over the longer term. The loan does not have a maturity premium or commitment fee, and the government has indicated that it will not be charging an on-lending margin. The inflation rate used to adjust the nominal values to real values is based on the long-term price escalation factors used by ADB. Given the estimated costs of equity and debt, and the relative proportions of equity and debt in the project capital structure, the WACC is calculated to be 0.3%.

Table 11-39: Computation of Weighted Average Cost of Capital (WACC)

	Financing component		Total
	ADB	Govt	
1. Amount ($ million)	19.17	0.89	20.05
2. Weighing	95.6%	4.4%	100.0%
3. Nominal cost	1.5%	13.0%	
4. Tax Rate	5.0%	0.0%	
5. Tax-adjusted nominal cost	1.4%	13.0%	
6. Inflation rate	1.5%	5.0%	
7. Real cost	-0.1%	7.6%	
8. Weighted component of WACC	0.0%	0.3%	0.3%
Weighted Average Cost of Capital (Real)			**0.3%**

The FIRR of the project is a summary measure of the return on investments from the viewpoint of the project itself. It indicates the maximum interest rate the project could pay on the invested capital and still break-even financially. The FIRR is measured as the discount rate that equalizes the present value cost stream associated with the project to the present value of the project's benefit stream.

The subproject's FIRR was calculated. Further, sensitivity analysis was conducted under three (4) worse case scenarios such as, one year delay in operation, a 10% increase in project cost, a 10% increase in operation and maintenance and 10% decrease in revenues.

The results of analysis show that in all scenarios, the computed FIRRs are greater than the computed WACC. For the base case scenario, FIRR is 2.6%. Even at worse case conditions, the FIRRs are higher than the WACC which means that the

[5] ADB, MYA-46390: Power Distribution Imrpovement Project, Report and Recommendation of the President. October 2015.

proposed subproject is financially viable. The FIRR and NPV for all scenarios are summarized in Table 11-40 while details are presented in Table 11-43.

Table 11-40: Summary Result of Financial Analysis – Hpa-An WSS

	NPV ($ m)	FIRR (%)	SI	% Change	SV
Base case	8.67	2.6%			
1-Year Delay in Operation	5.38	1.8%	3.10	10%	32%
Capital cost plus 10%	6.74	2.0%	2.26	10%	44%
O & M costs plus 10%	7.27	2.2%	1.34	10%	75%
Revenues less 10%	4.42	1.5%	3.99	10%	25%

The projected income statement shows that the proposed fees can adequately cover the costs of O&M starting 2022 when full operation occurs. Prior to subproject completion, the Township Government will continue to cover the cost shortfall.

AFFORDABILITY OF TARIFFS

A major consideration in the development of the water tariff schedule is the ability of target beneficiaries, specifically from the low income group (LIG), to pay for their monthly bill. Indicative affordability benchmark for water rates ranging from 3 to 5% has been adopted by many governments and international funding institutions.

The estimated average monthly income of the LIG is MK79.567 based on the results of the socio-economic survey undertaken as part of this study. Using the affordability criterion and an assumption of 10m3 average monthly consumption by the LIG, the computed average monthly bill of MK3,000 in 2020 is 3.3% of their income. Considering the proposed increases in water rates in subsequent years, the average charge is less than 5% for all years. Hence, the proposed level of tariff is deemed affordable and reasonable to the household beneficiaries

Table 11-41: Water rates and affordability

	2015	2016	2017	2018	2019	2020	2025	2026	2030	2035	2040
Domestic/Residential											
MK/m3	250	250	250	250	250	300	432	497	657	869	1,149
$ per m3	0.20	0.20	0.20	0.20	0.20	0.23	0.34	0.39	0.51	0.68	0.90
Commercial	-	-									
MK/m3	250	250	250	500	500	600	864	994	1,314	1,738	2,298
$ per m3	0.20	0.20	0.20	0.39	0.39	0.47	0.68	0.78	1.03	1.36	1.80
Increase in Water Rates						**20%**		**15%**	**15%**		

Affordability of Proposed Rates to the Low Income Group (LIG)

	2015	2016	2017	2018	2019	2020	2025	2026	2030	2035	2040
Average Income of LIG (MK/month) [a]	79,567	83,545	87,723	92,109	96,714	101,550	129,606	136,087	165,414	211,115	269,442
Minimum Monthly Charge (Mk/month) [b]			2,500	2,500	2,500	3,000	4,320	4,968	6,570	8,689	11,491
Share of Monthly Charge to Average Income (%)			2.8%	2.7%	2.6%	3.0%	3.3%	3.7%	4.0%	4.1%	4.3%

a Income data for 2015 is from the socio-economic survey. Annual increase in income is asumed to b 5%

b Average monthly water consumption for the LIG (m3 per month) = 10

Table 11-42: Projected Income and Expenditures–Hpa-An WSS ($million)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Operating Revenues												
Water tax	11	11	12	12	12	13	13	14	15	18	22	26
Water Sales	199	275	353	531	575	777	883	1,194	1,358	2,573	3,799	5,647
Domestic	180	230	295	445	481	649	738	998	1,135	2,146	3,168	4,708
Commercial	19	45	57	86	94	128	145	197	223	427	632	939
Other Operating Revenues												
Total Revenues	**210**	**286**	**364**	**543**	**587**	**789**	**896**	**1,208**	**1,373**	**2,591**	**3,821**	**5,673**
Operating Expenses												
Fixed Cost	136	143	150	157	165	174	182	191	201	256	327	418
Variable Cost	158	173	238	508	548	581	694	818	990	1,806	2,306	2,943
Total	**294**	**315**	**388**	**666**	**713**	**755**	**876**	**1,009**	**1,191**	**2,063**	**2,633**	**3,360**
Net Income	**-84**	**-29**	**-24**	**-123**	**-126**	**35**	**20**	**199**	**181**	**528**	**1,188**	**2,313**

Table 11-43: Financial Evaluation – Hpa-An WSS

FINANCIAL INTERNAL RATE OF RETURN

($ million)

Year	Base Hypothesis				Sensitivity Analyses															
	Incremental		Project Cost	Net	1 Year Delay in Operation		Project Cost	Net	Incremental		Project Cost (+10%)	Net	Incremental		Project Cost	Net	Incremental		Project Cost	Net
	Revenues	O&M			Revenues	O&M			Revenues	O&M			Revenues	O&M (+10%)			Revenues (-10%)	O&M		
2017	0.169	0.032	0.654	(0.517)			0.654	(0.654)			0.719	(0.719)			0.654	(0.654)			0.654	(0.654)
2018	0.243	0.032	6.121	(5.910)	0.169	0.032	6.121	(5.984)	0.243	0.032	6.733	(6.522)	0.243	0.036	6.121	(5.914)	0.218	0.032	6.121	(5.935)
2019	0.312	0.048	6.395	(6.130)	0.243	0.032	6.395	(6.184)	0.312	0.048	7.034	(6.769)	0.312	0.052	6.395	(6.134)	0.281	0.048	6.395	(6.161)
2020	0.418	0.291	3.383	(3.256)	0.312	0.048	3.383	(3.118)	0.418	0.291	3.721	(3.594)	0.418	0.320	3.383	(3.285)	0.376	0.291	3.383	(3.298)
2021	0.431	0.291	2.574	(2.434)	0.418	0.291	2.574	(2.447)	0.431	0.291	2.831	(2.691)	0.431	0.320	2.574	(2.463)	0.388	0.291	2.574	(2.477)
2022	0.512	0.291	0.640	(0.419)	0.431	0.291	0.640	(0.501)	0.512	0.291	0.704	(0.483)	0.512	0.320	0.640	(0.448)	0.461	0.291	0.640	(0.470)
2023	0.583	0.323	0.218	0.042	0.512	0.291	0.218	0.003	0.583	0.323	0.240	0.020	0.583	0.356	0.218	0.009	0.525	0.323	0.218	(0.017)
2024	0.693	0.323		0.370	0.583	0.323	-	0.259	0.693	0.323	-	0.370	0.693	0.356	-	0.337	0.624	0.323	-	0.300
2025	0.788	0.343		0.445	0.693	0.323	-	0.370	0.788	0.343	-	0.445	0.788	0.378	-	0.411	0.710	0.343	-	0.366
2026	0.810	0.381		0.430	0.788	0.343	-	0.445	0.810	0.381	-	0.430	0.810	0.419	-	0.392	0.729	0.381	-	0.349
2027	0.852	0.381		0.472	0.810	0.381	-	0.430	0.852	0.381		0.472	0.852	0.419		0.433	0.767	0.381		0.386
2028	0.939	0.381		0.559	0.852	0.381	-	0.472	0.939	0.381		0.559	0.939	0.419		0.521	0.846	0.381		0.465
2029	0.988	0.424		0.564	0.939	0.381	-	0.559	0.988	0.424		0.564	0.988	0.466		0.522	0.889	0.424		0.465
2030	1.089	0.438		0.651	0.988	0.424	-	0.564	1.089	0.438		0.651	1.089	0.482		0.607	0.980	0.438		0.542
2031	1.281	0.438		0.843	1.089	0.438	-	0.651	1.281	0.438		0.843	1.281	0.482		0.799	1.153	0.438		0.715
2032	1.508	0.438		1.070	1.281	0.438	-	0.843	1.508	0.438		1.070	1.508	0.482		1.026	1.357	0.438		0.919
2033	1.697	0.438	-	1.259	1.508	0.438	-	1.070	1.697	0.438	-	1.259	1.697	0.482	-	1.215	1.527	0.438	-	1.089
2034	1.998	0.438		1.560	1.697	0.438	-	1.259	1.998	0.438		1.560	1.998	0.482		1.517	1.799	0.438		1.360
2035	2.249	0.438		1.811	1.998	0.438	-	1.560	2.249	0.438		1.811	2.249	0.482		1.767	2.024	0.438		1.586
2036	2.648	0.438		2.210	2.249	0.438	-	1.811	2.648	0.438		2.210	2.648	0.482		2.166	2.383	0.438		1.945
2037	2.980	0.438		2.542	2.648	0.438	-	2.210	2.980	0.438		2.542	2.980	0.482		2.498	2.682	0.438		2.244
2038	3.509	0.438		3.071	2.980	0.438	-	2.542	3.509	0.438		3.071	3.509	0.482		3.027	3.158	0.438		2.720
2039	3.948	0.438		3.510	3.509	0.438	-	3.071	3.948	0.438		3.510	3.948	0.482		3.467	3.554	0.438		3.116
2040	4.650	0.438		4.212	3.948	0.438	-	3.510	4.650	0.438		4.212	4.650	0.482		4.168	4.185	0.438		3.747
2041	5.232	0.438		4.794	4.650	0.438	-	4.212	5.232	0.438		4.794	5.232	0.482		4.750	4.709	0.438		4.271
	FIRR			**2.91%**	**FIRR**			**1.84%**	**FIRR**			**2.25%**	**FIRR**			**2.66%**	**FIRR**			**1.97%**
	NPV			**10.53**	**NPV**			**5.93**	**NPV**			**8.41**	**NPV**			**9.54**	**NPV**			**6.52**

11.3.3 MYAWADDY SOLID WASTE MANAGEMENT

The main goal of the project is enhanced solid waste management through improved solid waste collection, expanded service coverage; availability of disposal facility, and efficient recycling and composting.

11.3.3.1 Existing Situation

Myawaddy is a border city located at the boundary of Thailand. The total urban population as of 2015 is 113,155 people. About two-third of the urban population is considered 'floating population' which means not formally registered in the city. The border crossing between Myawaddy in Myanmar and Mae Sot in Thailand has been identified as one of the 15 key GMS border crossings that is responsible for facilitating the massive passenger and goods traffic between GMS jurisdictions.

The Ward Development Committees in Myawaddy collect the waste from the households, but not in all wards. It was estimated that only half of the generated waste is collected, the rest is dumped into the Moei River (or Thaungyin River), which borders Thailand. The town has two small dumpsites, both located next to the river. At high water levels of the rivers, a large amount of waste is carried away by the floodwaters. Also the dumpsites are just about 100 meters away from housing areas. There is no protection against soil pollution and groundwater pollution. A water intake downstream of the dumpsites is not prone to contamination. Scavengers are on-site to take out recyclables.

Solid waste collection is under the responsibility of the wards administrators and organized on a community basis. The dumpsites are more or less under the control of the township but are indirectly operated by the communities. Contribution of the users can be cash (about 200 Kyats/plastic bag) or in-kind (labour) and there is no specific revenue recorded with the township budget nor in financial statements.

In light of these underlying conditions, the updating of the solid waste process in Myawaddy needs both communities and the township administration.

The corresponding price policy will have to split between the pricing for the pre-collection (under the responsibility of the communities at the ward level) and the pricing of the transfer and the treatment more likely under the control of the township. The global pricing will have to take into account the real service cost, at least for pre-collection. It is likely to share the financing of the waste transfer and treatment between tariffs and taxes (cleaning tax).

11.3.3.2 Proposed subproject

The proposed new ISWM system for Myawaddy consists of:

1) Improving primary collection system in the towns and transport system to the landfill and composting sites;
2) More efficient separation and collection of recyclables e.g. like plastic bottles, glass, aluminium cans and paper, both through the informal and formal sectors;
3) Implementation of small hospital waste incinerator;
4) Introduction of source separating organics (SSO) system for diverting large amounts of organic waste to the new planned composting plant; and

5) Implementation of a controlled landfill with bottom liner, leachate collection and treatment facility.

Above measures are included in the investment plans of the town and proposed for ADB financing.

SUBPROJECT COSTS AND FINANCING PLAN

Total subproject cost for Myawaddy Solid Waste Management is $9.99 million equivalent. This is based on the direct costs estimated in the technical study. The subproject cost includes civil works, vehicle and equipment, land acquisition and resettlement, detailed engineering survey and design, construction supervision, physical and price contingencies, and applicable taxes and duties. Details of the estimates are shown in the following table.

Table 11-44: Detailed cost estimates by expenditure category - Myawaddy ISWM

Item	In MK Millions			In $ millions			% of Base Cost
	Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total	
A. Investment Costs							
1. Civil works	3,908	4,299	8,208	3.05	3.36	6.41	79.7%
2. Equipment	1,610	97	1,707	1.26	0.08	1.33	16.6%
3. Vehicles	250	39	288	0.20	0.03	0.23	2.8%
4. Survey, Design and Supervision	-	47	47	-	0.04	0.04	0.5%
5. Land Acquisition and Resettlement	-	53	53	-	0.04	0.04	0.5%
Subtotal (A)	**5,768**	**4,535**	**10,303**	**4.51**	**3.54**	**8.05**	**100.0%**
B. Contingencies							
Physical Contingency	610	418	1,028	0.48	0.33	0.80	10.0%
Price Contingency	1,004	855	1,859	0.28	0.34	0.61	7.6%
Sub-total (B)	**1,614**	**1,273**	**2,887**	**0.75**	**0.67**	**1.42**	**17.6%**
D. Financing Charges	**768**	-	**768**	**0.52**	-	**0.52**	**6.5%**
Total Project Cost (A+B+C)	**8,150**	**5,808**	**13,959**	**5.78**	**4.21**	**9.99**	**124.1%**

The total investment will be loan-financed by Neighbouring Countries Economic Development Cooperation Agency (NEDA) with counterpart funding from Union Government of Myanmar counterpart. The available financing will be allocated as follows: NEDA will finance $9.45 million equivalent while Myanmar Union Government will shoulder all taxes and duties of $0.48 million equivalent. Kayin State will provide for land acquisition and resettlement costs. The distribution of fund sources is detailed in the following table.

Table 11-45: Detailed Cost Estimate by Financier – Myawaddy ISWM

Item	NEDA		Kayin State		Central Government			Total Cost
	Amount	% of Cost Category	Amount	% of Cost Category	Amount (Taxes and duties)	Amount (Total)	% of Cost Category	
A. Investment Costs								
1. Civil works	6.11	95%	-	0%	0.31	0.31	5%	6.41
2. Equipment	1.26	94%	-	0%	0.08	0.08	6%	1.33
3. Vehicles	0.20	87%	-	0%	0.03	0.03	13%	0.23
4. Survey, Design and Supervision	0.04	100%	-	0%	-	-	0%	0.04
5. Land Acquisition and Resettlement	-	0%	0.04	100%	-	-	0%	0.04
Subtotal (A)	**7.60**	**94%**	**0.04**	1%	**0.41**	**0.41**	5%	**8.05**
B. Contingencies								
Physical Contingency	0.76	94%	0.01	1%	**0.04**	0.04		0.80
Price Contingency	0.58	94%	0.00	0%	**0.03**	0.03	5%	0.61
Sub-total (B)	**1.34**	94%	**0.01**	1%	**0.07**	**0.07**	5%	**1.42**
D. Financing Charges	**0.52**	**100%**	**-**	0%	**-**	**-**	0%	**0.52**
Total Project Cost (A+B+C)	**9.45**	**95%**	**0.05**	1%	**0.48**	**0.48**	5%	**9.99**
% Total Project Cost	**94.7%**		**0.5%**			**4.8%**		

The subproject is proposed to be implemented over five years commencing in 2017 and to be completed by 2021. Operation of the subproject is targeted to start as soon as works are completed and full operation is expected by 2022. The indicative implementation schedule is shown in the following table.

Table 11-46: Detailed Cost Estimates by Year – Myawaddy ISWM ($ million)

Item	Total Cost	2017	2018	2019	2020	2021	2022	2023
A. Investment Costs								
1. Civil works	6.41	-	-	1.48	4.58	0.36	-	-
2. Equipment	1.33	-	-	0.01	1.17	0.16	-	-
3. Vehicles	0.23	-	-	-	0.11	0.11	-	-
4. Survey, Design and Supervision	0.04	-	-	0.04	-	-	-	-
5. Land Acquisition and Resettlement	**0.04**	**0.02**	**0.02**	**0.00**	**0.00**	**-**	**-**	**-**
Subtotal (A)	8.05	0.02	0.02	1.52	5.86	0.63	-	-
B. Contingencies								
Physical Contingency	**0.80**	**0.00**	**0.00**	**0.15**	**0.59**	**0.06**	**-**	**-**
Price Contingency	0.61	0.00	0.00	0.10	0.46	0.06	-	-
Sub-total (B)	**1.42**	**0.00**	**0.00**	**0.24**	**1.05**	**0.12**	**-**	**-**
D. Financing Charges	**0.52**	**0.04**	**0.00**	**0.01**	**0.07**	**0.13**	**0.13**	**0.13**
Total Project Cost (A+B+C)	**9.99**	**0.05**	**0.02**	**1.78**	**6.99**	**0.88**	**0.13**	**0.13**
% Total Project Cost		0.5%	0.2%	17.8%	69.9%	8.8%	1.3%	1.3%

REVENUE PROJECTIONS

It is assumed that the Township Government will gradually extend its coverage areas from the current 55% to 98% by 2040 in order to have an effective and sustainable environmental SWM project in the township. A local regulation must stipulate that all households and commercial establishments provided with collection service will pay mandatory weekly or monthly fees and that these fees will be collected either by the township or through community organizations or village leaders**.**

The ADB loan proceeds will be on-granted from the Central Government to Myawaddy. It is proposed that tariffs should at least cover O&M costs for sustainability. The proposed tariff structure classifies consumers as either domestic (i.e. households) or non-domestic (i.e. commercial and industrial connections), with non-domestic connections to be charged more to boost revenues. The proposed weekly fee is MK300 per domestic connection and MK1,000 per non-domestic connection.

Tariffs are expected to be implemented in 2020 when operation commences, increasing by 5% every five years to keep pace with real growth. The projected revenues were based on the projected increase in the coverage area multiplied by the monthly service fees.

Details of operation are provided in the following table.

Table 11-47: Projected Income and Expenditures – Myawaddy ISWM ($ million)

			2017	2018	2019	2020	2025	2030	2035	2040
BASIC DATA										
Population										
Myawaddy - urban areas			123,648	127,357	131,178	135,113	156,633	181,581	210,502	244,029
annual growth (%)			3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Number of households	HH size	5.0	24,730	25,471	26,236	27,023	31,327	36,316	42,100	48,806
Number of business establishments	Annual +	2%	2,122	2,165	2,208	2,252	2,487	2,746	3,031	3,347
Per Capita Waste Generation										
per capita per day (kg)			0.58	0.59	0.61	0.62	0.69	0.76	0.83	0.90
annual increase (%)			2.5%	2.4%	2.4%	2.3%	2.1%	1.9%	1.7%	1.7%
OPERATIONS DATA										
Waste Generation										263,551
Total waste generated (kg/day)			71,468	75,395	79,494	83,770	108,077	138,001	174,716	219,626
Additional waste from market (kg/day)	20%		14,294	15,079	15,899	16,754	21,615	27,600	34,943	43,925
Total annual waste generated (tons/yr)			31,303	33,023	34,818	36,691	47,338	60,445	76,526	96,196
Collection Coverage										
Annual coverage			57.0%	57.9%	58.8%	90.0%	92.0%	94.0%	96.0%	98.0%
Annual increase			0.9%	0.9%	0.9%	31.2%	12.4%	0.4%	0.4%	0.4%
Waste Collection						58.35				
Total waste collected per day (kg)			48,861	52,367	56,080	90,470	119,320	155,660	201,258	258,280
Total waste collected per year (tons)			17,834	19,114	20,469	33,022	43,552	56,816	73,459	94,272
Collected Waste Composition										
Organics & greens			0.0%	0.0%	0.0%	25.0%	40.0%	40.0%	40.0%	40%
Recyclables		+ 0.8%	17.5%	18.3%	19.0%	20.0%	20.0%	20.0%	20.0%	20%
Residuals		+ 0.4%	39.5%	39.6%	39.8%	45.0%	32.0%	34.0%	36.0%	38%
Total			**57.0%**	**57.9%**	**58.8%**	**90.0%**	**92.0%**	**94.0%**	**96.0%**	**98.0%**
Operations plan (tons/day)										
Days of operation			365	365	365	365	365	365	365	365
Organic material			0.0	0.0	0.0	25.1	51.9	66.2	83.9	105.4
Recycling production			15.0	16.5	18.1	20.1	25.9	33.1	41.9	52.7
Waste to landfill			33.8	35.9	38.0	45.2	41.5	56.3	75.5	100.2
Total			**48.9**	**52.4**	**56.1**	**90.5**	**119.3**	**155.7**	**201.3**	**258.3**

OPERATING COSTS

O&M costs were estimated by the technical engineers and were based on the capacity of the system. Included in O&M costs are personnel costs, chemicals and power cost. At 2015 constant prices, O&M costs are estimated to be $0.33 million annually when full operation is achieved by 2020. O&M costs are likewise shown in current prices in the financial income and expenditure statement.

Table 48: Operations and Maintenance Costs – Myawaddy ISWM ($ million)

OPERATIONS & MAINTENANCE		**2017**	**2018**	**2019**	**2020**	**2025**	**2030**	**2035**	**2040**
Waste Collection					0.06	0.06	0.06	0.06	0.06
Composting Plant					0.13	0.13	0.13	0.13	0.13
Sanitary Landfill					0.14	0.14	0.14	0.14	0.14
Total O&M with Project					**0.33**	**0.33**	**0.33**	**0.33**	**0.33**
Total O&M without Project	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RESULTS OF EVALUATION

A subproject is considered financially viable if the resulting FIRR of the proposed subproject is higher than the WACC that was used in financing the subproject. An FIRR higher than the WACC implies that the incremental net revenues generated by the project will be enough to recover the implementation and operating costs.

On the basis of the financing mix and the loan interest of 1.0% and the assumed cost of equity of 13%, the WACC is computed for the combined projects at 0.41%.

Table 11-48: Computation of Weighted Average Cost of Capital - Myawaddy ISWM

	Loan	Equity	TOTAL
Weight (%)	94.7%	5.3%	100%
Nominal Cost (%)	1.0%	13.0%	
Tax Rate (%)	5.0%	0.0%	
Tax Adjusted Nominal Cost (%)	1.0%	13.0%	
Inflation Rate (%)	1.5%	5.0%	
Real Cost (%)	-0.5%	7.6%	
Weighted Component of WACC (%)	0.0%	0.4%	
Weighted Average Cost of Capital (Real Terms)			**0.41%**

The subproject's FIRR was calculated. Further, sensitivity analysis was conducted under three (4) worse case scenarios such as, one year delay in operation, a 10% increase in project cost, a 10% increase in operation and maintenance and 10% decrease in revenues.

The results of analysis show that in all scenarios, the computed FIRRs are greater than the computed WACC. For the base case scenario, FIRR is 3.25%. Even at worse case conditions, the FIRRs are higher than the WACC which means that the proposed subproject is financially viable. The summary result of FIRR computation is provided in Table 11-49 and detailed computation is shown in Table 11-51.

Table 11-49: Summary Result of Financial Analysis – Myawaddy ISWM

FIRRs	Change	NPV	FIRR	SI (IRR)	SV (IRR)
Base Case		3.3	3.25%		
Case 1 - Increase in Capital Costs	10%	2.5	2.38%	3.07	33%
Case 2 - Increase in O&M Costs	10%	2.7	2.72%	1.88	53%
Case 3 - Decrease in Revenues	10%	1.5	1.73%	5.35	19%
Case 4 - Project Delay	1 Year Delay	2.0	2.07%	NPV lower by	40%

The projected income statement shows that the proposed fees can adequately cover the costs of O&M.

Table 11-50: Projected Income and Expenditures – Myawaddy ISWM ($ million)

Particulars	2020	2021	2022	2023	2024	2025	2030	2035	2040
Revenue									
Garbage fees	0.29	0.29	0.29	0.28	0.28	0.35	0.43	0.53	0.66
Tipping fees	0.24	0.25	0.26	0.28	0.29	0.31	0.39	0.50	0.63
Income from composting	0.03	0.03	0.03	0.03	0.04	0.06	0.08	0.10	0.12
Total Revenue	**0.55**	**0.57**	**0.58**	**0.60**	**0.61**	**0.72**	**0.90**	**1.13**	**1.40**
O&M Expenses									
Waste collection	0.07	0.07	0.07	0.08	0.08	0.08	0.10	0.12	0.15
Composting plant	0.15	0.16	0.17	0.18	0.18	0.19	0.23	0.28	0.34
Sanitary landfill	0.17	0.18	0.18	0.19	0.20	0.21	0.26	0.31	0.37
Total O&M Expenses	**0.39**	**0.41**	**0.42**	**0.44**	**0.46**	**0.48**	**0.59**	**0.71**	**0.85**
Net Income	**0.17**	**0.16**	**0.16**	**0.15**	**0.15**	**0.24**	**0.31**	**0.42**	**0.56**

Affordability of Tariffs

Setting of tariffs is a key factor which affects the subproject's viability as well as the sustainability of subproject operations. While tariffs need to recover costs, they also need to be affordable.

Results of the socio-economic survey conducted under the project indicated that average household monthly income is about MK347,111. Given a proposed monthly garbage fee of MK 1,200 per household, this is only about 0.3% of household income. For the low income group with household monthly income of MK89,444, the proposed rate is about 1.3% of their income. Hence, the proposed level of tariff is deemed affordable and reasonable to the household beneficiaries.

Table 11-51: Financial Evaluation - Myawaddy ISWM ($ million)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Incremental Costs												
Capital Costs	0.02	0.02	1.67	6.45	0.69	-	-	-	-	-	-	-
O&M Costs	-	-	-	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
Total Costs	0.02	0.02	1.67	6.78	1.02	0.33	0.33	0.33	0.33	0.33	0.33	0.33
Incremental Revenue	-	0.21	0.23	0.55	0.57	0.58	0.60	0.61	0.72	0.90	1.13	1.40
Net Cash Flow (Base Case)	(0.02)	0.20	(1.45)	(6.22)	(0.45)	0.26	0.27	0.29	0.40	0.58	0.80	1.08
Sensitivity Tests:												
Case 1 - Increase in Capital Costs	(0.02)	0.19	(1.61)	(6.87)	(0.52)	0.26	0.27	0.29	0.40	0.58	0.80	1.08
Case 2 - Increase in O&M Costs	(0.02)	0.20	(1.45)	(6.25)	(0.48)	0.22	0.24	0.25	0.36	0.55	0.77	1.05
Case 3 - Decrease in Revenues	(0.02)	0.17	(1.47)	(6.28)	(0.50)	0.20	0.21	0.23	0.32	0.49	0.69	0.94
Case 4 - Project Delay	(0.02)	(0.02)	(1.46)	(6.55)	(0.46)	0.24	0.26	0.27	0.29	0.52	0.74	1.00

FIRRs:	**Change**	**NPV**	**FIRR**	**SI (IRR)**	**SV (IRR)**
Base Case		3.3	3.25%		
Case 1 - Increase in Capital Costs	10%	2.5	2.38%	3.07	33%
Case 2 - Increase in O&M Costs	10%	2.7	2.72%	1.88	53%
Case 3 - Decrease in Revenues	10%	1.5	1.73%	5.35	19%
Case 4 - Project Delay	Delay	2.0	2.07%	lower by	40%

SI = sensitivity indicator (ratio of percentage change in IRR above the cut-off rate to percentage change in selected variable).

SV = switching value (percentage change in selected variable to reduce the IRR to cut-off rate).

11.3.4 MYAWADDY WATER SUPPLY SYSTEM

11.3.4.1 Existing Situation

In Myawaddy, water supply is operated by two private companies: Myawaddy Shwe Pyi Company Limited and Aye Mya San Ye Company Limited. Both companies have agreement with Kayin State Development Affair for a 30-year operation contract. Both are contracted to manage water production, distribute to domestic and non-domestic water users, collect tariff, undertake maintenance of facilities, and control non-revenue water.

They apply to Kayin State Government for business license and pay license fees amounting to MMK1 million, to Township Development Affairs for MMK1.5 million per year and MMK1.5 million paid monthly to District Development Affairs. There are no water tax and water tariff revenue received by Myawaddy Development Affairs.

The proposed water supply subproject will provide water to one of the companies -- Aye Mya San Ye Company Limited. AMSYCL currently gets water from one intake using natural spring. But this water source is not sufficient especially during summer season. Since the Company gets water from natural spring, they just assume that production and distribution volumes are the same. No data are available regarding NRW.

Existing tariff rate is MMK400/m3. The Company originally proposed MMK450/m3 but TDC agreed with MMK400/m3. Furthermore, the Company has an existing bank loan which they used for their initial investment.

The Myawaddy Shwe Pyi Company Limited was established in 1997 and reorganized in 2012. Its capitalization was increased with the reorganization to MMK1 billion. The company has four departments with 20 staff. It signed a 30-year water concession with the KSG in 2013. By 2015, the company serves 2,500 households located in wards 4 and 5 and starts expansion to ward 2. It produces 530,000 gallons/day. It uses two sources of water in Moei River (or Thaungyin River). It pays business license to the KST, to the District and the township levels. The company is financially autonomous and collects tariff from water users without any township or State interference. It has plans of developing its own additional water sources.

The Aye Mya San Yee Company Limited was established in 2012 and signed a 25-year BOT contract with KSG. Its capital is MMK5 million and has 17 staff. In 2015, the company serves 2,600 households located in wards 1 and 2. It produces 300.000 to 400.000 gallons of water per day. It uses natural spring water source, however, water supply is not sufficient especially during summer season. The company is interested to buy raw water from the township depending on the offered price. They pay business license to the KST, to the District and the township levels. The company collects water tariffs from the users without any township or State interference. Their financial situation is reportedly tight and has not been able to pay back all its debt obligations.

The two companies serve about 25 to 30% of the total township population, but with bad water quality and inefficient service.

Table 11-52: Water tariffs, population served in Myawaddy

Company	Water tariff	Number of connections
Aye Mya San Yee Company Limited	Single tariff for domestic and non-domestic: MMK400/m3 Special tariff for monastery: MMK200/m3	2.600
Myawaddy Shwe Pyi Company Limited	Single tariff for domestic and non-domestic: MMK715/m3 (20 Baths) Special tariff for monastery: MMK200/m3	2.500

11.3.4.2 Proposed subproject

During discussions with the officer of Aye Mya San Yee Company Limited, she expressed positive response that they are interested to buy water from the water source that will be developed by the TDC.

SUBPROJECT COSTS AND FINANCING PLAN

Total subproject cost for Myawaddy Water Supply System amounts to $13.4 million equivalent. This was based on the direct costs estimated in the technical study. The subproject cost includes civil works and equipment, land acquisition and resettlement, subproject operation and maintenance, physical and price contingencies, financing charges during implementation and applicable taxes and duties. Details of the estimates are shown in the following table.

Table 11-53: Detailed Cost Estimates by Expenditure Category – Myawaddy WSS

Item	In MK Millions			In $ millions			% of Base Cost
	Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total	
A. Investment Costs							
1. Civil works	4,928	5,421	10,348	3.85	4.23	8.08	74.3%
2. Equipment	2,432	147	2,579	1.90	0.11	2.01	18.5%
3. Land Acquisition & Resettlement	-	40	40	-	0.03	0.03	0.3%
Subtotal (A)	**7,360**	**5,607**	**12,967**	**5.75**	**4.38**	**10.13**	**93.1%**
B. Recurrent Costs							
Subproject O&M	-	965	965	-	0.75	0.75	6.9%
Subtotal (B)	**-**	**965**	**965**	**-**	**0.8**	**0.8**	**6.9%**
Total Base Cost (A+B)	**7,360**	**6,573**	**13,932**	**5.75**	**5.13**	**10.88**	**100.0%**
C. Contingencies							
Physical Contingency	775	620	1,395	0.61	0.48	1.09	10.0%
Price Contingency	797	847	1,644	0.24	0.37	0.61	5.6%
Sub-total (C)	**1,572**	**1,467**	**3,039**	**0.85**	**0.85**	**1.70**	**15.6%**
D. Financing Charges	**1,190**	-	**1,190**	**0.82**	-	**0.82**	**7.5%**
Total Project Cost (A+B+C+D)	**10,122**	**8,040**	**18,161**	**7.41**	**5.99**	**13.40**	**123.1%**

The total investment cost will be financed from ADB loan and the Union Government counterpart. The available financing will be allocated as follows: ADB will finance $12.6 million equivalent while Union Government will shoulder all taxes and duties of $0.58 million equivalent and equipment amounting to $0.19 million equivalent. The distribution of fund sources is detailed in the following table:

Table 11-54: Detailed Cost Estimate by Financier – Myawaddy WSS ($ million)

Item	NEDA		Central Government				Total Cost
	Amount	% of Cost Category	Amount (Costs)	Amount (Taxes and duties)	Amount (Total)	% of Cost Category	
A. Investment Costs							
1. Civil works	7.70	95%	0.00	0.38	0.38	5%	8.08
2. Equipment	1.74	86%	0.17	0.11	0.28	14%	2.01
3. Land Acquisition & Resettlement	-	0%	-	-	-	0%	0.03
Subtotal (A)	**9.43**	**93%**	**0.17**	**0.50**	**0.66**	7%	**10.13**
B. Recurrent Costs							
Subproject O&M	0.75	100%	-	-	-	0%	0.75
Subtotal (B)	0.75	100%	-	-	-	0%	0.75
Total Base Cost (A+B)	**10.19**	**94%**	**0.17**	**0.50**	**0.66**	6%	**10.88**
C. Contingencies							
Physical Contingency	1.02	93%	**0.02**	**0.05**	0.07		1.09
Price Contingency	0.57	94%	**0.00**	**0.03**	0.03	6%	0.61
Sub-total (C)	**1.59**	94%	**0.02**	**0.08**	**0.10**	6%	**1.70**
D. Financing Charges	**0.82**	**100%**	**-**	**-**	**-**	0%	**0.82**
Total Project Cost (A+B+C+D)	**12.60**	**94%**	**0.19**	**0.58**	**0.77**	6%	**13.40**
% Total Project Cost	94%				6%		

The subproject is proposed to be implemented over five years commencing in 2018 and to be completed by 2022. Operation of the subproject is targeted to start as soon as works are completed and full operation is expected by 2023. The indicative implementation schedule is shown in the following table

Table 11-55: Detailed Cost Estimates by Year – Myawaddy WSS ($ million)

Item	Total Cost	2017	2018	2019	2020	2021	2022	2023
A. Investment Costs								
1. Civil works	8.08	-	3.07	2.48	1.22	1.22	0.11	-
2. Equipment	2.01	-	1.11	0.90	-	-	-	-
3. Land Acquisition & Resettlement	0.03	-	0.03	-	-	-	-	-
Subtotal (A)	**10.13**	**-**	**4.21**	**3.38**	**1.22**	**1.22**	**0.11**	**-**
B. Recurrent Costs								
Subproject O&M	0.75	-	-	0.30	0.23	0.15	0.08	-
Subtotal (B)	**0.75**	**-**	**-**	**0.30**	**0.23**	**0.15**	**0.08**	**-**
Total Base Cost (A+B)	**10.88**	**-**	**4.21**	**3.68**	**1.45**	**1.37**	**0.18**	**-**
C. Contingencies								
Physical Contingency	1.09	-	0.42	0.37	0.14	0.14	0.02	-
Price Contingency	0.61	-	0.18	0.20	0.10	0.13	0.01	-
Sub-total (C)	**1.70**	**-**	**0.60**	**0.56**	**0.25**	**0.26**	**0.03**	**-**
D. Financing Charges	**0.82**	**-**	**0.03**	**0.10**	**0.14**	**0.16**	**0.18**	**0.18**
Total Project Cost (A+B+C+D)	**13.40**	**-**	**4.84**	**4.34**	**1.83**	**1.80**	**0.38**	**0.18**
% Total Project Cost		0%	36%	32%	14%	13%	3%	**1%**

REVENUE PROJECTIONS

A supplementary agreement is expected to be signed between the Kayin State Development Affairs and the Company for the bulk selling of the water that will be produced. The final tariff will be decided at a later stage but it is expected that the passed-on rate to the people will at least remain the same as the existing rate. It is assumed that the selling rate will replace the existing production cost that the Company is spending.

A study to determine the effect of this in terms of the effective increase in revenues needs to be conducted since this has not yet been considered in the financial analysis.

For the purpose of this study, the proposed rate of MMK300/m3 will be the rate that will be charged to the Company. The study likewise recommends a regular tariff adjustment of 20% to be implemented every two years after full operation to 2027 and then 10% onwards to demonstrate financial sustainability. The proposed tariff increases, as well as other data relative to operation, are presented in the following table.

Table 11-56: Revenue Projection – Myawaddy WSS

	2021	2022	2023	2024	2025	2030	2035	2040
Total Population	96,517	98,846	101,231	103,674	106,176	119,621	134,768	151,833
Number of households	19,303	19,769	20,246	20,735	21,235	23,924	26,954	30,367
Number of commercial establishment	309	312	315	318	321	338	355	373
Served Population	67,562	69,192	70,862	72,572	74,323	95,630	121,571	146,315
Service Coverage (%)	70%	70%	70%	70%	70%	80%	90%	96%
Water Revenues (with Project)								
Total Number of Connections	13,728	14,057	14,393	14,737	15,090	19,396	24,634	29,622
Revenue Water (m^3'000)	2,713	2,778	2,845	2,914	2,984	3,840	4,881	5,875
Water Revenues in $ million	0.627	0.642	0.789	0.808	0.993	1.687	2.855	4.157
Effective Water Rate ($/cum)	0.23	0.23	0.28	0.28	0.33	0.44	0.58	0.71
Water Revenues ($ million)	0.627	0.642	0.789	0.808	0.993	1.687	2.855	4.157
Net of Bad Debts ($ million)	0.621	0.636	0.781	0.800	0.983	1.670	2.826	4.116
Total Revenues ($ million)	**0.621**	**0.636**	**0.781**	**0.800**	**0.983**	**1.670**	**2.826**	**4.116**

OPERATING COSTS

O&M costs were estimated by the technical engineers and were based on the capacity of the system. Included in O&M costs are personnel costs, chemicals and power cost. At current prices, O&M costs were estimated annually when full operation is achieved by 2023. O&M costs were likewise de-escalated to constant prices for the computation of FIRR.

Table 11-57: Operations and Maintenance Costs – Myawaddy WSS ($ million)

	2017	2018	2019	2020	2025	2030	2035	2040
Fixed Costs	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Variable Costs	0.04	0.04	0.04	0.33	0.49	0.75	0.75	0.75
Total OPEX	0.11	0.12	0.12	0.41	0.57	0.83	0.83	0.83

RESULTS OF EVALUATION

The WACC is calculated as the weighted average cost of equity and debt used to fund the project. The cost of equity is calculated based on benchmarking against the cost of equity of several less-developed countries including Bangladesh, Indonesia, and Viet Nam, and adding a premium of 2.5% to reflect Myanmar's higher country risk.[6] The nominal cost of debt is taken as the ADB loan's fixed interest rate of 1.5% over the longer term. The loan does not have a maturity premium or commitment fee, and the government has indicated that it will not be charging an onlending margin. The inflation rate used to adjust the nominal values to real values is based on the long-term price escalation factors used by ADB. Given the estimated costs of equity and debt, and the relative proportions of equity and debt in the project capital structure, the WACC is calculated to be 0.2%.

[6] ADB, MYA-46390: Power Distribution Imrpovement Project, Report and Recommendation of the President. October 2015.

Table 11-58: Computation of Weighted Average Cost of Capital (WACC)

	Financing component		Total
	ADB - AIF	Govt	
1. Amount ($ million)	12.60	0.74	13.34
2. Weighing	94.4%	5.6%	100.0%
3. Nominal cost	1.5%	13.0%	
4. Tax Rate	5.0%	0.0%	
5. Tax-adjusted nominal cost	1.4%	13.0%	
6. Inflation rate	1.5%	5.0%	
7. Real cost	-0.1%	7.6%	
8. Weighted component of WACC	0.0%	0.4%	0.4%
Weighted Average Cost of Capital (Real)			**0.4%**

The FIRR of the project is a summary measure of the return on investments from the viewpoint of the project itself. It indicates the maximum interest rate the project could pay on the invested capital and still break-even financially. The FIRR is measured as the discount rate that equalizes the present value cost stream associated with the project to the present value of the project's benefit stream.

The subproject is analysed and FIRR is calculated. Further, sensitivity analysis was conducted under three (4) worse case scenarios such as, one year delay in operation, a 10% increase in project cost, a 10% increase in operation and maintenance and 10% decrease in revenues.

The results of analysis show that in all scenarios, the computed FIRRs are greater than the computed WACC. For the base case scenario, FIRR is 1.4%. Even at worse case conditions, the FIRRs are higher than the WACC which means that the proposed subproject is financially viable. The FIRR and NPV for all scenarios are summarized in Table 60 while details are presented in Table 62.

Table 11-59: Summary Result of Financial Analysis – Myawaddy Water Supply System

	NPV ($ m)	FIRR (%)	SI	% Change	SV
Base case	5.53	2.0%			
1-Year Delay in Operation	5.63	1.9%	0.39	10%	254%
Capital cost plus 10%	3.45	1.4%	3.22	10%	31%
O & M costs plus 10%	4.37	1.7%	1.59	10%	63%
Revenues less 10%	1.73	0.9%	5.26	10%	19%

SI = sensitivity indicator (ratio of percentage change in IRR above the cut-off rate to percentage change in selected variable).
SV = switching value (percentage change in selected variable to reduce the IRR to cut-off rate).

The projected income statement shows that the proposed fees to be collected from the Company can adequately cover the costs of O&M that will be required from the Township to properly operate the water source.

Table 11-60: Projected Income and Expenditures – Myawaddy Water Supply System ($ mil)

	2021	2022	2023	2024	2025	2030	2035	2040
Operating Revenues								
Water Sales	803	822	1,010	1,035	1,271	2,159	3,654	5,321
Total Revenues	**803**	**822**	**1,010**	**1,035**	**1,271**	**2,159**	**3,654**	**5,321**
Operating Expenses								
Fixed Costs	130	136	143	150	158	201	257	328
Variable Costs	428	459	535	574	761	1,481	1,891	2,413
Total	**558**	**595**	**678**	**724**	**918**	**1,682**	**2,147**	**2,741**
Net Income	**245**	**227**	**332**	**311**	**353**	**477**	**1,507**	**2,581**

Affordability of Tariffs

A major consideration in the development of the water tariff schedule is the ability of target beneficiaries, specifically from the low-income group (LIG), to pay for their monthly bill. Indicative affordability benchmark for water rates ranging from 3 to 5% has been adopted by many governments and international funding institutions.

The estimated monthly income for LIG in 2015 was MK89,444 based on the results of socio-economic survey undertaken as part of this study. Using the affordability criterion, the average monthly bill based on existing rate of MK400 per m3 and 10 m3 average monthly consumption of the LIG would be MK4,000. This is 3.7% of the estimated monthly income of households which is expected to increase to about MK186,101 by 2021. It is assumed that the current water tariff will be retained even with the new water source since the expected cost will just replace the Company's current expenditure of producing water. Compared to the other townships, this rate is already on the high side so attention should be taken when proposing any increase in fees to the households. Any increase in tariff to the end beneficiaries should be limited to about 5%. In this case, the proposed increase in tariff is evaluated as still affordable and reasonable to the target beneficiaries.

Table 11-61: Financial Evaluation – Myawaddy WSS ($ million)

Year	Base Hypothesis				Sensitivity Analyses															
	Incremental		Project Cost	Net	1 Year Delay in Operation		Project Cost	Net	Incremental		Project Cost (+10%)	Net	Incremental		Project Cost	Net	Incremental		Project Cost	Net
	Revenues	O&M			Revenues	O&M			Revenues	O&M			Revenues	O&M (+10%)			Revenues (-10%)	O&M		
2017	-	-	0.688	(0.688)			0.688	(0.688)			0.757	(0.757)			0.688	(0.688)			0.688	(0.688)
2018	-	-	7.089	(7.089)	-	-	7.089	(7.089)	-	-	7.798	(7.798)	-	-	7.089	(7.089)	-	-	7.089	(7.089)
2019	-	-	6.282	(6.282)	-	-	6.282	(6.282)	-	-	6.910	(6.910)	-	-	6.282	(6.282)	-	-	6.282	(6.282)
2020	-	0.336	3.028	(3.364)	-	-	3.028	(3.028)	-	0.336	3.331	(3.666)	-	0.369	3.028	(3.397)	-	0.336	3.028	(3.364)
2021	0.621	0.341	3.028	(2.748)	-	0.336	3.028	(3.364)	0.621	0.341	3.331	(3.051)	0.621	0.375	3.028	(2.782)	0.559	0.341	3.028	(2.810)
2022	0.636	0.347	0.720	(0.431)	0.621	0.341	0.720	(0.440)	0.636	0.347	0.792	(0.503)	0.636	0.382	0.720	(0.466)	0.572	0.347	0.720	(0.495)
2023	0.781	0.376	0.229	0.176	0.636	0.347	0.229	0.059	0.781	0.376	0.252	0.153	0.781	0.414	0.229	0.138	0.703	0.376	0.229	0.098
2024	0.800	0.382		0.418	0.781	0.376	-	0.405	0.800	0.382	-	0.418	0.800	0.421	-	0.380	0.720	0.382	-	0.338
2025	0.983	0.462		0.521	0.800	0.382	-	0.418	0.983	0.462	-	0.521	0.983	0.508	-	0.475	0.885	0.462	-	0.423
2026	1.034	0.501		0.534	0.983	0.462	-	0.521	1.034	0.501	-	0.534	1.034	0.551	-	0.484	0.931	0.501	-	0.430
2027	1.306	0.523		0.783	1.034	0.501	-	0.534	1.306	0.523		0.783	1.306	0.575		0.730	1.175	0.523		0.652
2028	1.373	0.554		0.819	1.306	0.523	-	0.783	1.373	0.554		0.819	1.373	0.610		0.764	1.236	0.554		0.682
2029	1.589	0.628		0.961	1.373	0.554	-	0.819	1.589	0.628		0.961	1.589	0.691		0.898	1.430	0.628		0.802
2030	1.670	0.663		1.007	1.589	0.628	-	0.961	1.670	0.663		1.007	1.670	0.730		0.941	1.503	0.663		0.840
2031	1.930	0.663		1.267	1.670	0.663	-	1.007	1.930	0.663		1.267	1.930	0.730		1.200	1.737	0.663		1.074
2032	2.026	0.663		1.363	1.930	0.663	-	1.267	2.026	0.663		1.363	2.026	0.730		1.296	1.823	0.663		1.160
2033	2.338	0.663	-	1.675	2.026	0.663	-	1.363	2.338	0.663	-	1.675	2.338	0.730	-	1.608	2.104	0.663	-	1.441
2034	2.452	0.663		1.788	2.338	0.663	-	1.675	2.452	0.663		1.788	2.452	0.730		1.722	2.206	0.663		1.543
2035	2.826	0.663		2.163	2.452	0.663	-	1.788	2.826	0.663		2.163	2.826	0.730		2.096	2.543	0.663		1.880
2036	2.960	0.663		2.297	2.826	0.663	-	2.163	2.960	0.663		2.297	2.960	0.730		2.231	2.664	0.663		2.001
2037	3.099	0.663		2.436	2.960	0.663	-	2.297	3.099	0.663		2.436	3.099	0.730		2.369	2.789	0.663		2.126
2038	3.243	0.663		2.580	3.099	0.663	-	2.436	3.243	0.663		2.580	3.243	0.730		2.513	2.919	0.663		2.255
2039	3.321	0.663		2.658	3.243	0.663	-	2.580	3.321	0.663		2.658	3.321	0.730		2.592	2.989	0.663		2.326
2040	3.401	0.663		2.738	3.321	0.663	-	2.658	3.401	0.663		2.738	3.401	0.730		2.672	3.061	0.663		2.398
2041	0.317	0.663		(0.347)	3.401	0.663	-	2.738	0.317	0.663		(0.347)	0.317	0.730		(0.413)	0.285	0.663		(0.378)
	FIRR			**1.51%**	**FIRR**			**1.49%**	**FIRR**			**0.85%**	**FIRR**			**1.16%**	**FIRR**			**0.42%**
	NPV			**3.58**	**NPV**			**3.78**	**NPV**			**1.50**	**NPV**			**2.41**	**NPV**			**(0.02)**

11.4 Consolidated data for project sites

The following table summarises the data used to assess the financial viability of the project in the three towns.

Table 11-62: Consolidated data for project sites

	HPA AN	MYAWADDY	MAWLAMYINE
BASIC DATA			
Population (2014)	77,020	116,550	258,809
Annual Growth Rate	2.50%	3%	2.0%
Number of Households	15,404	23,310	51,762
Number of Business Establishments	2,659	2,040	2,418
SOLID WASTE			
Per capita waste generation (kg/c/day)			
2015	55	55	55
2040	90	90	90
Total Waste Generation (tons/day)			
2015	42,361	64,102	145,192
2040	128,511	219,626	389,786
Garbage collection coverage			
2015	25.6%	55.2%	46.8%
2040	98.0%	98.0%	98.0%
Investment Costs ($ million)			
Civil works	7.36	6.41	12.47
Equipment	1.29	1.33	1.87
Vehicles	0.30	0.23	0.62
Survey, Design and Supervision	0.04	0.04	0.04
Land Acquisition and Resettlement	0.03	0.04	0.23
Subtotal	9.03	8.05	15.22
Physical Contingency	0.90	0.80	1.53
Price Contingency	0.62	0.61	1.02
Subtotal	1.52	1.42	2.55
IDC	0.44	0.52	0.73
TOTAL	10.99	9.99	18.50
Financier			
ADB	10.36	-	17.28
NEDA	-	9.45	-
Mon State	-	-	0.27
Kayin State	0.04	0.05	-
Central Government	0.54	0.48	0.91
TOTAL	10.99	9.99	18.50
OPEX ($ million/ year)			

	HPA AN	MYAWADDY	MAWLAMYINE
Collection	0.05	0.06	0.18
Composting	0.11	0.13	0.17
Sanitary Landfill	0.33	0.14	0.44
TOTAL	0.49	0.32	0.78
Garbage fees			
Households (MK/HH/week)	500	300	350
Business establishments (MK/BE/week)	2,500	1,000	2,000
Increase in fees (every 5 years)	10%	5%	5%
Weighted Average Cost of Capital (WACC)	0.43%	0.41%	0.50%
Financial Internal Rate of Return (FIRR)			
Base Case	2.3%	3.2%	3.1%
Case 1 - Increase in Capital Costs	1.5%	2.4%	2.2%
Case 2 - Increase in O&M Costs	1.8%	2.7%	2.7%
Case 3 - Decrease in Revenues	0.9%	1.7%	1.7%
Case 4 - Project Delay	1.2%	2.1%	2.1%
WATER SUPPLY			
Investment Costs ($ million)			
Civil works	14.08	8.08	19.68
Equipment	1.51	2.01	1.63
Land Acquisition and Resettlement	0.01	0.03	0.03
Recurrent Cost	0.98	0.75	1.06
Subtotal			
Physical Contingency	1.66	1.09	2.24
Price Contingency	0.98	0.61	1.45
Subtotal	2.63	1.70	3.7
IDC	0.85	0.82	1.08
TOTAL	20.05	13.40	27.17
Financier ($ million)			
ADB	18.99		25.75
Grant		12.60	
Mon State			0.03
Kayin State			
Central Government	1.01	0.77	1.35
TOTAL	20.05	13.40	27.17
OPEX ($ million)			
2020			
Fixed Cost	0.10	0.08	0.10
Variable Cost	0.30	0.49	0.27
2030			

	HPA AN	MYAWADDY	MAWLAMYINE
Fixed Cost	0.10	0.08	0.10
Variable Cost	0.68	0.75	0.95
Water Tariff (2015)			
Existing (MK/m3)	250	-	150
Proposed (MK/m3)	300	300	177
Increase in rates	20% every 2 years from 2020-24; 15% in 2026-38	20% in 2023-2027, 10% in 2029-35	18% every two years
Tariff Affordability			
Average household income (LIG)	79,567	89,444	79.933
Minimum	2.6%	3.6%	1.7%
Maximum	4.7%	5.0%	5.0%
Willingness to pay (MK/m3)			
Water Supply Service Coverage			
2015	14%		42%
2020	42%	70%	52%
2040	80%	96%	95%
Domestic (2020)			
No. of Connections	7,337	13,728	18,482
Water Consumption (lpcd)	100		100
Ave. Consumption (m3/conn/month)	15.0		15.0
Average Water Demand, (m^3/day)	3,669		9,241
Revenue Water (m^3 '000)	1,339		3,373
Average Water Fee ($/connection/month)	3.52		2.02
Revenue from Connection Fees	0.04		0.04
Total Water Revenues ($ million)	0.35		0.49
Commercial (2017)			
No. of Connections	1,162		1,412
Water Consumption (ltrs/connection/day)	316		655
Ave. Consumption (m3/conn/month)	9.5		19.6
Average Water Demand, (m^3/day)	367		924
Revenue Water (m^3 '000)	134	2,713	337
Average Water Fee ($/connection/month)	4.44	0.23	5.43
Revenue from Connection Fees	0.01		0.002
Water Revenues in $ million	0.07	0.63	0.09

	HPA AN	MYAWADDY	MAWLAMYINE
Weighted Average Cost of Capital (WACC)	0.3%	0.4%	0.4%
Financial Internal Rate of Return (FIRR)			
Base Case	2.6%	1.5%	1.7%
Case 1 – Project Delay by 1 year	1.8%	1.5%	0.9%
Case 2 - Increase in Capital Costs (+10%)	2.0%	0.9%	1.1%
Case 3 – Increase in O&M Costs (+10%)	2.2%	1.2%	1.4%
Case 4 – Decrease in Revenues (-10%)	1.5%	0.4%	0.7%