ADB

Initial Environmental Examination

Project Number: 47152
December 2015

Myanmar: Irrigated Agriculture Inclusive Development Project

Asian Development Bank

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CURRENCY EQUIVALENTS

(as of 1 September 2015)

Currency unit	–	Myanmar Kyats
Kyats 1.00	=	US $0.0007855
US $1.00	=	MMK 1,273

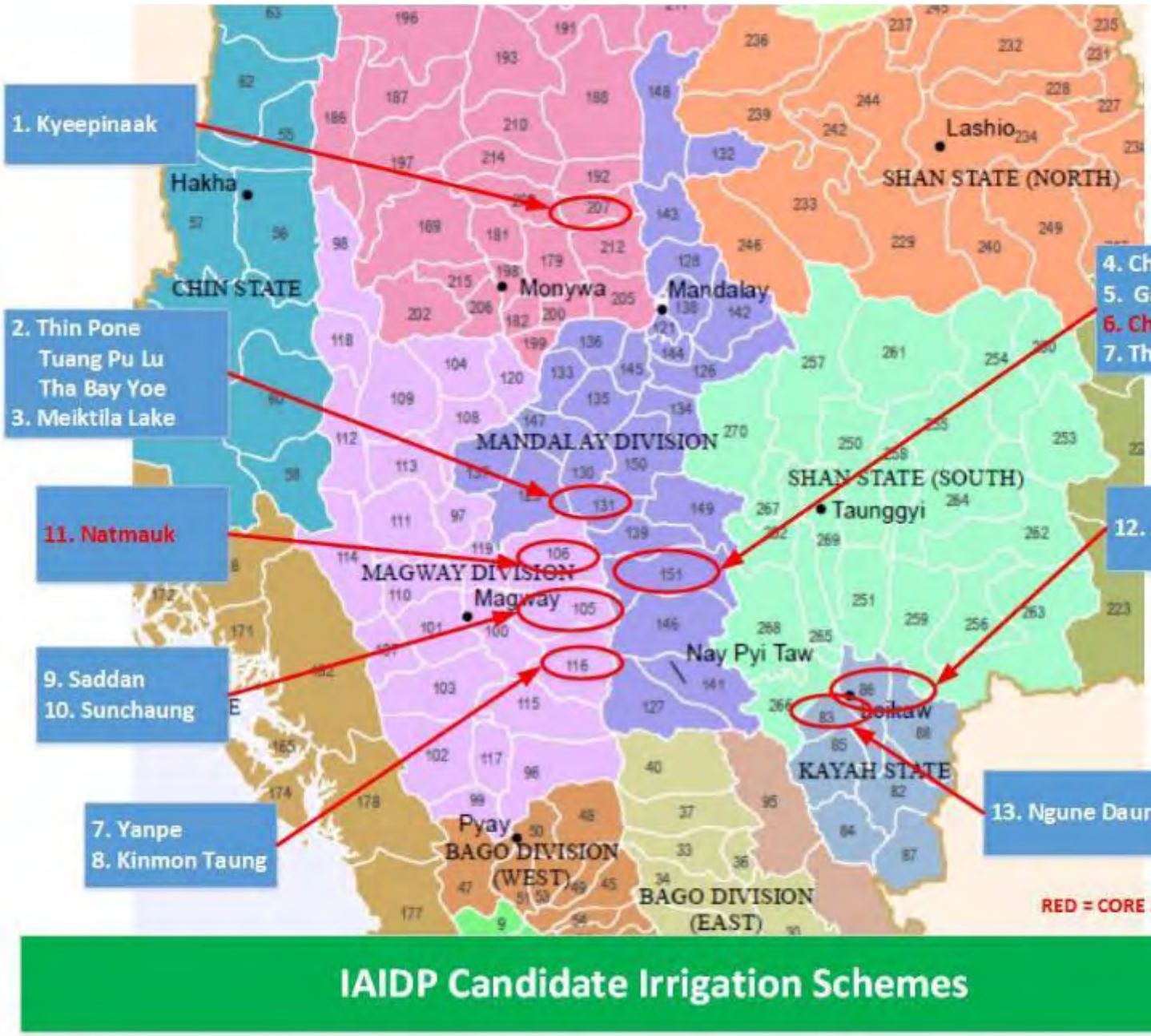
ABBREVIATIONS

ADB	–	Asian Development Bank
ADRA	–	Adventist Development and Relief Agency
CDZ	–	Central Dry Zone
DAP	–	Department of Agricultural Planning, MOAI
DAR	–	Department of Agricultural Research, MOAI
DOA	–	Department of Agriculture, MOAI
EA	–	Executing Agency
EARF	–	Environmental Assessment and Review Framework
ECD	–	Environmental Conservation Department, under MOECAF
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
GOM	–	Government of Myanmar
GRC	–	Grievance Redress Committee
GRM	–	Grievance Redress Mechanism
IEE	–	Initial Environmental Examination
IA	–	Implementing Agency
ID	–	Irrigation Department, MOAI
IAIDP	–	Irrigated Agriculture Inclusive Development Project
IPSA	–	Initial Poverty and Social Analysis
LIEC	–	Loan Implementation Environmental Consultant
LIFT	–	Livelihoods and Food Security Trust Fund
LISC	–	Loan Implementation Social Consultant
MOECAF	–	Ministry of Environmental Conservation and Forestry
MOAI	–	Ministry of Agriculture and Irrigation
NECC	–	National Environmental Conservation Coordination Committee
NGO	–	Non-Government Organization
O&M	–	Operation and maintenance
PAM	–	Project Administration Manual
PAP	–	Project affected person
PPMS	–	Project Performance Monitoring System
PPTA	–	Project preparation Technical Assistance
REA	–	Rapid Environmental Assessment Checklist
REGF	–	Resettlement and Ethnic Group Framework
RRP	–	Report and Recommendation to the President (of ADB)
SPS	–	Safeguard Policy Statement 2009 of ADB
WRUD	–	Water Resources Utilization Department
WUG	–	Water User Group
VAO	–	Village Administration Office

WEIGHT AND MEASURES

cm	–	centimeter
cm/sec	–	centimeter per second
dbA	–	decibels
ha	–	hectare
km	–	kilometer
m	–	meter
mm	–	millimeter

Irrigated Agriculture Inclusive Development Project – Location Map


1. Kyeepinaak
2. Thin Pone
Tuang Pu Lu
Tha Bay Yoe
3. Meiktila Lake
11. Natmauk
9. Saddan
10. Sunchaung
7. Yanpe
8. Kinmon Taung
4. Ch
5. G
6. Ch
7. Th
12.
13. Ngune Daun
Hakha
CHIN STATE
Monywa
Mandalay
Lashio
SHAN STATE (NORTH)
MANDALAY DIVISION
SHAN STATE (SOUTH)
Taunggyi
MAGWAY DIVISION
Magway
Nay Pyi Taw
Loikaw
KAYAH STATE
Pyay
BAGO DIVISION (WEST)
BAGO DIVISION (EAST)
RED = CORE
IAIDP Candidate Irrigation Schemes

MAP OF CENTRAL DRY ZONE MYANMAR


Location of IAIDP Core Subprojects
Kachin
Sagaing
Shwebo District
Monywa District
Sagaing District
Chin
Kyaukse District
Pakokku District
Myingyan District
Mandalay
Nyaung-U District
Meiktila District
Shan
Minbu District
Magway District
Yamethin District
Rakhine
Magway
Natmauk
Chaungmagyi
Thayet District
Kayah
Kayin
Bago
MIMU
Township Boundary
District Boundary
State/Division Boundary
Dry Zone Townships
0 15 30 60 km
1:2,000,000
Disclaimer: The names shown and designations used on this map do not imply official endorsement or acceptance by the United Nations.

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EXECUTIVE SUMMARY

A. Introduction and Purpose

1. This Initial Environmental Examination (IEE) has been prepared for the proposed Irrigated Agriculture Intensive Development Project Myanmar (IAIDP). The Central Dry Zone (CDZ) is one of the most food insecure, water-stressed, climate sensitive and natural resource poor regions in Myanmar. It has the second highest population density in Myanmar but remains one of the least developed. Access and availability of water resources are key determinants of rural poverty with livelihoods largely dependent on the southwest monsoon. Seasonal water shortages caused by low and erratic annual rainfall patterns and sandy and fragile soils render rainfed agriculture a high risk endeavor. Under such uncertain climatic conditions, the provision of functional canal irrigation systems is critical to safeguarding crops and sustaining the livelihoods of farmers and farm workers. Many of these irrigation schemes in the CDZ were built before the 1980s and have operated for 30 years. These schemes need to be rehabilitated, redesigned and upgraded to meet changing demands and uses.

2. In the context of the Government's Framework for Economic and Social Reforms (FESR), the National Comprehensive Development Plan 2011-2031 (NCDP) and the reform processes, the Ministry of Agriculture and Irrigation is implementing a Five Year Short Term Plan to develop the sector with the following targets:

- To extend net cultivated area up to 13.6 million hectares and cropping intensity 168 percent.
- To attain 4.28mt/ha of average yield of paddy and 33 million mt of paddy production.
- To extend the total irrigated area to 2.3 million hectare.
- To extend the activities for the accuracy of agricultural statistics.
- To encourage the production of qualified and standardized agricultural value-added products to be more competitive in international market.
- To create profitable and sustainable market for farmers.

3. The proposed IAIDP is consistent with the national level policies for economic development and reform. The Ministry of Agriculture and Irrigation (MOAI) translated the FESR and NCDP into a five year sector plan with clearly defined and quantified national targets. The rationale for the proposed IAIDP sector-like project is to apply the national sector plan in the particular conditions of the food insecure and resource poor CDZ, so that farmers in the CDZ can participate and contribute to improved sector performance in terms of increased efficiency and effectiveness of resource use to develop the national economy and, in particular, increase the food security and livelihood sustainability of the poor farmers and their communities.

4. Despite the fact that the main infrastructure of irrigation works was completed many years ago, distribution canals and water courses to farmers' field are still under construction or deteriorated. Renovation of the distribution canals of completed dams and reservoirs has also been delayed due to limitations of the maintenance budget. Extension and education activities in connection with efficient utilization of irrigation water to water users are also inefficient due to weakness of on-farm research and demonstration. There is great potential for expansion of irrigated areas (within existing perimeters) by improving efficiency in irrigation.

5. Table ES 1 presents a summary of the potential IAIDP infrastructure components evaluated by the PPTA team. Chaungmagyi in the Mandalay Division and Natmauk in the Magway Division were ultimately agreed as the IAIDP "core subprojects" for initial feasibility assessment, and they are the focus of this IEE. The remaining components will be placed in a

project pipeline for future implementation, reviewed under the framework of the IAIDP Environmental Assessment and Review Framework (EARF), and other IEEs may be required for future subprojects. See Table ES 1**,** with core subprojects highlighted.

Table ES 1 Component Projects Evaluated with Core Subprojects

Region / State	System	Storage volume (acre-ft.)	Net command area (acre)	Storage per unit command area (feet)	Average Water Use (acre-ft.)		Cropping Intensity (%)	
					avg	dry year	avg	dry year
Kayah	Mobye	580,000	17,917	32.37			85	
Kayah	Ngwe Daung		6,291		28,568	17,847	119	
Magway	Natmauk	88,400 (1)	25,380	3.48	140,255	102,664	119	101
Magway	Sun Chaung	24,576	7,125	3.45	25,212	14,906	130	121
Magway	Saddan	18,000	10,500	1.71	28,956	16,414	115	110
Magway	Yanpe	35,140	10,845	3.24	24,437	1,625	108	103
Magway	Kinpuntaung	10,520	5,190	2.03	13,882	6,651	111	99
Mandalay	Thin Pone	13,059	8,728	1.50			96	79
Mandalay	Meiktila	17,209	26,297	0.65	17,549	10,506	10	7
Mandalay	Chaung Gauk	3,250	6,614	0.49	12,909	8,635	64	51
Mandalay	Chaungmagyi	33,200 (1)	7,255	4.58	30,534	21,909	129	97
Mandalay	Thitsone	39,965	12,345	3.24	27,134	13,569	73	30
Sagaing	Kyeepinakk	38,700	5,458	7.09	36,075	22,739	118	64

(1) Numbers being refined during feasibility work and may differ slightly in other reports.

6. The IAIDP is also linked with the Global Environment Fund (GEF) project “Mitigation Focused Rural Productivity and Ecosystems Services Enhanced in Central Dry Zone Forest Reserves.” The GEF project is being implemented by Ministry of Environmental Conservation and Forestry (MOECAF) in the Mae-nyo-taung Forest Reserve. The overall project consists of four "cascading" series of interventions. Lessons learned on water saving and reducing sedimentation from the pilot work of the GEF project will be incorporated into the detailed design of the core subprojects and subsequent subprojects under IAIDP.

7. The overall investment cost is presented below.

Myanmar
Irrigated Agriculture Inclusive Development

Components by Financiers (US$ '000)	The Government		Asian Development Bank		Total		For. Exch.	Local (Excl. Taxes)	Duties & Taxes
	Amount	%	Amount	%	Amount	%			
1. Irrigation Development	2,248.7	4.8	44,692.0	95.2	46,940.7	59.9	15,769.7	28,922.3	2,248.7
2. Agriculture Development	764.6	3.1	23,787.2	96.9	24,551.9	31.4	7,395.3	16,391.9	764.6
3. Project Management	288.0	6.8	3,961.3	93.2	4,249.3	5.4	2,316.3	1,644.9	288.0
Total PROJECT COSTS	3,301.3	4.4	72,440.5	95.6	75,741.8	96.7	25,481.4	46,959.1	3,301.3
Interest During Implementation	-	-	2,296.1	100.0	2,296.1	2.9	-	-	-
Commitment Charges	-	-	263.4	100.0	263.4	0.3	-	-	-
Total Disbursement	3,301.3	4.2	75,000.0	95.8	78,301.3	100.0	25,481.4	46,959.1	3,301.3

B. Project Impact, Outcome and Impacts

8. The project impact will be improved household incomes in the project area. The indicator proposed at this stage in preparation is an increase in household income as a consequence of increased agricultural productivity. The outcome will be *"Improved agricultural production in the project areas"* which will contribute to national economic development and also be a contributor to the impact of improved household incomes. The increase in the value of production has been added as a necessary indicator linking physical agricultural improvements to the improved financial condition of the beneficiary households. Value based indicators will be developed in the context of the design of the agricultural development component. Quantifiable physical indicators include cropping intensity, yields and labour productivity. These will include indicators specific to both core subprojects and more generally for the pipeline.

9. To support the outcomes the project will include two main inter-related outputs: (i) irrigation development including both irrigation infrastructure rehabilitation and development and improved irrigation management and service delivery (Output 1 – Irrigation Development); and (ii) agricultural support for increasing productivity which focuses on value chain development (Output 2 – Agricultural Development).

10. **Output 1, Irrigation Infrastructure.** Output 1 involves the provision and management of improved irrigation infrastructure and is the focus of this subproject IEE. It involves the following performance indicators:

a) Irrigation management improved and intensity of irrigation on 50,000 acres increased by 10% in project systems through improvement and construction of: repair of canals, improved cross drainage, provision of control structures, and better operating procedures by 2023,
b) Management improved through: new system operation manuals; technology pilots; training of 120 ID staff, 900 leader farmers, including 30% women, in tertiary and field level water management and organised into gender-sensitive water user groups by 2023.

11. **Output 2, Agricultural Development.** Output 2 involves associated agricultural sector improvements for which the main environmental aspects are for training activities in areas such as proper use of pesticides and fertilizers and agricultural waste management. It involves the following performance outputs:

a) Diversified and higher value crops planted on 20% of all project-improved irrigation systems by 2025;
b) Value chains and market connectivity demonstrably improved in all subprojects by 2025,
c) Farmer capacity for land management and climate-smart agriculture enhanced with10% of households benefiting being women-headed households.

12. Output 1 <u>infrastructure improvements and management improvements</u> are the focus of this IEE. The two core subprojects involve the following general types of features:

- Sediment control at weirs;
- Repair of flood damage to main canal and provision of adequate cross-drainage;
- Canal re-sectioning and stabilizing (to reduce problems of bank instability);
- Water level control in canals at low flows, for which new gated regulators will be needed;
- Provision of gates to head regulators and outlets, to enable closure at times of low demand or during rotations;
- Scour protection at structures to ensure that they are stable.

- Flow measurement so performance can be monitored and used as a basis for management, combined with the ability to control flows at these points;
- Upgrading canal inspection roads;

C. Description of Environment at Project Sites

13. The CDZ is part of the central plain of Myanmar, sandwiched by the mountainous zone on the west, and the highlands on the east. It spreads across three divisions (formerly regions): Ii) Sagaing (Sagaing, Shwebo and Monywa districts), (ii) Mandalay (Kyaukse, Myingyan, Meikhtila, Yamethin and Nyang-U districts) and (iii). Magway (Pakokku, Magway, Minbu and Thayet districts). The CDZ is mostly flat, with the Ayeyarwady flowing through it from north to south, but topographically inaccessible to IAIDP project areas. A range of hills (Bago Hills) runs parallel to the river in the southern part of the CDZ, gaining altitude towards the north and ending in southeast Mandalay. Fertile alluvial soil is found mostly along the banks of the Ayeyarwady, with Sagaing Division having the largest area under alluvial soil, and Magwe Division the lowest, but these areas are not in IAIDP subprojects. The climate is low rainfall and very hot as it lies in the semi-arid zone

14. The Chaungmagyi system is in Pyawbwe Township, in Yamethin District, Mandalay Region in the CDZ (with a very small part of the system in Thazi Township). It lies between N20^{o}, 20' and N20^{o}, 41' and E 95^{o} 34' and 96^{o} 20'. The total area of the township is 637.82 square miles. It borders with Kalaw township of Shan State and Thazi Township of Mandalay region in the East, Yamethin Township of Mandalay Region in the South, Natmauk township of Magway Region in the West and Meiktila Township of Mandalay Region in the North.

15. The Natmauk System is located in Myothit and Natmauk Townships, in Magway District, Magway Region in the CDZ. It lies between N 20^{o,} 22' and E 94^{o}, 96 '. The total area of the township is 612.68 square miles and is 33 miles from East to West and 18 miles from North to South. It borders with Yamethin township of Mandalay region in the East, Taungwin Gyi township of Magway Region in the South, Magway township of Magway Region in the West and Natmauk Township and Yenangyang Township of Magway Region in the North respectively

D. Alternatives

16. **No Action.** The No-Action Alternative would result in continued poor performance in the core subproject area irrigation perimeters with insufficient crop production. The irrigation systems will continue to deteriorate and would remain more vulnerable to potential negative climate change impacts. The No-Action Alternative is not a reasonable option if the future food security and resilience of these existing irrigation systems is to be assured.

17. **Selection of Core Subprojects.** The subprojects were ranked by economic viability as noted earlier, during prefeasibility studies. As the most viable subprojects, and ones which can provide models for other projects in the CDZ, the PPTA team proposed feasibility studies of Natmauk in Magway and Chaungmagyi in Mandalay with the intent of demonstrating a development model for water-constrained systems.

18. **Technology Alternatives.** The IAIDP involves rehabilitation of existing irrigation infrastructure and adjacent canal roads and bridges. The technologies involved are fairly simple with few available options. The rehabilitation will put the existing irrigation systems back into full operational condition with some structural improvements, to be optimized during detailed design. Standard details are available for each type of intervention.

19. The feasibility studies assessed other technology alternatives such as large-scale drip irrigation and alternative canal control methods using SCADA or downstream control. These were not found to be viable for the IAIDP. Other alternatives assessed included construction materials and arrangements for sediment management. Options for improved irrigation management were assessed and a recommended system was proposed.

E. Environmental Due Diligence

20. **Categorization, due diligence**. The Project was classified as Category B for environment by the Asian Development Bank (ADB). For the two core subprojects, an initial environmental examination (IEE), including an environmental management plan (EMP), was prepared by the PPTA consultant on behalf of the MOAI, the Executing Agency (EA) for the project. The EMP is presented in **Annex 1** of this IEE.

21. All safeguard-related activities in IAIDP will be guided by the Safeguard Policy Statement (SPS) and GOM requirements. The core subprojects selected based on prefeasibility study have had a Category B IEE prepared. Future pipeline projects will utilize the IAIDP Environmental Assessment and Review Framework (EARF) and the standard procedures and EMP of the core subproject IEE. Additional IEEs may be required for these pipeline projects.

22. In Myanmar, the draft 2014 Environmental Impact Assessment Procedure and Myanmar environment quality standards have also been developing with technical support from ADB and others and the EIA Procedure will likely to be completed by the end of 2015. A summary of the draft rule is included as **Annex 5,** while full rule is in EARF. These new EIA procedures and environmental quality standards have yet to be adopted by Ministry of Environmental Conservation and Forestry (MOECAF). The Environmental Conservation Department (ECD) under MOECAF currently lack the budget and staff to fully implement the proposed EIA procedure. Given the lack of environmental standards yet promulgated by ECD, this IEE utilizes good international industry practice (GIIP) such as the IFC Environmental Performance Standards and the World Bank Group Environmental Health and Safety Guidelines for assessment of impacts and potential mitigation measures. There is not current Myanmar review and approval procedure in place for such environmental assessments, only informal procedures. If the procedures are in place by the time of future IAIDP IEEs, the Myanmar procedures will be followed along with ADB procedures.

F. Anticipated Impacts, Mitigation Measures

23. **Environmental Impacts Related to the Project**. The potential impacts (positive and negative) and risks were screened during the IEE process in order to (i) identify the relative significance of potential impacts from the activities of the proposed infrastructure; (ii) establish the scope of the assessment which assists in focusing on major, critical, and specific impacts; and (iii) enable flexibility in regard to consideration of new issues, such as those reflecting the requirements of both the Myanmar's environmental laws, regulations and standards, and ADB's Safeguard Policy Statement (2009).

24. The major anticipated impacts caused by the infrastructure subcomponents for IAIDP during construction phase include: wastewater discharge, soil erosion; spoil and solid waste disposal; interference with traffic and municipal services, and occupational and community health and safety. These impacts can extend to project borrow pits and material disposal sites.

25. Some land will be acquired for temporary use during construction. Involuntary resettlement impacts will be avoided. Land agreements will be completed using negotiated settlement or voluntary donation. Land acquisition will be undertaken according to the Resettlement and Ethnic Groups Framework

26. The major potential impacts of the infrastructure component for IAIDP during operation phase may include soil erosion, waterlogging and potential salinization due to insufficient drainage systems, potential water quality, soil quality and health impacts of overuse of fertilizers and pesticides, canal sedimentation, and safety issues. The IAIDP project design has incorporated both design and agriculture support features which will minimize these potential operational impacts.

G. Project Benefits

27. **Direct project beneficiaries.** The implementation of the Project and the development of IAIDP is expected to generate direct irrigation benefits to the core subproject areas due to an increase in irrigated and harvested area attributable solely to the irrigation infrastructure development. In conjunction with the Agriculture Development Component, the Project is expected to increase agricultural production substantially.

28. Primary beneficiaries will be the farming and landless communities (individual farmers, farmer groups, cooperatives and later water user groups (WUGs)) in the irrigation systems in the CDZ, plus the private sector agribusinesses which are part of the value chains (especially those involved in input supply, post-harvest operations and marketing). It is important to note that the poor, landless and women will be targeted by enabling more equitable access to water and ensuring that they are represented in new water management arrangements (see Para 50). Staff of the Irrigation Department (ID) of MOAI will also benefit.

29. Secondary beneficiaries are the GOM staff involved in extension, Department of Agriculture (DOA), Agricultural Mechanization Department (AMD) and Department of Agricultural Research (DAR), especially those working in the irrigation systems. Tertiary beneficiaries will be the other players in the various value chains through an improved MIS and greater awareness of the issues as regards to the development of irrigated agriculture.

30. **Positive Impacts.** With proper design and commitment, the proposed project can have positive impacts on food security, household income, health conditions, and rural employment. It should have multiplier effects on local economic development and water governance.

31. **Economic Benefits**. The IAIDP subprojects will be implemented soundly and in line with good international industry technical practices, so benefits should be felt widely. These benefits may be moderate magnitude but of high significance because they will be felt most by poor farmers.Positive economic impacts for the farming households will flow from increased agricultural productivity and some new employment opportunities, and there will be potential for other long-term economic benefits. These would include improved agricultural production on a larger scale and the potential for creating new economic activities through other allied development measures.

32. **Social and Environmental benefits.** The project will rehabilitate dilapidated irrigation infrastructure and provide direct and indirect environmental benefits. Dangerous and non-functional infrastructure will be repaired or replaced. This will include adjacent roads and bridges which will provide safer access to nearby homes and villages. The direct benefits will

include improved irrigation water management and significant training to improve the use of fertilizers and pesticides in the project area. Monitoring of potential waterlogging and other drainage issues will improve the areas downstream of the irrigation perimeters, although there are few existing problems with waterlogging or salinization. The improved cross drainage systems will eliminate localized flood risks and canal failures, as well as convey stormwater safely from nearby residents.

33. **Poverty benefits.** The Project, by its nature of improving environment and public services, is classified as general intervention regarding poverty reduction impact. The Project will not create disparities and inequalities between the poor and non-poor for their access to the project outputs and the access to the resultant social and economic benefits. Poverty incidence in rural areas is significantly higher than in urban areas, with 85% of the poor living in rural areas. Most poor households are engaged in agricultural activities and/or have members employed as casual laborers.

34. **Gender benefits.** There will be employment in construction of irrigation infrastructure and farm roads. The target will be at least 30% women laborer to be recruited for construction work in irrigation and frontline centers with receiving training on construction. Both male and female will receive equal wages for work of equal value[1] and will have access to water and sanitation facilities for women in all construction sites and all laborers receive occupational safety measures and training. Poor and disadvantaged women and men will be prioritized to get employment in this work. Women will comprise at least 40% of total participants in consultations related decision-making on irrigation system planning, design and implementation. Separate women farmers' meetings will be held to assess their prioritized needs related to location, alignment and access to irrigation infrastructure. Other detailed targets for women and men's participation are included in the PPTA documents, such as the Gender Action Plan. .

H. Environmental Management Plan (EMP)

35. The environmental management plan (EMP) for the project defines mitigation and monitoring measures and describes the institutions, responsibilities and mechanisms to monitor and ensure compliance. Such institutions and mechanisms will seek to ensure continuous improvement of environmental protection activities during preconstruction, construction, and operation of the project in order to prevent, reduce, or mitigate adverse impacts. The EMP will be reviewed and updated if there are any changes during the detailed design. The final IEE and EMP will be disclosed on ADB's website following any required updates.

36. **EMP implementation responsibilities.** The EMP specifies the roles and responsibilities of key project stakeholders in overall environmental management:

a. **Executing Agency (EA)**. MOAI will be the executing agency (EA) for the project and will oversee overall project implementation and management activities to ensure smooth and timely implementation and completion of project activities. The EA has overall responsibility for the project and therefore is ultimately responsible for ensuring the implementation of the mitigation in the EMP and for ensuring compliance with loan covenants. The EA will guide and coordinate closely with other government agencies and the ADB for the timely resolution of any issue and completion of the project within the target dates, expediting the procurement process, and organizing and chairing the Project Steering Committee (PSC) meetings. The EA will designate a project management unit (PMU) Director to oversee the day-to-day management of the project

[1] This is not applicable to quota based work.

and liaise with all relevant government offices. The EA will also designate a Chairman of PSC that will provide overall supervision to project implementation.

b. **Project Steering Committee (PSC).** The PSC will be established by the EA. The PSC will be chaired by the designated official from the EA and composed of senior government officials. The PSC will meet quarterly to (i) approve annual budgets and plans for the project; (ii) review progress in project implementation; (iii) guide and support project implementation; and (iv) provide coordination between ministries and agencies involved in project implementation. The operational cost of the PSC will be funded by EA. ADB will attend the PSC meetings as observer, as needed.

c. **Project Management Unit (PMU)**. The PMU will be established at MOAI in Naypyitaw. On behalf of the executing and implementing agencies, the PMU will assume day-to-day management of the project and will be responsible for coordinating and implementing project activities, including procurement, recruitment, disbursement, contract administration, monitoring and reporting. The PMU will be headed by a Project Manager and will comprise full-time core staff, including environmental management staff The PMU Director will guide and supervise the work of the PMU. The PMU consultants will be recruited under the guidance of the EA and ADB. The EA will provide a furnished, air conditioned/heated office space with communication and other support facilities as in-kind contribution for project implementation and management.

d. **Implementing Agency (IA)**. The ID and DOA will be the implementing agencies, and be responsible for the project outputs associated with their core missions.

e. **LIEC**. The Project will procure the services of a loan implementation environment consultant (LIEC) to provide support in (i) project implementation including updating the project EMP; (ii) training; (iii) coordinating the conduct of regular environmental compliance monitoring (air and noise) in compliance with the monitoring plan; (iv) annual project EMP progress reporting; and (v) identifying environment-related implementation issues and necessary corrective actions. The Terms of Reference for the LIEC is attached to the EMP. The LIEC will work closely with other staff in the PMU, especially the Monitoring and Evaluation Specialist, the Loan Implementation Social Consultant (LISC) and the Gender and Social Specialist.

I. Consultation, information disclosure, grievance redress mechanism (GRM)

37. **Environmental and social grievance redress mechanism**. Environment and social safeguards related complaints or disputes will be handled in accordance with the grievance redress mechanism (GRM) established for the project. The PMU will coordinate the GRM, with support of the LIEC and the LISC. A Public Complaints Unit (PCU) will be established by the IAs within the PMU. The Gender and Social Specialist will be responsible for the day to day PCU activities: maintaining the grievance register, organizing investigations, acknowledging and communicating results to the affected person, and monitoring for the closing out of the issueThe GRM is defined in the IEE and requirements shown in EMP.

38. **Consultation, information disclosure.** The public consultation indicated that the majority of the potential APs supported the project and project components and believed they would benefit the local economy, raise residents' living quality, improve local environmental conditions, and effectively protect the local environment. The public will be informed about the IAIDP project components during detailed design and prior to construction and be given an

opportunity to comment again on the projects. In compliance with ADB's Safeguard Policy Statement (2009), environmental information related to the Project was and/or will be disclosed as follows: (i) this IEE is disclosed on ADB's project website (www.adb.org), and is available for consultation in the PMU's office; and (ii) and annual reports on project's compliance with the EMP will be available at www.adb.org.

J. Risks and assurances

39. Risks and risk mitigating measures have been identified in the risk assessment and risk management plan. The following are proposed environmental assurances:

a. the Borrower has incorporated the relevant provisions from the EMP into the Works contract;
b. Involuntary resettlement impacts will be avoided. Land agreements will be completed using negotiated settlement or voluntary donation. Land acquisition will be undertaken according to the Resettlement and Ethnic Groups Framework, EMP update and submission to ADB for clearance and disclosure prior to civil works; and
c. GEF demonstration project results integrated into engineering design.

K. Environmental Management and Monitoring Plan

40. The environmental management plan will serve as the framework for the environmental management of IAIDP projects, commencing from detailed design phase through to operation. The EMP is included in **Annex 1.** This will be updated by the PMU based on the detailed design, with technical assistance from the LIEC. It may be necessary to significantly update the IEE based on detailed design decisions. The EMP will be implemented by the detailed design Consultant, PMU, implementing agencies and contractors for civil works.

41. The EMP also features an Environmental Monitoring Plan that prescribes periodic monitoring of air, noise and groundwater by a licensed entity to verify the effectiveness of implemented mitigation measures and the overall environmental performance of IAIDP projects during construction and during operation. This monitoring may be conducted by the LIEC if no licensed entity can be found.

42. The Government, EA and IAs have assured ADB that implementation of the project shall conform to all applicable ADB policies including those concerning anticorruption measures, safeguards, procurement, consulting services, and disbursement as described in detail in the project administration manual and in the draft loan agreement.

L. Conclusions

43. The project IEE concludes that as long as the environmental mitigation and management measures defined in the EMP are properly implemented, all adverse environmental impacts associated with the project will be prevented, eliminated, or minimized to an acceptable level. The project is feasible from an environment safeguards point of view. The public consultation indicated that the majority of the potential APs supported the project and project components and believed they would benefit the local economy, raise residents' living quality, improve local environmental conditions, and effectively protect the local environment.

44. The overall findings of the project IEE are that some negative impacts on air, water, soil and acoustic environment are expected, in both construction and operation phases. Any adverse environmental impacts and risks associated with the project can be prevented, eliminated, or

minimized to an acceptable level, if all the mitigation measures and monitoring requirements defined in the EMP are strictly implemented during detailed design, construction and operation, and the environmental management and institutional capacities of the IAs are strengthened through implementation of the comprehensive training and capacity building program.

I. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK AND STANDARDS

A. National Environment Policy and Legal Framework

1. **Policy Framework.** The GOM National Environment Policy was issued in 5 December 1994[2] to establish sound environment policies, utilization of water, land, forests, mineral, marine resources, and other natural resources in order to conserve the environment and prevent its degradation. The objective of Myanmar's environmental policy is aimed at achieving harmony and balance through the integration of environmental considerations into the development process to enhance the quality of the life of all its citizens.

2. The development of the environmental policy was followed by the drafting of Myanmar Agenda 21, which followed a UN framework for a multi-pronged approach to sustainable development. Myanmar Agenda 21 calls for integrated management of natural resources and provides a blueprint for achieving sustainable development and recognizes the need for environmental impact assessment (EIA).

B. Environmental Provisions in the 2008 Constitution

3. Under the 2008 Constitution, the government "shall protect and conserve the natural environment" (Chapter 1, Section 45). The national legislature can, but does not need to, enact laws to protect the environment and help restore areas degraded or damaged by mining and forestry activities or those that have experienced destruction of plants, wildlife, and habitat (Chapter 4, Section 96). State and Division Legislatures also have the power to regulate environmental protection, but within the boundaries of legislation passed by the National Legislature (Chapter 4, Section 196). In addition, every citizen has the duty to "assist" the government in carrying out environmental conservation (Chapter 8, Section 390).

C. National Law on Environmental Management

4. The Pyidaungsu Hluttaw Law No. 9/2012, also known as the Environmental Conservation Law (ECL), was enacted in 30 March 2012 to facilitate (i) implementation of the country's National Environmental Policy, (ii) systematic integration of environmental conservation in the sustainable development process, (iii) healthy and clean environment and conservation of natural and cultural heritage, (iv) reclamation of degenerated and disappearing ecosystems, (v) management of natural resources for sustainable use, (vi) public awareness, (vii) international, regional and bilateral cooperation, and (viii) collaboration within different government departments and organizations, and with non-government organizations, and other stakeholders.

5. The National Environmental Conservation Coordination Committee (NECCC) was formed for effective coordination among stakeholders with the senior officials from various agencies while Environmental Conservation Department (ECD) was also newly created to regulate environmental situations in the country. Environmental quality standards are to be set up by government for monitoring the environmental performance and management throughout the country. New investment and development projects must conduct the environmental and social impact assessment (ESIA) as well.

[2] Proclaimed through a gazette in accordance with Notification No.26/94

D. Other Environmental Laws, Regulations and Rules

6. In June 2014, the GOM issued the Environmental Conservation Rules (Ministry of Environmental Conservation and Forestry (MOECAF), Notification No. 50 / 2014, the 8th Waxing Day Nayon, 1376 M.E., (5th June, 2014)). Specific measures for the implementation of the national policy and national law on environmental management were included.

7. The updated 2012 Environmental Conservation Law and 2014 Rules, empowers MOECAF to act as a "gate keeper" for business activities. It confers powers on MOECAF to regulate and to establish a "prior permission scheme"[3] for a range of business activities that "may cause impact on environmental quality". Other Government departments authorized to approve business activities may do so only after the relevant permission from MOECAF. MIC Notification No. 1 sets out the list of economic activities that require an ESIA and approval by MOECAF that includes the exploration, drilling and production of O&G, although the EIA Procedures under the Environmental Conservation Law will refine these. In addition, there are basic provisions in this law, as there are in the Foreign Direct Investment Law that requires basic pollution control.

8. The draft 2015 Environmental Impact Assessment Procedure and local environment quality standards have also been developing with technical support from ADB and others and the EIA Procedure may be completed by the end of 2015. A summary of the draft rule is included as **Annex 5,** while entire draft rule is in an appendix to the EARF. Since this new EIA procedure and environmental quality standards have yet to be adopted by MOECAF/ECD, this IEE utilizes good international industry practice (GIIP) such as the IFC Environmental Performance Standards and the World Bank Environmental Health Standards for assessment of impacts and potential mitigation measures.

9. The Conservation of Water Resources and River Law of 2006 prohibits pollution of water resources and specify penalties. This law is primarily concerned with river transportation and the regulation of river fishing and sewage discharge. It authorizes the Directorate of Water Resources and Improvement of River Systems to determine dangerous water levels for towns; cooperate with relevant government departments and organizations to solve related problems; and guide the use river water for domestic and agricultural use. The law prohibits water pollution; prescribes terms and conditions for the monitoring and prevention of water pollution; and specifies penalties for those who pollute water.

10. The 1994 Protection of Wildlife and Natural Areas Conservation Law specifies penalties for water pollution. It also contains the legal provision for protecting rare and endangered flora and fauna species in Myanmar. It requires updating the list of permanently and temporarily protected species in accordance with the list of species identified by CITIES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). There is also no provision for water quality and protected fish species. The Forest law (1902) was amended in 1992 and controls the management, utilization and conservation of existing forest land in Myanmar.

11. Myanmar is a signatory of a large number of international agreements relevant to environment protection. Those with direct application to the project, along with the date of signing by the Myanmar, include:

1) *Kyoto Protocol to the United Nations Framework Convention on Climate Change,*

[3] Article 26.

23 February 2005.To further reduce greenhouse gas emissions by enhancing the national programs of developed countries aimed at this goal and by establishing percentage reduction targets for the developed countries;

2) *Montreal Protocol on Substances That Deplete the Ozone Layer,* 1 January 1989.To protect the ozone layer by controlling emissions of substances that depletes it.
3) *United Nations Framework Convention on Climate Change,* 21 March 1994.To achieve stabilization of greenhouse gas concentrations in the atmosphere at a low enough level to prevent dangerous anthropogenic interference with the climate system.
4) *UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage,* 1985.To integrate the practice of heritage conservation in Myanmar with that being done around the world.
5) Plant Protection Agreement for the South-East Asia and the Pacific Region, Rome, 1956 (1959)
6) Treaty Banning Nuclear Weapons Test in the Atmosphere in Outer Space and Under Water, Moscow, 1963 (1963)
7) Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Sea-Bed and Ocean Floor and in the Subsoil there of, London, Moscow, Washington, 1971(
8) Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons, and on their Destruction, London, Moscow, Washington, 1972
9) International Convention for the Prevention of Pollution from Ships, London, 1973.
10) Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, London, 1973 (1988)
11) United Nations Convention on the Law of the Sea, Montego Bay, 1982 (1996)
12) Convention on Biological Diversity, Rio de Janeiro, 1992 (1994)
13) Treaty on the Non-Proliferation of Nuclear Weapons, London, Moscow, Washington, 1968 (1992)
14) Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and their Destruction, Paris, 1993 (1993)
15) International Tropical Timber Agreement (ITTA), Geneva, 1994 (1996)
16) Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985 (1993)
17) Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1987 (1993)
18) ICAO Annex 16 Annex to the Convention on International Civil Aviation Environmental Protection Vol. 1 Aircraft Noise
19) ICAO Annex 16 Annex to the Convention on International Civil Aviation Environmental Protection Vol. II Aircraft Engine Emission
20) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space Including the Moon and Other Celestial Bodies (Outer Space Treaty), London, Moscow, Washington, 1967 (1970)
21) Agreement on the Networks of Aquaculture Centers in Asia and the Pacific, Bangkok, 1988 (1990)
22) South East Asia Nuclear Weapon Free Zone Treaty, Bangkok, 1995 (1996)
23) United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and / or Desertification, Particularly in Africa, Paris, 1994 (UNCCD)(1997)
24) Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, D.C., 1973; and this convention as amended in Bonn, Germany,1979

(CITES) (1997)

25) Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, New York, 1994 (2006)
26) Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, Rome, 1973(1994)
27) ASEAN Agreement on the Conservation of Nature and Nature Resources, Kuala Lumpur, 1985 (1997)
28) Catagena Protocol on Biosafety, Cartagena, 2000 (2008)
29) ASEAN Agreement on Transboundary Haze Pollution (1997)
30) International Treaty on Plant Genetic Resources for Food and Agriculture, 2001(2004)
31) Declaration on ASEAN Heritage Parks(2003)
32) Stockholm Convention on Persistent Organic Pollutants (POPs), 2001 (2004)
33) The Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat, 1971 as amended in 1982 and 1987(2004)
34) Establishment of ASEAN Regional Centre for Biodiversity (2005)
35) Copenhagen Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, Copenhagen, 1992 (2009)
36) International Tropical Timber Agreement (ITTA), Geneva, 2006 (2011)
37) Montreal Amendment, 1997 and Beijing Amendment, 1999 to the Montreal Protocol on Substances that Deplete the Ozone Layer, 1997 (2012)
38) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Basel, 1989 (2015)

12. There is also concern in Myanmar with regard to Climate Change. As Myanmar is signatory to the United Nations Convention on Climate Change (UNFCCC), Myanmar had prepared first national communication report submittal to UNFCCC. Attempts were also made by government for not only estimating the greenhouse gas emission from various sources but also developing measures related to climate mitigation and adaptation. In responding to mitigation aspect, abatement strategy to reduce emission from its main sources such as deforestation, land use land cover change and paddy field were evaluated and there are no changes as a result of this project. Since methyl emission from irrigation reservoir and increased cultivation of paddy can be responsible for GHG emission, it is noted that the IAIDP project will not involve new reservoirs and cause a very small increase in irrigation area and no increase and possibly a decrease in GHG emissions.

13. The National Framework for Biosafety was also drafted in 2008 by Department of Agriculture Planning (DAP) under MOAI in accordance with the Cartagena Protocol on Biosafety, Cartagena, 2000. Therefore, if importing genetically modified seed for agriculture development is intended, it may require following the procedure and guidelines of biosafety framework procedures. If hybrid seeds and plant materials are to be imported, it also requires following to the procedure and guideline set up by The Plant Pest Quarantine Law (1993 revised in 2011) and The Seed Law (2011).

14. For those fertilizers that are to be used in irrigated area as part of agriculture development, verification is required to see if they are officially licensed, imported, transported and stored according to 'The Pesticide Law (1990)' as well as to the international good international industry practice (GIIP). The current problem encountered in rural township is that there are illegally imported pesticides across the border and how pesticide law can be effectively enforced at ground level. The same is applied to the case of fertilizer imported from neighboring countries. Any fertilizer that are imported and used should be in conformity with 'The Fertilizer

Law' enacted in 2002. However, this is not currently the case in the project area and the IAIDP does not address this illegal importation problem. Groundwater monitoring has been included in the project EMP.

15. There are also some regulations related to irrigation and drainage work that might be also relevant to dam safety and environmental and social safeguard of the proposed IAIDP, including the Canal Act, 1905 (Amendment in 1998); the Myanmar Embankment Act, 1909 (Amendment in 1998), and the Myanmar Irrigation Manual, 1945 (Revised & Edited). However a review of these documents finds no reference to social or environmental safeguards.

16. A number of laws and policies concern the management of urban water resources. 'The Canal Act (1905, last amended in 1998)' regulates the allocation of water for public purposes, water supply and drainage works. The Act permits all water in all rivers and streams flowing in natural channels as well as lakes and other national still water bodies to be used and controlled for public purposes. The 'Myanmar Embankment Act (1909, last amended in 1998)' requires every owner or occupier of immovable property in the vicinity of an embankment to help maintain the embankment or to provide a laborer who can. The Act authorizes an embankment officer to enter into any immovable property in the vicinity of an embankment and take possession of, appropriate or remove and use any relevant materials for the purpose of such work.

17. The 'Underground Water Act (1930) deals with the conservation and protection of underground sources of water supply in Myanmar.

18. **Ethnic Minorities**. According to Chapter 1, Clause 22 of the 2008 Constitution of Myanmar, the GOM is committed to assisting in developing and improving the education, health, language, literature, arts, and culture of Myanmar's "national races." The constitution provides equal rights to the various ethnic groups included in the national races and a number of laws and regulations aim to preserve their cultures and traditions. This includes the establishment of the University for the Development of the National Races of the Union which was promulgated in 1991 to, among other things, preserve and understand the culture, customs and traditions of the national races of the Union, and strengthen the Union spirit in the national races of the Union while residing in a friendly atmosphere and pursuing education at the University.

19. **Land Acquisition**. The legal framework in Myanmar is evolving. Myanmar does not have a unitary land law but has several laws for different categories of land. All land belongs to the state under the current legal system, and land users receive certificates from the Settlement Land Records Department. The 'Land Acquisition Act (1894)' provides certificates. When private land is acquired or private assets such as trees and standing crops are lost under public or private projects, compensation is paid at market value. The Act also provides that affected people with complaints can bring the case to court. A new 'Farmland Law' was recently adopted which introduced various reforms such as the recognition that farmland owners are able to sell, mortgage, lease, exchange, inherit or donate all or part of their farmland. There is also the requirement that compensation be paid for both land and buildings attached to it.

E. Environmental Assessment Requirements

a. Safeguard Policy Statement 2009 of ADB (SPS)

20. Safeguard requirements for all projects funded by ADB are defined in ADB SPS (2009). SPS 2009 establishes an environmental review process to ensure that projects undertaken as part of programs funded through ADB loans are environmentally sound, are designed to operate

in compliance with applicable regulatory requirements, and are not likely to cause significant environmental, health, or safety hazards. SPS 2009 is underpinned by the ADB Operations Manual, Bank Policy (OM F1, 2010). The policy promotes international good practice as reflected in internationally recognized standards such as the *World Bank Group's Environmental, Health and Safety Guidelines*.

21. Based on ADB environmental categories, the IAIDP project was categorized as Category 'B' meaning that potential environmental impacts are less adverse than those of Category 'A' projects, and an initial environmental examination (IEE) is required for the two core subprojects.

22. All safeguard-related activities in IAIDP will be guided by the SPS and GOM requirements. The two core subprojects selected based on prefeasibility study are the subject of this Category B IEE. Future pipeline projects will utilize the Environmental Assessment and Review Framework (EARF) prepared under IAIDP and the standard procedures and EMP of the core subproject IEE. Additional IEEs may be required for these pipeline projects.

23. SPS 2009 environmental assessment requirements specify that:

(i) At an early stage of project preparation, the borrower/client will identify potential direct, indirect, cumulative and induced environmental impacts on and risks to physical, biological, socioeconomic, and cultural resources and determine their significance and scope, in consultation with stakeholders, including affected people and concerned NGOs. If potentially adverse environmental impacts and risks are identified, the borrower/client will undertake an environmental assessment as early as possible in the project cycle. For projects with potentially significant adverse impacts that are diverse, irreversible, or unprecedented, the borrower/client will examine alternatives to the project's location, design, technology, and components that would avoid, and, if avoidance is not possible, minimize adverse environmental impacts and risks;
(ii) The assessment process will be based on current information, including an accurate project description, and appropriate environmental/social baseline data;
(iii) Impacts and risks will be analyzed in the context of the project's area of influence;
(iv) Environmental impacts and risks will be analyzed for all stages of the project cycle, including preconstruction, construction, operations, decommissioning, and post-closure activities such as rehabilitation or restoration;
(v) The assessment will identify potential trans-boundary effects as well as global impacts; and
(vi) Depending on the significance of project impacts and risks, the assessment may comprise a full-scale environmental impact assessment (EIA) for Category A projects, an initial environmental examination (IEE) or equivalent process for Category B projects, or a desk review.

24. Other key requirements of SPS 2009 include:

(i) *Environmental Management Plan.* The borrower/client will prepare an environmental management plan (EMP) that addresses the potential impacts and risks identified by the environmental assessment.
(ii) *Consultation and Participation.* The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.

(iii) *Information disclosure.* The borrower/client will submit to ADB the following documents for disclosure on ADB's website: (i) a draft full IEE (including the EMP); (ii) a new or updated IEE and corrective action plan prepared during project implementation, if any; and
(iv) Annual environmental monitoring reports.
(v) *Grievance Redress Mechanism.* The borrower/client will establish a mechanism to receive and facilitate resolution of affected people's concerns, complaints, and grievances about the project's environmental performance.
(vi) *Monitoring.* The borrower/client will monitor and measure the progress of implementation of the EMP.

25. This IEE is intended to meet SPS 2009 requirements.

b. Environmental Assessment Requirements of Myanmar

26. Currently, ADB is assisting Myanmar to strengthen its EIA capability through TA 7566-REG: Strengthening and Use of Country Safeguards Systems (Capacity Building for Implementing Environment and Social Safeguards in Myanmar.) This capacity building regarding EIA knowledge for the staff of Environmental Conservation Department was completed in the middle of 2014 and the TA is still continuing capacity development for the Applicable ADB and Myanmar Policies and Assessment Categories staffs of Ministry of Construction now). Other capacity building is being done with ECD on environmental standards and assessment issues, but based on an interview with ECD senior staff, there is insufficient capability at ECD to fully implement these new procedures at this stage. Additional budget, staff and equipment will need to evolve at ECD to allow them to manage the overall environmental program and EIA requirements. As noted, the EIA procedures hope to be finalized by the end of 2015 while work continues on environmental quality standards and sector standards for EIA. Future subproject IEEs when required may need to comply with Myanmar procedures and standards.

c. Assessment Areas, Sensitive Receptors

27. The assessment areas for air, noise, surface water and ecological impacts are defined by the technical guidelines which have been evaluated based on the environmental sensitivity of the project areas and vicinity as well as the nature of the project and its components. Due to the rural agricultural nature of the infrastructure improvements and the rehabilitation nature of the works, there are many small villages but no sensitive receptors directly adjacent to the proposed rehabilitations.

d. Assessment Period

28. The duration of impact assessed in this project IEE covers the design, construction and operation phases of the project.

F. Assessment of Legal Framework and Institutional Capacity

29. The ADB, Norwegian Government and the Vermont Law School have all been working to improve the procedures, standards and capability of the MOECAF Environmental Conservation Department (ECD). The current work involves development of environmental standards for Myanmar as well as sectoral environmental standards for various line ministries. The current technical assistance is greatly improving the environmental systems and competence of the ECD to manage the environmental assessment process in Myanmar. Once the sector standards are

in place, overall environmental assessment training will be required for line ministries such as the MOAI. The MOAI has not implemented an ADB loan project and has little familiarity with ADB or international environmental procedures.

30. The proposed Implementing Agencies (IAs) for the IAIDP are the ID and the DOA under the Executing Agency (MOAI). The IAs are familiar with certain environmentally-sound construction and operation practices, but there is very little current capacity for environmental management in the IAs so significant training is required to improve their capacity for environmental management for the implementation of the core subproject IEE and EMP, as well as managing the environmental review process for future subprojects under the IAIDP. As such, it is not possible to develop an "environmental capacity assessment" (including capacity, track record, and practice of executing and implementing agencies) for the IAIDP since there is no previous experience. In fact, there is little previous experience in the IAs with basic contracting of services, as recent work has been done in house.

31. The most logical place to start with this training will be at the Project Management Unit (PMU) once in place for the IAIDP. The project PMU staffing includes a Loan Implementation Environmental Consultant (LIEC) on an intermittent basis and one of the first tasks of the LIEC will be training the PMU and IAs in ADB Safeguards. This work will initially focus on the implementation of the core subproject EMP, and expanded to the screening and management of future subprojects under the EARF. It is likely that the new ECD systems and standards being developed with ADB support will be finalized and put into place during the life of the IAIDP. As such, training will be expanded to include national systems as well as ADB environmental management and safeguard systems as they become operational. The training strategy will include a "cascade" approach using a "training of trainers" with first training the PMU by the LIEC, then the PMU and LIEC training of the IAs, and finally the IAs training the construction contractors with assistance by the LIEC.

32. **Training.** Training materials will be translated into the national language. In doing so, a set of teaching materials and a cadre of trainers is left behind. This will provide the basic capital necessary to undertake training but does not provide for the operating funds. Financial resources to deliver the training programs are provided for in the PMU budget. The PPTA team has prepared a translated version of the EMP requirements as a starting point for the future training program. The EA, PMU, IAs and contractors will all receive training in environmental management, environmental monitoring and supervision, mitigation planning, emergency response, public consultation and Grievance Redress Mechanism, occupational and community health and safety, and other environmental management techniques. The Gender and Social Specialist will ensure women have equitable access to training opportunities. The irrigation management component includes extensive training for farmers, water users' groups and related local stakeholders on water management; the agriculture component includes a major component of farmer training including integrated pest management. These programmes are described in supplementary documents 2 and 3.

33. The EMP contains a proposed training program for capacity building of the PMU, IAs, construction contractors, etc.

II. DESCRIPTION OF THE PROJECT

A. Rationale and Justification of the Project

34. The Central Dry Zone (CDZ) is one of the most food insecure, water-stressed, climate sensitive and natural resource poor regions in Myanmar. It has the second highest population density in Myanmar but remains one of the least developed. Access and availability of water resources are key determinants of rural poverty with livelihoods largely dependent on the southwest monsoon. Seasonal water shortages caused by low and erratic annual rainfall patterns and sandy and fragile soils render rainfed agriculture a high risk endeavor. Under such uncertain climatic conditions, the provision of functional canal irrigation systems is critical to safeguarding crops and sustaining the livelihoods of farmers and farm workers. Many of these irrigation schemes in the CDZ were built before the 1980s and have operated for 30 years. These schemes need to be rehabilitated, redesigned and upgraded to meet changing demands and uses.

35. In the context of the Government's Framework for Economic and Social Reforms (FESR), the National Comprehensive Development Plan 2011-2031 (NCDP) and the reform processes, the MOAI is implementing a Five Year Short Term Plan to develop the sector with the following targets:

(i) To extend net cultivated area up to 13.6 million hectares and cropping intensity 168 percent.
(ii) To attain 4.28 mt/ha of average yield of paddy and 33 million mt of paddy production.
(iii) To extend the total irrigated area to 2.3 million hectare.
(iv) To extend the activities for the accuracy of agricultural statistics.
(v) To encourage the production of qualified and standardized agricultural value-added products for [to be] more competitive in international market.
(vi) To create profitable and sustainable market for farmers.

36. While the proposed design of the IAIDP does not offer support for more accurate agricultural statistics it does offer support for each of the other five sector targets: (i) increased cultivated area and cropping intensity; (ii) increased yields and production of paddy and other crops; (iii) extended irrigated area; (iv) development of value added products for national and international markets; and, particularly, (v) a market focused approach offering better profits for farmers and the rural communities of which they are a part.

37. The proposed IAIDP is consistent with the national level policies for economic development and reform. MOAI has translated the FESR and NCDP into a five year sector plan with clearly defined and quantified national targets. The rationale for the proposed IAIDP sector-like project is to apply the national sector plan in the particular conditions of the food insecure and resource poor CDZ, so that farmers in the CDZ can participate and contribute to improved sector performance in terms of increased efficiency and effectiveness of resource use to develop the national economy and, in particular, increase the food security and livelihood sustainability of the poor farmers and their communities.

38. Water is a major limiting factor to crop production especially in CDZ upland areas with bi-modal rainfall patterns of around 750mm of precipitation (even as low as 600mm in dry years). In such agro-ecologies, risk-adverse farmers tend to adopt mixed cropping systems to spread risk and mitigate crop failure. In these areas in-situ moisture conservation practices such as minimum tillage, stubble mulching etc. that retain as much of the rainfall as possible accessible to crop root systems should be an extension priority.

39. The dams and main irrigation infrastructure were built many years ago, but in many cases is incomplete or dilapidated, with repairs delayed due to limitations of the maintenance budget. Water management is constrained by limited staff in the irrigation department and weak arrangements for management by local officials, or by water users or their representative organisations. There is great potential for improving the productivity of irrigation water.

40. The following table presents a summary of the potential IAIDP infrastructure components evaluated by the PPTA team. Chaungmagyi in the Mandalay Division and Natmauk in the Magway Division were ultimately agreed as the IAIDP "core subprojects" for feasibility design, and they are the focus of this IEE. The remaining components will be placed in a project pipeline for future implementation, reviewed under the framework of the IAIDP EARF, and other IEEs may be required in the future. See

41. , with core subprojects highlighted.

Region / State	System	Storage volume (acre-ft.)	Net command area (acre)	Storage per unit command area (feet)	Average Water Use (acre-ft.)		Cropping Intensity (%)	
					avg	dry year	avg	dry year
Kayah	Mobye	580,000	17,917	32.37			85	
Kayah	Ngwe Daung		6,291		28,568	17,847	119	
Magway	Natmauk (1)	88,400	25,380	3.48	140,255	102,664	119	101
Magway	Sun Chaung	24,576	7,125	3.45	25,212	14,906	130	121
Magway	Saddan	18,000	10,500	1.71	28,956	16,414	115	110
Magway	Yanpe	35,140	10,845	3.24	24,437	1,625	108	103
Magway	Kinpuntaung	10,520	5,190	2.03	13,882	6,651	111	99
Mandalay	Thin Pone	13,059	8,728	1.50			96	79
Mandalay	Meiktila	17,209	26,297	0.65	17,549	10,506	10	7
Mandalay	Chaung Gauk	3,250	6,614	0.49	12,909	8,635	64	51
Mandalay	Chaungmagyi (1)	33,200	7,255	4.58	30,534	21,909	129	97
Mandalay	Thitsone	39,965	12,345	3.24	27,134	13,569	73	30
Sagaing	Kyeepinakk	38,700	5,458	7.09	36,075	22,739	118	64

Table II-1 IAIDP Component Projects Evaluated with Core Subprojects

Region / State	System	Storage volume (acre-ft.)	Net command area (acre)	Storage per unit command area (feet)	Average Water Use (acre-ft.)		Cropping Intensity (%)	
					avg	dry year	avg	dry year
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Kayah	Ngwe Daung		6,291		28,568	17,847	119	
Magway	Natmauk (1)	88,400	25,380	3.48	140,255	102,664	119	101
Magway	Sun Chaung	24,576	7,125	3.45	25,212	14,906	130	121
Magway	Saddan	18,000	10,500	1.71	28,956	16,414	115	110
Magway	Yanpe	35,140	10,845	3.24	24,437	1,625	108	103
Magway	Kinpuntaung	10,520	5,190	2.03	13,882	6,651	111	99
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Mandalay	Thitsone	39,965	12,345	3.24	27,134	13,569	73	30
Sagaing	Kyeepinakk	38,700	5,458	7.09	36,075	22,739	118	64

(1) Numbers being refined during feasibility work and may differ slightly in other reports.

42. The thirteen systems were built at various dates between 1960 and 2005, apart from Meiktila Lake which has evolved from a historic tank which has gradually been expanded over the

years. They all take water from small streams which have been dammed to provide some storage to smooth out short term fluctuations in flow and to enable some summer cropping. The dams are generally reported to be in good condition, but have not been inspected or reviewed as part of this project. Most canals are unlined, but some brick lining has been provided in vulnerable sections. Maintenance is undertaken by ID down to the outlets from distributary/minor canals and owing to limitations of budget and other resources has not been undertaken comprehensively. Some parts of the systems are in good condition, and others are more severely degraded.

43. The schemes are generally small with reasonably well-structured canal layouts: main canals, distributary canals and minor canals managed by the ID supply water via outlets to watercourses and ultimately individual farms. There are, however, a large number of direct outlets from the main canals which tend to receive a disproportionate amount of water resulting in relative shortages further down the system. Most distributary canals are quite small, but those towards the tail of the larger systems may cover substantial areas resulting in relative difficulties in managing water supplies to those areas. Generally such tail-end areas only receive water in the monsoon: the limited water availability would make summer cultivation impractical even if infrastructure were improved.

44. The subprojects were ranked by economic viability. The choice of two projects considered core subprojects and taken to feasibility level was made in the context of choosing projects which were “safely viable”, chosen from those with higher IRRs (Natmauk, Mobye, Ngwe Daung, Chaungmagyi, and Thitsone). There were no obvious environmental or social discriminators in the subprojects. To be effective in a “sector-like project” the core projects not only need to be viable in themselves, but also to be effective demonstrations of the proposed interventions which can be replicated in the pipeline subprojects. As the most viable subprojects which can provide models for other projects in the CDZ, the PPTA team proposed and MOAI agreed on feasibility studies of Natmauk in Magway and Chaungmagyi in Mandalay with the intent of demonstrating a development model for water constrained systems.

45. **Linked Global Environment Facility (GEF) Project.** The IAIDP is also linked with the GEF project “Mitigation Focused Rural Productivity and Ecosystems Services Enhanced in Central Dry Zone Forest Reserves.” The GEF project is being implemented by MOECAF in the Mae-nyo-taung Forest Reserve. The overall project consists of four "cascading" series of interventions. The first is the Regional Technical Assistance (TA) 8564 on Promoting Ecosystem Services and Forest Carbon Financing (ADB TA 8564) which seeks to support the protection and management of large scale ecosystems by building knowledge, partnerships and capacity for the assessments and valuation of ecosystem services, and by strengthening planning and project level decision making (ADB, 2013). Under this TA, a pilot project will focus on the Mae-nyo-taung Forest Reserve and the agricultural land and settlements surrounding the reserve in the Central Dry Zone. The pilot project, the outputs of which will be available by July 2016, can serve as a model for understanding the relationship between dryland forests and agricultural productivity and livelihoods and inform the sustainable rehabilitation and restoration of degraded reserved forests across the CDZ.

46. The second initiative will be the proposed GEF project, building on the ecosystems valuation pilot to strengthen soil and water conservation through mitigation-focused management practices, enhance livelihoods of forest dependent communities, improve forest biodiversity and ecosystems services, and strengthen knowledge management to support adoption of best practice in and around the Mae-nyo-taung forest reserve and surrounding communities, as well as replication and scaling up to other forest reserve and relevant settlements in the CDZ.

47. Third, there is the linkage to the IAIDP which supports technical assistance, loans and investments in the CDZ region. The IAIDP project impact will be improved household incomes in the project area. It is hoped that the pilot work of the GEF demonstration project can help in developing measures related to upstream forest improvement which would reduce sedimentation in reservoirs and thus increase their life beyond their current design life. It should, however, be noted that the reservoirs are generally large in relation to the storage requirements and thus would still be able to store sufficient water even if part of the live storage is filled by sediment (the two core sub-projects have only been full on three occasions in the last 15 years). Sedimentation in the canals largely derives from the river bed between the dam and irrigation intakes or from undammed intermediate tributaries, and this will be addressed by provision of sluiced sediment settling basins at the head of the main canals.The GEF pilot area is is in the catchment of a pipeline project, and the results of the pilot work will be reviewed for consideration in the feasibility studies and detailed design phases of subprojects.

48. The fourth initiative is another planned ADB "Climate-Friendly Agribusiness Value Chain Sector Project" in Myanmar. This proposed loan / investment project will aim to increase rural productivity and household incomes, and promote more efficient resource utilization and climate resilience for competitive and inclusive agribusiness in project areas. At the output level, the project will support i) improved and climate resilient critical infrastructure for agribusiness value chains, such as roads, water use and storage systems, processing centers, etc, ii) expanded use of bio- energy and sustainable biomass management, including use of agricultural waste and off-grid clean energy systems, iii) strengthened agribusiness support services, and iv) increased knowledge, mainstreamed into climate change adaptation policies and climate-smart smallholder agriculture. Project areas and crop varieties are yet to be determined, however rice, pulses and high value horticultural products will be considered. One project area is expected to be established in the CDZ.

B. Project Impact, Outcome, and Outputs

49. The project impact will be improved household incomes in the project area. The indicator proposed at this stage in preparation is an increase in household income as a consequence of increased agricultural productivity. The outcome will be *"Improved agricultural production in the project areas"* which will contribute to national economic development and also be a contributor to the impact of improved household incomes. The increase in the value of production has been added as a necessary indicator linking physical agricultural improvements to the improved financial condition of the beneficiary households. Value based indicators will be developed in the context of the design of the agricultural development component. Quantifiable physical indicators include cropping intensity, yields and labour productivity. These will include indicators specific to both core subprojects and more generally for the pipeline.

50. To support the outcomes the project will include two main inter-related outputs: (i) irrigation development including both irrigation infrastructure rehabilitation and development and improved irrigation management and service delivery (Output 1 – Irrigation Development); and (ii) agricultural support for increasing productivity which focuses on value chain development (Output 2 – Agricultural Development).

51. **Output 1, Irrigation Infrastructure.** Output 1 involves the provision and management of improved irrigation infrastructure and is the focus of this subproject IEE. It involves the following performance indicators: (i) Irrigation management improved and intensity of irrigation on 50,000 acres increased by 10% in project systems through improvement and construction of: repair of canals, improved cross drainage, provision of control structures, and better operating procedures

by 2023, and (ii) Management improved through: new system operation manuals; technology pilots; training of 120 ID staff, 900 leader farmers, including 30% women, in tertiary and field level water management and organised into gender-sensitive water user groups by 2023. The WUGs will be developed from traditional management arrangements, which are based around individual lead farmers (myaunggaungs) who manage tertiary canals and field ditches currently and interact with irrigation department field staff (binthas) who are responsible for main and distributary canals. In practice myaunggaungs are involved informally in the management of distributary canals, but this is ad hoc and unsystematic. The precise future arrangements will be developed in a participatory manner during the project implementation period but are likely to involve a WUG including several myaunggaungs and other elected farmers managing larger areas than at present. It is anticipated that eventually the water users' organisations (WUOs) will manage entire distributary canals, with the irrigation department just managing the dams and main canals. Responsibilities at the interface between ID and WUOs will be carefully described and agreed by both parties.

52. **Output 2, Agricultural Development.** Output 2 involves associated agricultural sector improvements that have few environmental aspects, except that training activities could improve environmental performance in such areas as proper use of pesticides and fertilizers and agricultural waste management. It involves the following performance outputs: (i) diversified and higher value crops planted on 20% of all project-improved irrigation systems by 2025; (ii) value chains and market connectivity are demonstrably improved in all subprojects by 2025; and (iii) Farmer capacity for land management and climate-smart agriculture enhanced and 10% of households benefiting being women headed households.

53. Output 1 infrastructure improvements are the focus of this IEE. The two core subprojects involve the following general features (with some examples shown in **Annex 6)**:

- Water level control in canals at low flows, for which new gated regulators will be needed;
- Provision of gates to head regulators and outlets, to enable closure at times of low demand or during rotations;
- Flow measurement so performance can be monitored and used as a basis for management, combined with the ability to control flows at these points;
- Sediment control at weirs;
- Repair of flood damage to main canal and provision of adequate cross-drainage;
- Upgrading canal inspection roads;
- Canal re-sectioning and stabilizing (to reduce problems of bank instability);
- Scour protection at structures to ensure that they are stable.

C. IAIDP Infrastructure Component Details

54. **General Issues for All Candidate IAIDP Schemes.** The schemes are on small ungauged catchments ranging from 20 to 450 square miles, but streamflows have been estimated from reservoir water balances. Sedimentation is believed to be high and thus depth storage curves may be inaccurate, which would affect the streamflow estimates. The exception is the Mobye scheme in Kayah which takes water from a major reservoir, which was built primarily for hydropower (over 90% of the water is released for that purpose). Rainfall data is available at the dam sites since construction started, and there are meteorological stations in representative townships. Dry season inflows to the reservoirs approach zero so there is no base or minimum flow in the systems for environmental purposes.

55. The priority for the irrigation system is to adequately convey available water resources from the head of the system to the tail. In order to achieve this, adequately sized canal prisms are required to be bounded by continuous embankments offering adequate freeboard and stability on all channels. Where natural drainage streams cross the canal alignments, infrastructure is required to ensure such drainage flows bypass the canal and prevent damage to the canal architecture which can compromise the basic conveyance function of the system. The existing infrastructure within the core subprojects (and other future IAIDP subprojects) does not presently fulfil this requirement, with low and dis-continuous embankments that have been damaged by surface drainage flows.

56. Management of sediment throughout the system is also required to reduce sedimentation in canals which leads to a reduction in the conveyance capacity of the system and requires recurrent maintenance expenditure for its removal. Sediment from the source is largely trapped in reservoirs, but the relatively clean water discharged back into the river picks up sediment between the dam and irrigation intake. Sediment settling basins are provided at the head of canals so that this sediment can be sluiced back into the river system. Sediment management further down the system requires consideration of canal flow velocities. High velocities result in erosive flows which erode canal banks and increase the sediment load which is carried to the tail of the system where it may be deposited. Conversely, low flow velocities lead to sedimentation of any particles carried in suspension by the upstream canal. The canals are designed to be non-scouring and non-silting to the extent possible through provision of drop structures in the canal system.

57. In order to ensure efficient and equitable distribution of irrigation supplies, it is vital that the management of flow throughout the system is reactive to both the available water resources (supply) and the temporal irrigation requirements at a field level (demand). To achieve this it is necessary to provide water control infrastructure with inbuilt flexibility (such as adjustable gates) to ensure flow management techniques proposed as part of the irrigation management component can be implemented. Flow measurement infrastructure is also required to enable accurate and equitable division on available water resources.

58. It is probable that some command areas are larger than can be justified by the available water. The area irrigable in the summer season is quite small (typically less than 30%) and irrigation in the monsoon is largely protective and supplementary. However, the nature of the layouts of some systems means that losses at the head are captured and reused further down the system. The nominal efficiency thus increases, but with a time lag so that the start of the season may be delayed or there may be dry periods during the season as the monsoon rainfall pattern is bimodal.

59. Although there is a common perception that rainfall has declined recently and that the onset of the monsoon has been delayed, this is not supported by the limited data or IWMI's analysis (2012). Climate change models generally indicate higher temperatures and higher annual total rainfall in the future. Rainfall patterns will change, with the dry season probably becoming 'more dry' and the monsoon 'more wet.' However, there may be more intense rainfall, a delayed start and longer dry periods during the monsoon which will require improved management of the reservoirs. The available storage will make it possible to smooth out the impact of greater variability in the timing of rainfall.

60. Many main canals do not receive their design discharge all the time, even during the monsoon, and are not operated at full discharge in the summer season. It is only possible to command offtakes in this situation if there are cross regulators to raise the water level at times of low flow. However, many cross regulators are in poor condition or are not operable. Many rely on

stoplogs rather than gates. Whilst this is acceptable for small canals, provided stoplogs can be kept available on site, the large canals need gated regulators. A combination of a long crested weir with a gated central section is a useful approach. Conversely, low level offtakes may take more than their share of water, even when the main canal flow is low. As there are many such offtakes, most of which are un-gated, there is a risk of very inequitable distribution of water governed more by local topography and outlet configuration than as a result of planned operation. All direct outlets on main and distributary canals should be gated.

61. There is not usually a constructed drainage system as the topography and natural drainage channels largely suffice, particularly since rice is the dominant crop. Drainage may need to be improved in some areas to enable diversification. However, there are significant problems of flood damage to contour canals during the monsoon. High flows from the streams draining the hills to the east and west of the project area are intercepted by the main canals for Natmauk and Yanpe and there is inadequate provision for cross drainage, resulting in the canal banks being severely damaged in several locations. The IAIDP project area suffers from damage due to inadequate capacity of cross drainage works and poor quality embankment construction. These will be addressed in rehabilitation plans and detailed designs will take account of best estimates of flood flows at an appropriate rate of return with a factor of safety appropriate to the uncertainty in flood flow estimates. The redesign and refurbishment of the schemes offers many opportunities to correct problems which result from the original design and at the same time to ensure that the new structures are robust and resilient, and able to protect against future flooding under climate change scenarios.

62. Most canals are earthen and unlined, presumably resulting in significant losses although no data is available either of the magnitude of conveyance losses or of their relative importance as compared to other losses. Some lining (brick or concrete) has been provided in critical locations typically close to roads. There is considerable weed growth in some canals as well as sedimentation. Scouring of the bed or slumping of the canal banks are also common problems. Inadequate scour protection downstream of control structures contributes to bank instability as well as undermining structures. All systems need a combination of cleaning, sediment removal, canal re-sectioning and possibly lining.

63. The formal network extends down to distributary or minor level; these canals typically command 50 to 500 acres through a number of ungated outlets. Outlet command areas are of the order of 50 acres. Irrigation downstream of the outlet is managed entirely by the farmers through informal cooperation arrangements, often led by a myaunggaung who is a local farmer nominated by the irrigation department to manage water at farm ditch level. Where there are no myaunggaungs, irrigation is managed on an ad hoc basis by farmers and village leaders. Neither of these existing arrangements are necessarily fair or equitable at present, but a major component of the project is to improve arrangements for water management – as set out in supplementary document 2. There are generally some field channels but the extent and quality of the channels is very variable so much irrigation is field to field. In the case of non-rice crops which cannot be flooded, small temporary channels may be dug along field boundaries to convey water to downstream plots.

64. Roads are generally in poor condition; even main canal inspection roads are often low quality. Some tarmac roads cross the subproject areas, linking townships, but most other roads are earthen and more suited to bullock carts and tractors. Access during the monsoon is thus particularly problematic.

65. The IAIDP concept envisages crop diversification in both seasons. It is likely that rice will remain the dominant crop, but there are alternatives which could give greater returns to water and to labour (which are or will be key limiting resources). However, diversification is constrained by multiple factors, including the nature and condition of infrastructure and the way it is managed. There is a need to ensure that the infrastructure can provide the flexibility for mixed cropping but also to improve management, as flexibility on its own creates opportunities for greater misuse of the system, increasing risks of water theft and conflict. A simple irrigation system gives low outputs but is easy to manage and is relatively resilient in the face of mismanagement. A more flexible, modern system takes more management skill, has the potential to increase productivity (for both individuals and as a whole) but is less robust. The rural economy in the CDZ is likely to change rapidly in the near future and thus the infrastructure and corresponding system of management needs to be adaptable.

66. **Generic Rehabilitation Schemes.** Rehabilitation refers to restoring the system to its original state. This is not always sufficient as there may be a need for completion, improvement or modernization to make effective. Many systems are dysfunctional not so much because of poor maintenance but due to incomplete construction or out of date or inappropriate designs which don't meet current requirements. These problems then become manifest in poor standards of maintenance, particularly at the tail of the system where they cannot be operated effectively and are damaged by dissatisfied farmers. Simple rehabilitation is not sufficient in such situations.

67. **Main systems.** The subprojects will include improvement and rehabilitation of irrigation and drainage infrastructure at the primary and secondary distribution levels. Works would include improvement of conveyance systems (canal prisms and embankments), additional drainage infrastructure, flow regulation structures, flow measurement structures and sediment management systems. Works would also include the replacement of all tertiary outlets with gate controlled outlets, and the selection of a DY canal as a pilot for installation of proportional control tertiary outlets. The aim of all interventions would be to improve the reliability, efficiency, flexibility and equity of water distribution throughout the system. Works shall also support and enhance rural connectivity through construction of dedicated access infrastructure and incorporation of access features in canal regulation infrastructure.

68. **Tertiary Systems.** The subprojects will support the improvement of farmer-owned water management infrastructure. Development of tertiary systems, through the extension of watercourse and field ditches (within the perimeter of the existing command areas) will be undertaken in areas where crop diversification is anticipated. This shall allow the replacement of traditional field to field (and plot to plot) water distribution with delivery of irrigation supplies directly from channel to field, providing individual farmers with increased flexibility in irrigation methods and timing. Infrastructure to support improved regulation of tertiary canal supplies shall be provided where summer cropping is anticipated in order to ensure more efficient distribution of the limited water resources during this season. In addition, infrastructure to support improved drainage and rural access shall be provided, especially where the proposed extension of water courses and field ditches may intersect existing drainage and access routes. The specific infrastructure rehabilitation will be determined on the basis of participatory studies during project implementation.

69. **Core Subproject Infrastructure.** Table II- 1 provides a summary of the estimated infrastructure rehabilitations in the two core subproject areas based on the feasibility studies. However, the exact locations for these rehabilitations are not yet defined in the feasibility studies and will need to be set during detailed design. **Annex 6** shows some examples of these rehabilitation structures alongside some photos of existing problems.

Table II- 1 Estimated Number of IAIDP Interventions by Core Subproject Area

	Type of Interventions	Unit	Chaungmagyi Installations (estimated)	Natmauk Installations (estimated)
1	Sediment basins at head of main canals	Nr	2	2
2	Construction of main canal drop structures (ungated)	Nr	20	14
3	Rehabilitation of main canal drop structures (ungated)	Nr	-	3
4	Construction of main canal water level control (gated cross-regulators)	Nr	12	17
5	Rehabilitation of main canal water level control (gated cross-regulators)	Nr	-	10
6	Construction of head regulators	Nr	12	20
7	Rehab of head regulators - Ability to close head regulators and outlets at times of low demand or during rotations	Nr	8	3
8	Provision of gates to direct outlets (from main canals)	Nr	3	54
9	Construction of main canal cross-drainage culverts	Nr	-	11
10	Strengthening of river afflux bunds	Nr	-	5
11	Removal of sediment from main canals and dispose	100 cft	8,871	48,000
12	Filling to main canal embankment for repair of flood damage and provision of adequate freeboard (from borrow)	100 cft	5,241	23,000
13	Strengthening and protecting critical reaches of main canal embankment	Km	-	0.25
14	Lining of critical reaches of main canal (erosion and seepage control)	Km	-	4
15	Construction of bridges over main canal	Nr	7	20
16	Rehabilitation of bridges over main canal	Nr	10	8
17	Upgrading main canal inspection roads	Km	19	50
18	Upgrading dam access road	Km	11	11
19	Construction of DY and minor canal drop structures (ungated)	Nr	8	60
20	Construction of DY and minor canal water level control (gated cross-regulators)	Nr	42	140
21	Rehab of DY and minor canal water level control(gated cross-regulators)	Nr	4	-
22	Provision of gates to watercourse outlets (from DY and minor canals)	Nr	75	292
23	Construction of DY and minor canal cross-drainage culverts	Nr	-	37
24	Removal of sediment from DY and minor canals and dispose	100 cft	2,255	20,674
25	Filling to DY canals and canal embankments (from borrow)	100 cft	18,435	138,131
26	Jungle clearance from DY and minor canals	100 sft	6,448	-
27	Lining of critical reaches of DY and minor canals (erosion and seepage control)	km	3	
28	Flow measurement weirs at the head of DY and minor canals	Nr	15	26
29	Construction of bridges over DY and minor canals	Nr	13	73
30	Rehabilitation of bridges over DY and minor canals	Nr	4	49
31	Extension of tertiary watercourses and field ditches	Km	41	288

70. **Change in Irrigated Areas.** Water supply is a major limiting constraint for agriculture. No significant change to the total volume of water can be expected, and large annual fluctuations are inevitable. There is some scope to improve the utilization of water and thereby increase the cropped area, within existing perimeters. There is also scope to diversify crops which would enable a larger area with the same volume of water. The agricultural component of the project (supplementary document 3) will include many activities to encourage and facilitate diversification and hence more profitable agriculture as well as greater productivity of water. Both increasing areas and diversification of cropping would require different and better standards of management and a willingness to change, and toghther they should increase the overall agricultural output. Specific changes will be made to the irrigation infrastructure and its management to relieve constraints of water supply by:

- Improving command levels, enabling irrigation to relatively high land at low flows, thus reducing losses direct to drains;
- Enabling control of flows into outlets systematically resulting in less loss to drains and less conflict between outlets;
- Ensuring more responsive management of dams at times of rain, to make more effective use of the rainfall;
- Improving management of tertiary canals so that a variety of crops can be grown within the same area, with less loss to drains; and
- Reducing flood damage to canals which can curtail irrigation at critical times.

71. Depending on households' interests, participation and location, the ability to benefit from the improved system management could affect them differentially and their uptake of new techniologies will occur at different paces.The impact of these changes would be to:

- save water in the monsoon so that it can be stored for use in the following dry season,
- use the additional water and manage the total volume of water better to increase crop area in the summer season.

72. Analysis of the increase in areas that should be achievable was made on the following assumptions:

- Greater efficiency in dam operations and water use in the monsoon should reduce the amount used in the monsoon and hence increase the volume stored for the subsequent summer season. It has been assumed than 60% of rainfall would be effective and that overall efficiency should be increased from 42% to 48% through improvements in application and operational efficiency as a result of better infrastructure enabling better control of water.
- Even in the monsoon there is some land not irrigated. The reasons for this are partly due to the infrastructure – for example the large area at the tail of Natmauk, where the canal system is sparsely developed and control is inadequate. Improved operation should enable increased area subject to the same improve in operational efficiency. It should be noted that these areas are partly irrigated by drainage from upstream areas. The increase in operation and application efficiencies will reduce these flows, but that reduction will be offset by deliveries from the canals which will be timelier and will reduce over-irrigation.

73. Table II- 2 provides an estimate of the anticipated increase in irrigated area in the core subprojects, noting that these are not new areas but existing irrigation areas in the perimeters that are not now receiving water. The combination of agricultural and irrigation improvements is anticipated to increase yields over both the original and incremental areas.

Table II- 2 Anticipated Increase in Irrigated Area

Name of System	Irrigated area increase (acres)		Overall System area (acres)
	Monsoon	Summer	
Chaungmagyi	820	1,294	7,255
Natmauk	1,522	2,474	25,380

74. This analysis assumes no change to the overall cropping patterns.This assumption of unchanged cropping was made to compare subprojects at prefeasibility level. There is scope for, and significant benefit in diversifying crops, but changes to the infrastructure and its management will be needed. **Annex 2** provides a summary of information received from field investigations on the two core subprojects, which gives an overview of conditions but the information has not been verified in all cases.

D. Core Subproject Infrastructure Component Details

75. **Chaungmagyi Core Subproject.** Chaungmagyi is a small system (7,000 acres) completed in 1982 in relatively good condition down to distributary canal level, with the left main canal being in good condition but the right canal being heavily silted and few structures provide the degree of water control which is required. The left canal appears to be a scouring channel which will reduce the maintenance requirements at the head but increase the problems at the tail and also undermine structures which generally have inadequate cut-offs. There are some checks with provision for stoplogs and several drop structures all of which are ungated. These provide a limited degree of control but need to be operated with temporary methods such as plastic sheets, sandbags and timbers.

76. The offtakes for distributary canals are fitted with gates and are generally in good condition. This has been the subject of a reconnaissance study by LIFT (2013), which recommended a minor programme of repairs and improvement to management; further details of the system are provided in that report. Distributary canals are in much poorer condition, with extensive weed growth and dilapidated structures (often completely bypassed or suffering from severe downstream scour). There are some tertiary canals which are supplied via ungated pipe outlets. There is extensive use of groundwater irrigation for vegetables, notably onions. Some of this land is out of command, but water shortage is the main limitation. The groundwater is reportedly slightly saline in the CDZ (IWMI, 2012) although there is no systematic data.

77. The left main canal is 6.93 miles long with nine distributary canals. This is a well-structured system with few direct outlets which should simplify management. The right main canal is slightly smaller and shorter, but similar in layout although it needs more repair work. There are a large number of drops on both main and distributary canals – some are in good condition but others need extensive repairs – for example due to downstream scour or even complete bypassing. These problems cause difficulties in commanding offtakes and hence farmers place informal mud/sandbag checks. There is good road access along the main canals but rarely along distributary canals. Tertiary development is incomplete, being around 20-40%.

78. Paddy is the dominant crop, but cotton is common particularly in downstream areas where there is a water shortage – very little water is provided for cotton. In addition there are quite extensive areas (about 10% of the command area) of vegetables grown in parts of the command area, large from privately managed groundwater. Cropping intensity has dropped in recent years,

with significantly lower areas of monsoon paddy and rather more erratic summer irrigation even though rainfall has not declined significantly.

79. Chaungmagyi has the potential to increase water utilization significantly. Increasing productivity will depend as much on agricultural development as the condition and management of the infrastructure. There is a potential saving of water in most years which could be used to increase the summer paddy area, and efficiency improvements in the monsoon should enable close to 100% paddy in the monsoon. Figure II- 1 shows the existing irrigation network at Chaungmagyi.

Figure II- 1 Existing Irrigation Network at Chaungmagyi

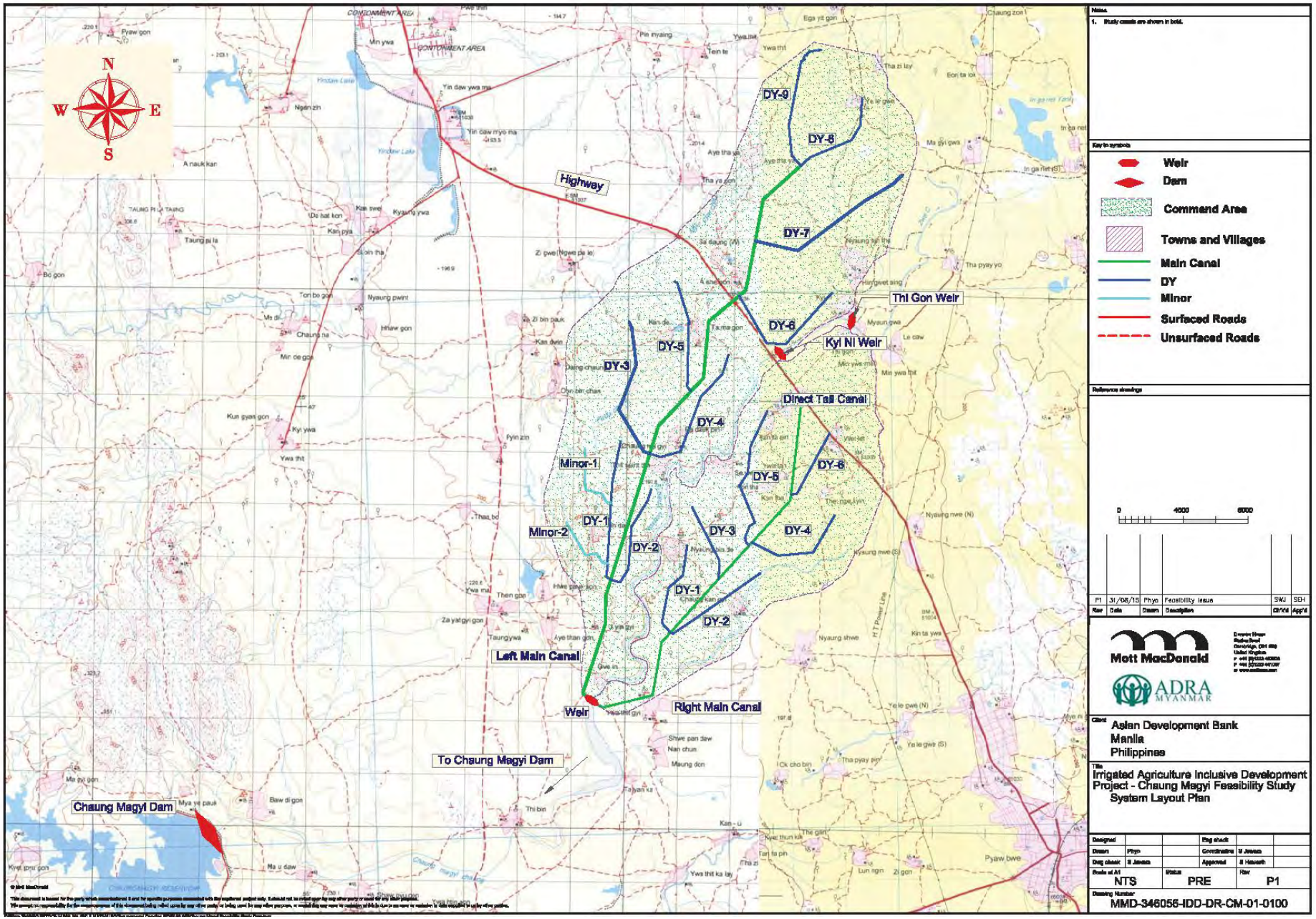
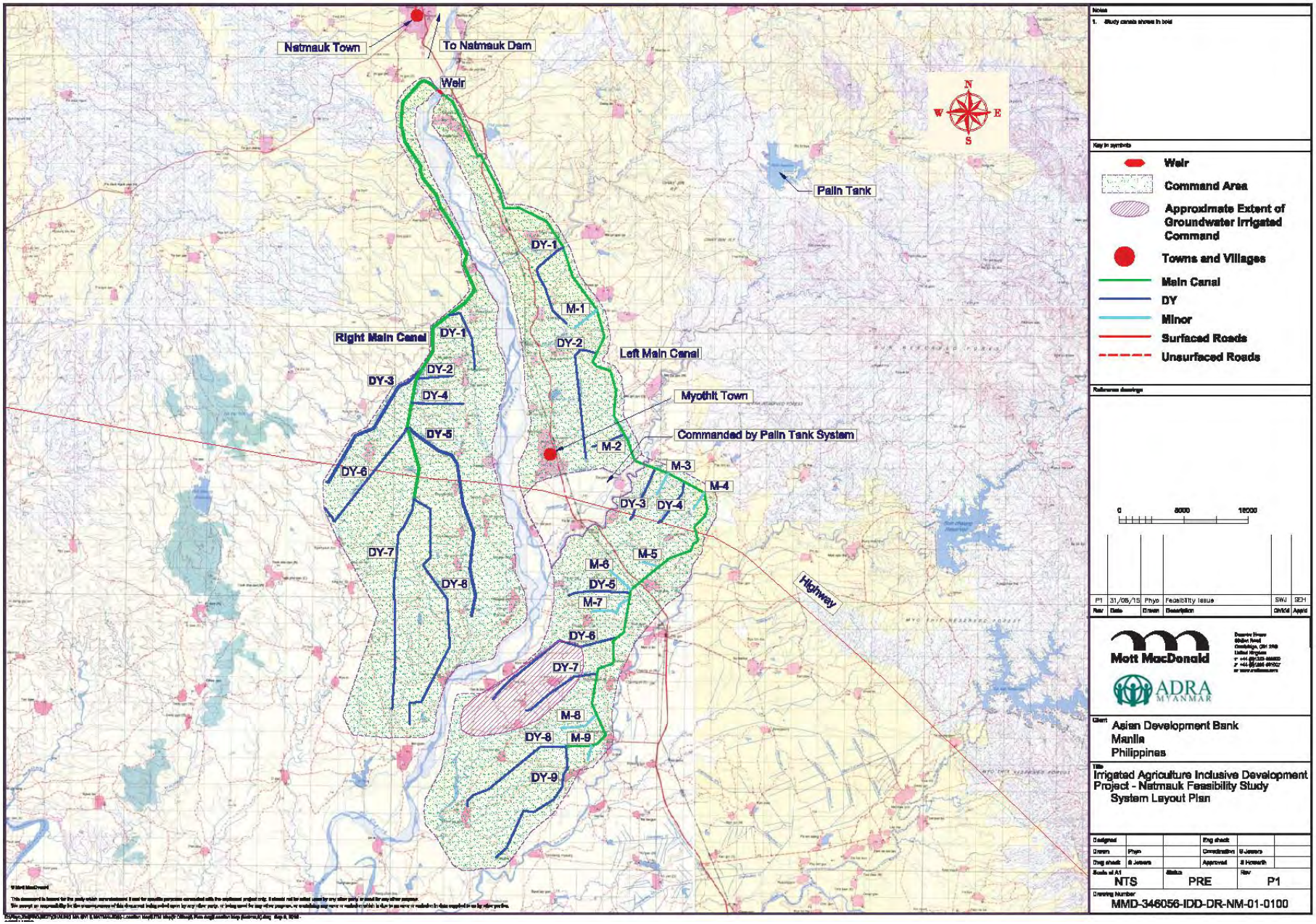


Figure II- 2 Existing Irrigation Network at Natmauk Core Subproject



80. **Natmauk Core Subproject.** Natmauk is a large scheme built in 1995 which is fed by a dam on the Yin River and supplemented by a major unregulated tributary between the dam and the weir. The gross command area is around 36,000 acres with a net area of the order of 25,000 acres. The Palin reservoir separately supplies an area of around 1,000 acres within the boundary of the system. There is severe sedimentation upstream of main canal intakes at weir, largely due to the uncontrolled inflows between dam and weir. This is excavated from time to time but this expensive and only a temporary and partial solution. The canal flows are thus restricted to 100 cusec (about 50% of the design discharge), as a result (although this year no release from dam, hence zero flow in river in summer season). A second major problem is flood damage to the right main canal as there is insufficient cross drainage.

81. The reservoir has an active storage of 86,400 acre-ft plus 12,600 acre-ft dead storage. This is approximately 65% of average runoff but comparable to the one in five year runoff and to the actual annual utilization and in most years (8 out of the last 10) there is sufficient water stored to enable an irrigated summer crop on part of the area (See Supplementary Document 2).

82. There are two large main canals, which are generally in good condition apart from the flood damage in the head reach of the right main canal. However, there are few cross regulators on the main canals which, combined with low flows, means difficulties in commanding some outlets. The regulators are ungated (although with provision for stoplogs) and some are in poor (inoperable) condition. In some cases (e.g. LMC DY1) a separate low level uncontrolled pipe has been installed to augment the flow into the distributary when the main canal flow is low. The official outlet is just used to irrigate some relatively high land adjacent to the main canal and the unofficial adjacent pipe is used for the bulk of the command. A similar problem arises even with the official outlets.

83. There is said to be a rotation of the main canal at times of shortage in the monsoon, with the first three DY canals (about 35% area) having water for 3 days and the remaining DY canals (65% of the area) getting water for 4 days (2 days each for DY4/5/6 and 7/8). The tail distributary canals are very long and irrigated large areas with a poor supply – this land is only cultivated in the monsoon, largely from rainfall but supplemented by canal irrigation and drainage reuse. Outlets along the DY canals are nominally the responsibility of the Irrigation Department (ID) although the farmers are actively involved, probably taking a leading role. All outlets are said to be operated simultaneously.

84. The distributary canals are simple earthen channels with few structures. Most outlets are either simple cuts through the bank, or ungated pipes. Operation is thus essentially managed by the farmers, opening outlets to their land and possibly closing upstream outlets. Control is largely achieved by temporary interventions by the farmers, but the larger canals have some formal structures. Some of these are in very poor condition - notably on the long channels at the tail where water supply is erratic and maintenance neglected.

85. Crop data suggests that cropping intensity is fairly high (130%, almost entirely paddy) in years where rainfall is greater than 25” which has occurred 5 years out of the last ten, but the intensity drops to 100% if rainfall is less than 20” which has occurred twice in the last decade. Even greater rainfall does not result in greater cropping as the reservoir spills and water cannot be delivered efficiently to the tail areas.

86. Figure II- 2 shows the irrigation network map at Natmauk core subproject.

E. Project Area of Influence, Project Implementation Schedule

87. The core subproject sites were visited for the preparation of this IEE for public consultation with particular attention paid to: (i) sensitive natural environmental receptors such as water bodies and wildlife habitats; (ii) sensitive human receptors; and (iii) cultural and heritage sites. The project's area of influence was defined based on the definition provided in ADB's Safeguard Policy Statement (2009) as follows:

a. **Primary project site(s) and related facilities:** These include the irrigation infrastructure rehabilitation systems at the core subprojects.
b. **Associated facilities that are not funded as part of the project**: Under ADB's Environment Safeguards Sourcebook, associated facilities are those "not funded as part of a project but whose viability and existence depend exclusively on the project."
c. **Areas and communities potentially affected by cumulative impacts from further planned development of the project**: The communities around the core subproject areas are principally very isolated with only small supporting villages nearby.
d. **Areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location**: It is not anticipated that the project related improvements will cause any unplanned developments. They are site-specific projects that is not likely to cause additional developments in the villages.

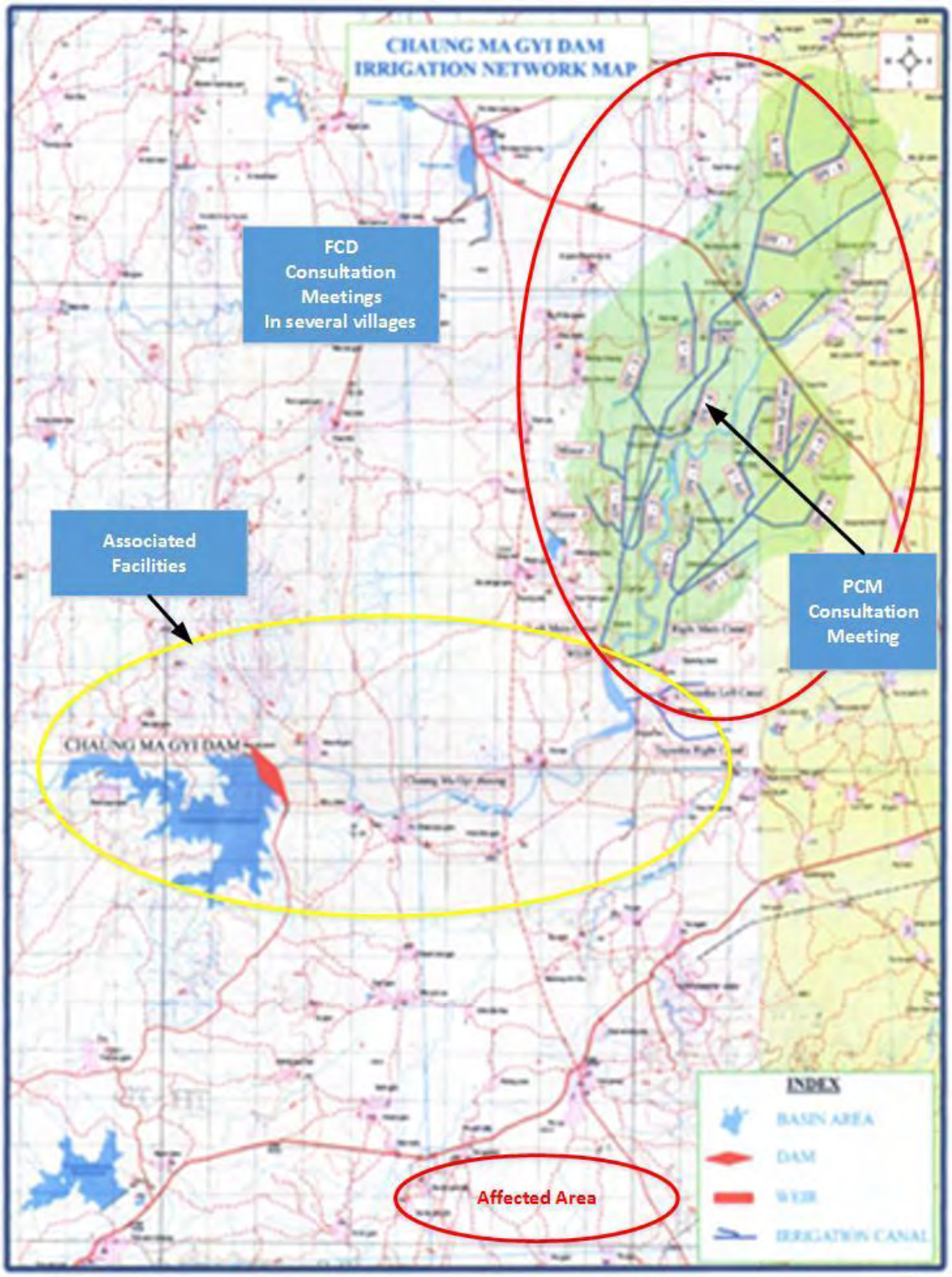
88. **Associated Facilities**. For Chaungmagyi core subproject, the Chaungmagyi Dam and diversion structures are associated with the IAIDP; no rehabilitation is proposed, but operational improvements are an important part of the project (see Supplementary Document 2). Agricultural market issues addressed by the Agriculture component but not addressed in this IEE would include private sector agribusinesses which are key part of the value chains, especially those involved in input supply, post-harvest operations and marketing.

89. **Project Area of Influence**. Based on the above, the area which may potentially be affected by the project can be considered as: (i) "main project areas of influence", covering core subproject sites (footprints) and areas within 200 m from their edges. This rationale is based on fact that 200 m is the potential reach of noise and dust which is likely to have an impact on human receptors which are the most sensitive receptors in the project area; and (ii) "extended areas of influence" which includes borrow areas/quarry sites, waste disposal sites, access routes to and from component sites and the resources in close proximity to them, sources of water for construction use, resource use and sources of labor, as well as local receiving water bodies.

90. Since the exact locations of these rehabilitations are still under development, it is not possible to show details of potential sensitive receptors at this time. Likewise, the project preparation provides information on the need for quarry sites and disposal sites but the locations have yet to be determined. All of these decisions are deferred until detailed design but the EMP includes mitigation measures to be applied.

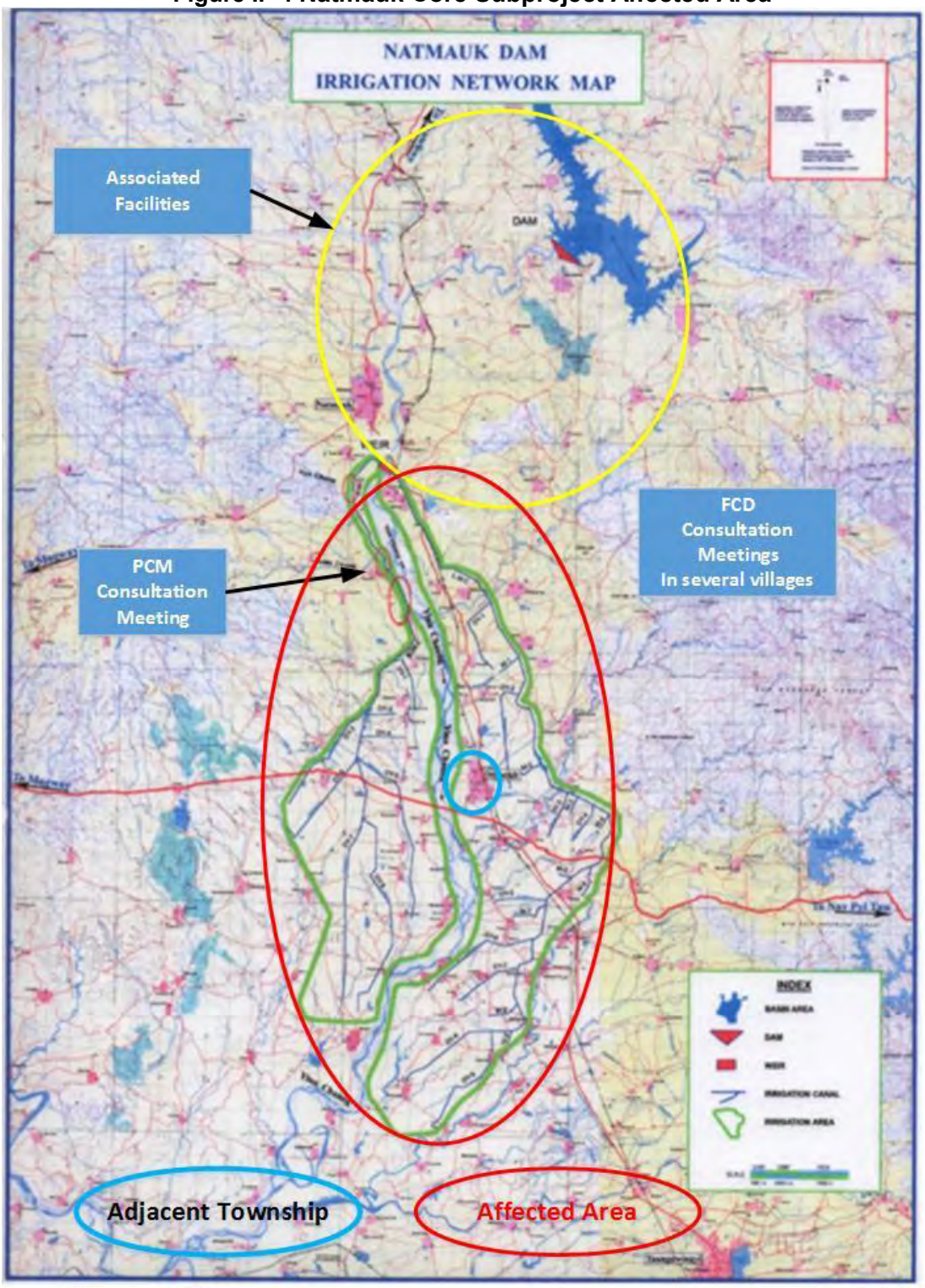
91. There are many small villages adjacent to and inside the two core subproject areas. As noted, it is not possible to determine exactly which villages might be directly impacted by the direct or associated project interventions. Figure II- 3 and Figure II- 4 show the general locations of the core subproject irrigation perimeters along with adjacent villages and associated facilities. The locations of the public consultation meetings are shown and it is noted that future consultation meetings will need to be held when exact intervention locations are more formally identified.

Figure II- 3 Chaungmagyi Core Subproject Affected Area



Chaungmagyi Core Subproject Affected Area

Figure II- 4 Natmauk Core Subproject Affected Area



F. Project Management and Institutional Capacity Building

92. **Executing Agency (EA)**. MOAI will be the executing agency (EA) for the project and will oversee overall project implementation and management activities to ensure smooth and timely implementation and completion of project activities. The EA has overall responsibility for the project and therefore is ultimately responsible for ensuring the implementation of the mitigation in the EMP and for ensuring compliance with loan covenants. The EA will guide and coordinate closely with other government agencies and the ADB for the timely resolution of any issue and completion of the project within the target dates, expediting the procurement process, and organizing and chairing the Project Steering Committee (PSC) meetings. The EA will designate a project management unit (PMU) Director to oversee the day-to-day management of the project and liaise with all relevant government offices. The EA will also designate a Chairman of PSC that will provide overall supervision to project implementation.

93. **Project Steering Committee (PSC).** The PSC will be established by the EA. The PSC will be chaired by the designated official from the EA and composed of senior government officials. The PSC will meet quarterly to (i) approve annual budgets and plans for the project; (ii) review progress in project implementation; (iii) guide and support project implementation; and (iv)provide coordination between ministries and agencies involved in project implementation. The operational cost of the PSC will be funded by EA. ADB will attend the PSC meetings as observer, as needed.

94. **Project Management Unit (PMU)**. The PMU will be established on behalf of the executing and implementing agencies, toassume day-to-day management of the project and will be responsible for coordinating and implementing project activities, including procurement, recruitment, disbursement, contract administration, monitoring and reporting. The PMU will be headed by a Project Manager and will comprise full-time core staff. The PMU Director will guide and supervise the work of the PMU. The PMU consultants will be recruited under the guidance of the EA and ADB. The EA will approve the provision of a furnished, air conditioned/heated office space with communication and other support facilities as in-kind contribution for project implementation and management.

95. **Implementing Agency (IA)**. The ID and DOA will be the implementing agencies, and be responsible for the project outputs associated with their core missions.

96. **LIEC**. The Project will procure the services of a loan implementation environment consultant (LIEC) to provide support in (i) project implementation including updating the project EMP; (ii) training; (iii) coordinating the conduct of regular environmental compliance monitoring (air and noise) in compliance with the monitoring plan; (iv) annual project EMP progress reporting; and (v) identifying environment-related implementation issues and necessary corrective actions. The Terms of Reference for the LIEC is attached to the EMP. The LIEC will coordinate with other staff in the PMU, namely the Monitoring and Evaluation Specialist, the Loan Implementation Social Consultant and the Gender and Social Specialist.

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III. DESCRIPTION OF THE ENVIRONMENT

A. General

97. The description of the existing environment (biophysical, ecological and socio-economic) establishes (i) the environmental setting within which the project will be implemented, and (ii) the environmental values which will be changed (either negatively or positively) by the project. Both of these roles are encompassed by the concept of the "baseline" environment. The baseline environmental surveys were determined by the kinds of components proposed and the environmental parameters which were relevant to their impact assessment. The focus of the IEE is on the two core subprojects, Chaungmagyi and Natmauk.

B. Physical Setting

98. **Location.** The CDZ is part of the central plain of Myanmar, sandwiched by the mountainous zone on the west, and the highlands on the east. It spreads across three divisions (formerly regions): 1) Sagaing (Sagaing, Shwebo and Monywa districts), 2) Mandalay (Kyaukse, Myingyan, Meiktila, Yamethin and Nyang-U districts) and 3) Magway (Pakokku, Magway, Minbu and Thayet districts). The CDZ is mostly flat, with the Ayeyarwady flowing through it from north to south, but topographically inaccessible to project area. A range of hills (Bago Hills) runs parallel to the river in the southern part of the CDZ, gaining altitude towards the north and ending in southeast Mandalay. Fertile alluvial soil is found mostly along the banks of the Ayeyarwady, with Sagaing Division having largest area under alluvial soil, and Magwe Division the lowest, but these areas are not in the IAIDP subproject areas.

99. Figure III- 1 shows an overview of Myanmar topography and Figure III- 2 shows the project location for Chaungmagyi and Natmauk system.

100. The Chaungmagyi system is located in Pyawbwe Township, in Yemethin District, Mandalay Region in the CDZ. It lies between N20^{o} 20' and N20^{o} 41', and E 95^{o} 34' and 96^{o} 20'. The total area of the township is 637.82 square miles. It borders with Kalaw township of Shan State and Thazi Township of Mandalay region in the East, Yamethin Township of Mandalay Region in the South, Natmauk township of Magway Region in the West and Meiktila township of Mandalay Region in the North.

101. The Natmauk System is located in Myothit and Natmauk Townships, in Magway District, Magway Region in the CDZ. It lies between N 20^{o,} 22' and E 94^{o}, 96 '. The total area of the township is 612.68 square miles and is 33 miles from East to West and 18 miles from North to South. It borders with Yamethin township of Mandalay region in the East, Taungwin Gyi township of Magway Region in the South, Magway township of Magway Region in the West and Natmauk Township and Yenangyang Township of Magway Region in the North respectively.

Figure III- 1 Topography of Myanmar

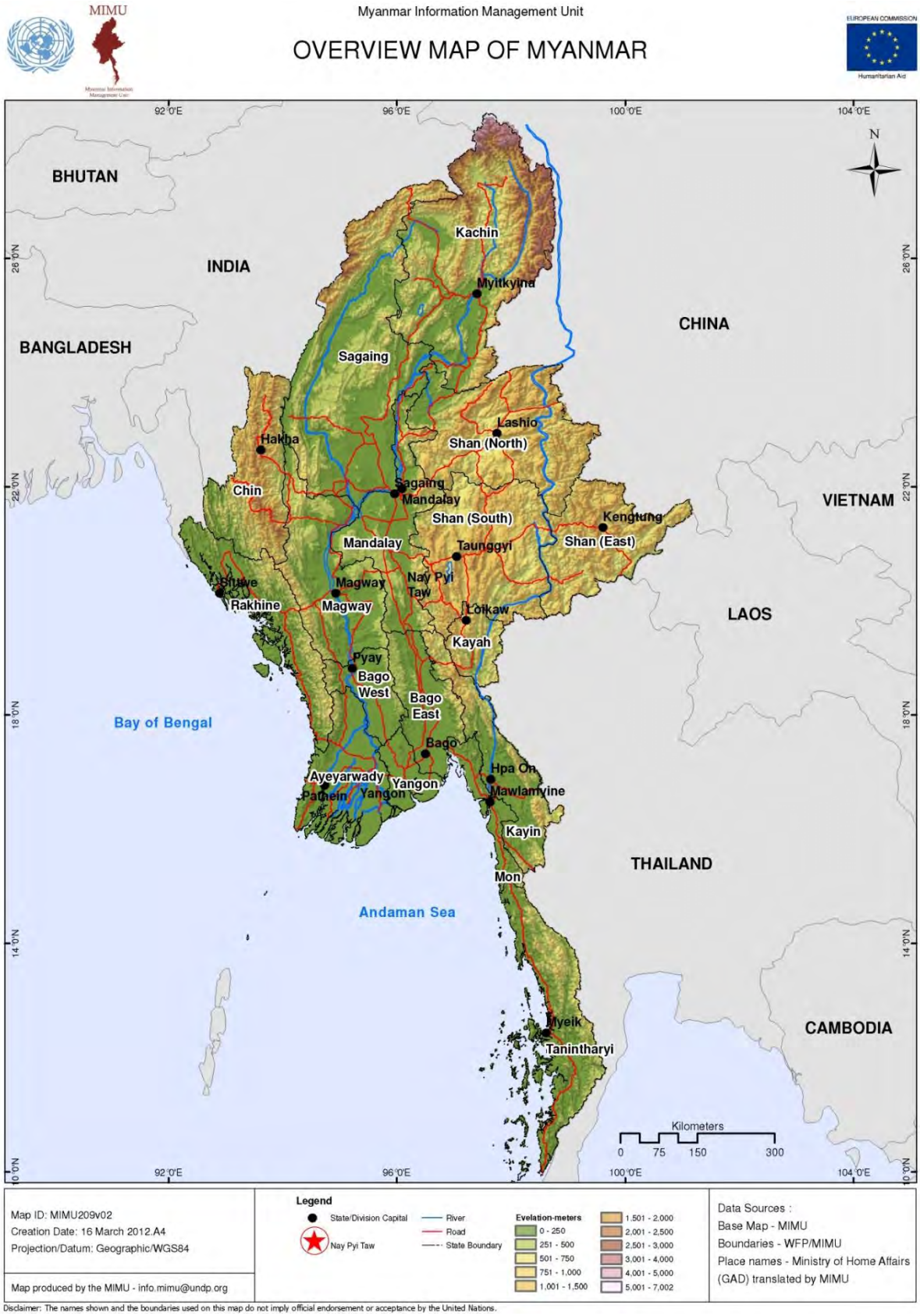
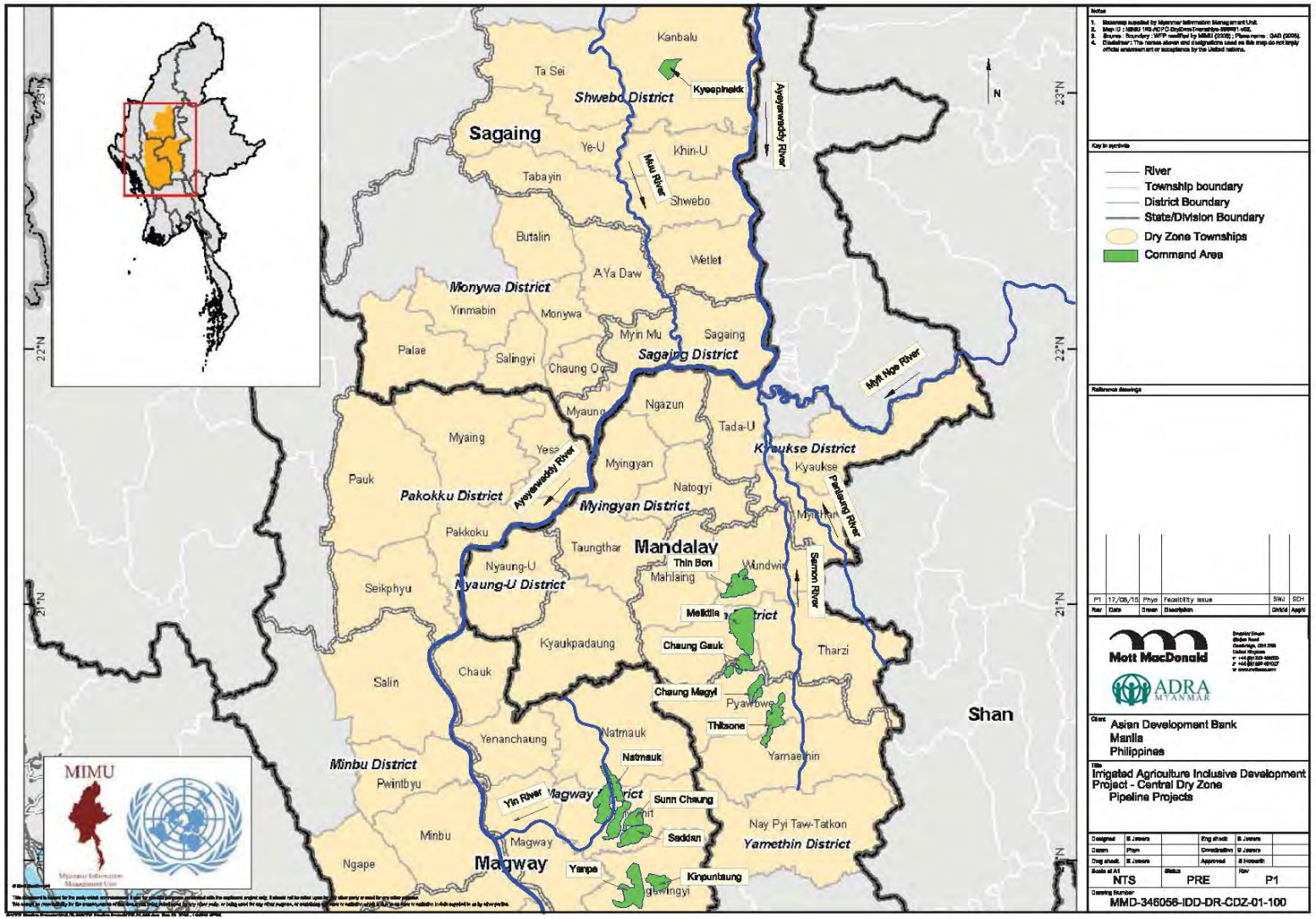


Figure III- 2 Location of Core and Pipeline Subprojects



102. **Regional topography, soil.** Soil in the core subproject areas are generally sandy and fragile and subject to high erosion potential. The Chaungmagyi system is west of Pyawbwe with its catchment in the Bago Yoma mountain ranges in the west. It lies 1001 feet ASL and Chaungmagyi stream runs through Pyawbwe Township into the Samon river in Thazi township. In addition to Chaungmagyi dam, there are eight other systems in Pyawbwe Township including Thaphan Chaung dam and Natkar dam. There are also many water resources such as Yintaw pond, Kyaukse pond, Yan Aung pond, Minthargyi pond, Ngazin pond and Yogyi pond for agricultural use and drinking purposes. A soil map of Pyawbwe Township, Mandalay Division shows the following:

- In general light forest soil – sandy and silty loam with good fertility found on gently sloping alluvial-deluvial undermountainous plains,
- Red brown forest soil – generally sandy well drained and main cultivated soil of CDZ, erodible, found in undulating relief of the hill slopes and low uplands,
- Yellow brown is generally sandy and clay loam.
- Indiang is similar to red brown but with slightly higher clay content.

103. Natmauk system, is located at the middle of township. From the east of township to Yamethin Township, Mandalay region, to the end of township boundary there are small hills. The Yin Chaung stream flows from north to south and Palin Chaung stream, Sung Chaung stream and Satong Chaung stream flow from east to west. A soil map of Myothit Township in Magway Division with Natmauk shows:

- In general light forest soil – sandy and silty loam with good fertility found on gently sloping alluvial-deluvial undermountainous plains,
- Meadow and meadow alluvial soil – generally clayey loam and silty loam.
- Red brown forest soil – generally sandy well drained and main cultivated soil of CDZ, erodible, found in undulating relief of the hill slopes and low uplands,
- Yellow brown is generally sandy and clay loam.
- Indiang is similar to red brown but with slightly higher clay content.

104. **Climate.** The climate of the CDZ can be divided into two periods—the wet season and the dry season. The wet season coincides with the southwest monsoon and lasts from May to October. The dry season is divided into "winter" (November to February) and "summer" (March to April). Mean annual rainfall in the CDZ is lower than in the rest of the country, ranging from 500 to 1000 mm. The CDZ also typically experiences a brief dry spell during the wet season in June/July. For both Chaungmagyi and Natmauk, the climate is similar, very hot and dry and low rain fall throughout the year and maximum temperature is 42 ^{o}C and minimum temperature is 14 ^{o}C. Table III- 1 shows monthly average temperatures for Mandalay.

Table III- 1 Monthly Average Temperatures in Mandalay, ^{o}C

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg 20-year temp ^{o}C
Mandalay 2002-2014 (mean max)	30.0	33.6	37.3	39.3	36.7	35.6	35.5	34.5	34.1	33.5	31.9	28.8	34.2
Mandalay 2002-2014 (mean min)	14.4	16.6	21.3	25.5	26.3	26.5	26.5	25.8	25.6	24.3	20.4	16.4	22.5

105. The CDZ is characterized by erratic rainfall. Both streamflow and food production are highly susceptible to rainfall variability. It is anticipated that climate change [See Chapter IV, F. Climate Change Assessment], in conjunction with increased population, may aggravate the imbalance between water demand and supply. Improved irrigation systems are an important

mitigatory measure for these imbalances. However, currently, there is little understanding of how rainfall is spatially distributed within the CDZ and how rainfall patterns have changed or are changing over time.

106. The monthly rainfall in Pyawbwe and Myothit is shown in Table III- 2.

Table III- 2 Monthly Rainfall (mm) In Pyawbwe (Chaungmagyi) and Myothit (Natmauk)

Township Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total mm
Pyawbwe 2002-2014	1	0	8	36	126	103	64	98	161	178	43	12	830
Myothit 2005-2014	3	0	1	16	72	147	115	164	165	185	5	9	882

107. The annual mean daily relative humidity in Mandalay and Taungdwingyi bordering Myothit Township under Natmauk system are 73% and 67%. See Table III- 3**.**

Table III- 3 Relative Humidity of Core Subproject Areas

Township Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mandalay 2005-2014	79	66	57	60	70	73	75	79	81	82	79	81	73
Taungtwingyi 2006-2014	59	49	44	46	65	79	81	83	82	81	74	67	67

108. Annual mean wind speed in Mandalay (Chaungmagyi) is 1.2 mile/hr. See Table III- 4. No equivalent data was available for the Natmauk area.

Table III- 4 Wind Speed in Core Subproject Areas

Township Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mandalay 2001-2014	0.25	0.53	1.26	1.84	1.70	2.58	2.60	1.66	1.10	0.49	0.26	0.15	1.20

109. Mean monthly sunshine hours in Mandalay (Chaungmagyi) and Taungdwingyi bordering Myothit (Natmauk) is 220. See Table III- 5**.**

Table III- 5 Sunshine Hours in Core Subproject Areas

Township Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mandalay 2001-2014	273.7	238.8	252.0	237.5	228.9	200.1	161.3	169.6	166.1	215.7	244.7	251.0	219.9
Taungtwingyi 2011-2014	275.9	254.8	260.4	249	226.3	138	158.1	142.6	186	223.2	240	244.9	220.1

110. Average evaporo-transpiration rates in Mandalay (Chaungmagyi) and Taungdwingyi bordering Myothit (Natmauk) is 3.89 inches and 3.74 mm/day respectively, according to the Penman-Monteith method. See Table III- 6**.**

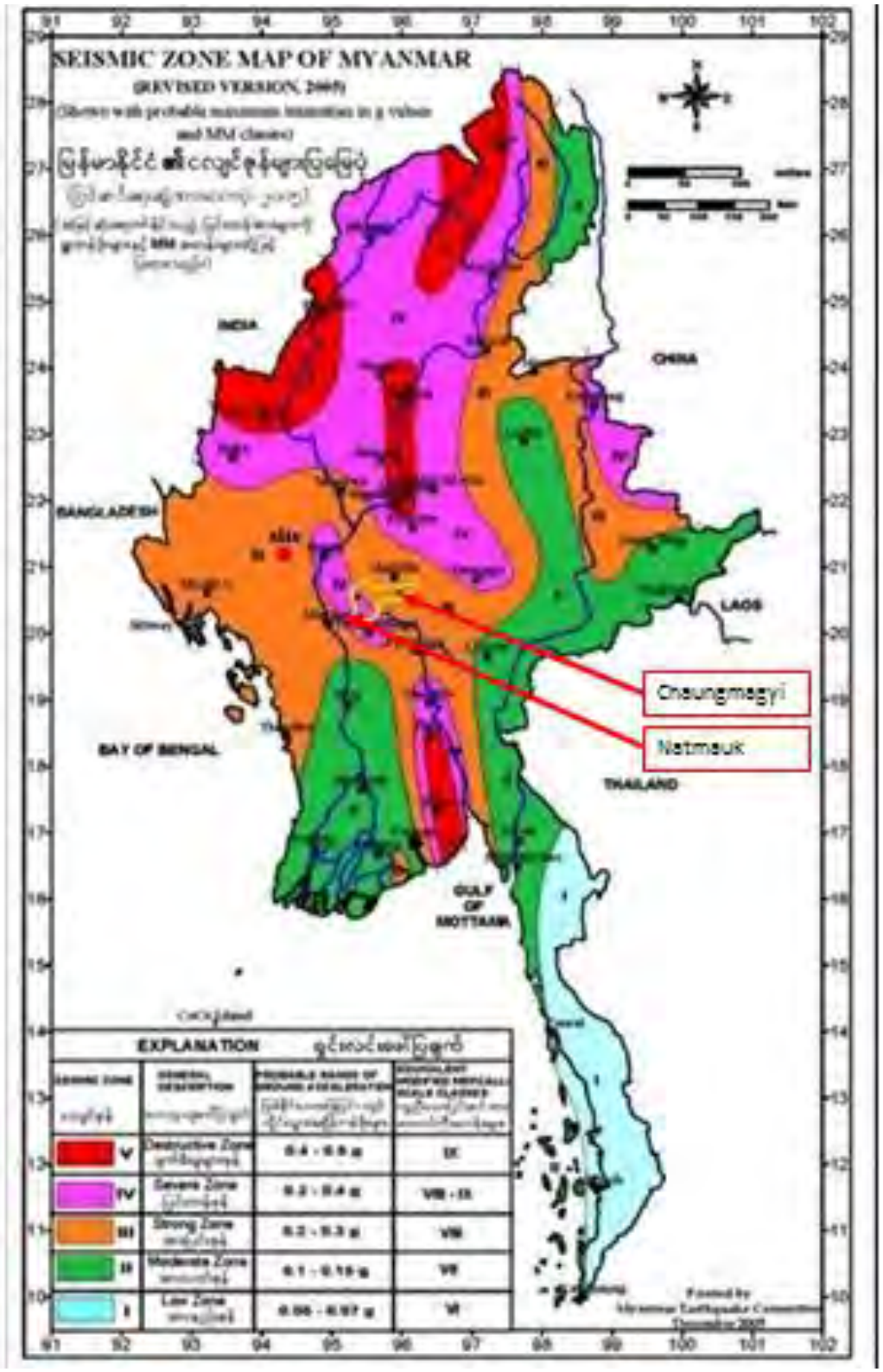
Table III- 6 Evapo-transpiration Rates of Core Subproject Areas (mm/day)

Township Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Mandalay 2001-2010	2.62	3.17	4.24	5.20	5.03	4.92	4.45	4.15	3.78	3.60	3.09	2.49	3.89
Taungdwingyi 2011-2014	2.59	3.22	4.3	5.34	4.99	4.01	3.97	3.61	3.78	3.58	3.07	2.46	3.74

111. **Seismicity.** Chaungmagyi (Pyawbwe) is located within the Seismic Zone III where the possible range of ground acceleration of earthquakes is between 0.2 g and 0.3 g. Natmauk (Myothit) is located within the Seismic Zone IV and its probable range of ground acceleration of the earthquake 0.3 g to 0.4 g. Figure III- 3 shows the seismic zones of Myanmar developed by Myanmar Earthquake Committee in December 2005.

112. Structures of required renovations and establishments should be designed in compliance with existing engineering standard in Myanmar which includes formula for consideration of preventing or reducing possible earthquake impacts in designing the proposed structures which are located in the earthquake zones.

Figure III- 3 Seismic Zones of Myanmar With Core Subproject Locations



113. **Hydrology.** Surface water in the CDZ is dominated by the Ayeyarwady River and its tributaries. The CDZ is mostly flat, with the Ayeyarwady flowing through it from north to south. A range of hills (Bago Hills) runs parallel to the river in the southern part of the CDZ, gaining altitude towards the north and ending in southeast Mandalay. Topographic constraints restrict use of Ayeyarwady for irrigation in the CDZ.

114. **Chaungmagyi surface water resources.** Water resources available to the project area comprise rainfall and releases from the Chaungmagyi reservoir. Although there is some distance between the dam and the main diversion weir, the additional catchment area is very small and runoff from it is not significant. There is a clearly-defined wet season of duration about 6 months, building to a peak in October. The average annual rainfall is 670mm. The average annual inflow is about 31,000 acre-feet. Over the catchment area of 93 square miles this represents average runoff of about 160mm, 24% of the average rainfall at the dam site. There is no information available on how the rainfall may vary across the catchment area, but this calculated runoff is reasonable and gives some confidence in the inflow series.

115. There is substantial inter-annual variability in inflows, with a minimum of less than 8,000 acre-feet in 2014 and a maximum of about 50,000 acre-feet the previous year. The very low average inflows from December to March reflect the almost complete lack of rainfall in those months. The maximum monthly inflow for any of those months within the 12-year period of data is only 430 acre-feet. On the basis of the long-term rainfall record for Mandalay, the period of available inflow data (1989-2014) appears to be reasonably representative of longer-term conditions (average annual rainfall 845mm compared to long-term 858mm).

116. **Natmauk water resources.** Water resources available to the project area is comprised of rainfall, releases from the Natmauk reservoir and runoff from the unregulated catchment between the dam and the diversion weir. For rainfall, there is a clearly-defined wet season of duration about 6 months, building to a peak in October. The average annual rainfall is 750mm. The average annual inflow to Natmauk reservoir is about 130,000 acre-feet. Over the catchment area of 433 square miles this represents average runoff of about 145mm, 19% of the average rainfall at the dam site.

117. There is substantial inter-annual variability in inflows, with a minimum of less than 40,000 acre-feet in 1997 (a known drought year in Myanmar and more widely across south-east Asia) and a maximum of about 350,000 acre-feet in 2010 when there was a major flood and the total inflow in October and November was about 80% of the annual total, and more than double the average annual inflow. The very low average inflows from December to April reflect the almost complete lack of rainfall in those months. The maximum monthly inflow for any of those months within the 20-year period of data is only 3,500 acre-feet.

118. There is no direct data on flows from the intermediate catchment between the dam and the weir. There is a limited period where flows into the two main canals can be compared to releases from the dam, though the reliability of the canal flow data is not known. The comparison suggests that on average the flow from the additional catchment more than compensates for the losses from the released water during its passage down the river to the weir. For the present analysis it is considered reasonable to assume that the additional catchment flows do compensate for the losses, but to ignore any excess since the additional flow is unregulated and high flows may not be useable.

119. **Flooding.** The existing reservoirs at Chaungmagyi and Natmauk provide a fairly good upstream protection for localized flood events in the project areas. There are some uncontrolled

cross drainages that can contribute to localized flood problems and damage to irrigation infrastructure. Good engineering design of the rehabilitated structures can mitigate concerns for these localized flooding issues.

120. In Chaungmagyi, the reservoir provides significant protection against flooding in the river downstream from the dam. In some instances the entire flood volume can be accommodated in the reservoir, giving complete protection, while in others the reservoir will spill but the peak outflow will be lower than the flow that would have occurred without the presence of the reservoir. There is insufficient data to reliably quantify the flood protection provided by the reservoir, but the limited amounts of spill in the historic record suggest that the effect is substantial.

121. In Natmauk, the reservoir also provides significant protection against flooding in the river downstream from the dam. In some instances the entire flood volume can be accommodated in the reservoir, giving complete protection, while in others the reservoir will spill but the peak outflow is likely to be lower than the flow that would have occurred without the presence of the reservoir. The latter situation can be seen in the major flood event in 2011 where the peak daily inflow of 30,000 acre-feet (15,000ft^3/s) was attenuated to a peak daily outflow of just less than 17,000 acre-feet.

122. **Environmental Flows.** Based on reservoir inflows approaching zero in the dry seasons, there are minimal low flows to support environmental resources along the drainage systems where the Chaungmagyi and Natmauk dams were constructed. During the dry season, these drainageways likely were usually dry precluding any natural ecosystems associated with waterways. There are no downstream users on the Yin River for 25 miles to the Ayeyarwady. There are some downstream users along the Samon River which flows for 100 miles to the Ayeyarwady River, although it is augmented incrementally by larger rivers draining from Shan State. Since return flows from the irrigation areas are largely reused within the same irrigation command there is unlikely to be any significant change in flows downstream of the subprojects as a result of the rehabilitation.

123. **Groundwater.** Groundwater largely occurs throughout the CDZ although useful supplies of suitable quality and cost of access cannot be found everywhere, particularly in areas underlain by aquifers of the Pegu group rocks. Main groundwater resources are located near major river courses and tributaries. While groundwater is available in varying quantities throughout the CDZ, spatial variability in water quality can constrain utilization. In some areas groundwater may be of brackish or saline quality due to natural processes. This may be due either to enrichment of rainwater by evapotranspiration concentrating the salt naturally present, or else due to salts trapped within the formations of marine origin that have not been leached by flushing since deposition. Groundwater is sometimes used in the subproject areas but quality issues limit extensive use. Much of this “groundwater” is very shallow and actually leakage from canal systems in some locations, with little use of deep groundwater resources.

C. Ecological Resources

124. For the Chaungmagyi system located in Pyawbwe Township, there are degrading nearby natural forests of Dry Lower Mixed Deciduous (DLMD) and Indaing forests with few wildlife species present. There are some ‘Non-Timber Forest Products’ such as bamboo, edible wild vegetables, fruits and orchids found in the proposed project area according to District Forest Management Plan of Yamethin. For the Natmauk System located in Myothit Township, there are nearby degraded natural forests of Dry Lower Mixed Deciduous (DLMD) and Indaing forests with few wildlife species present. There are some ‘Non-Timber Forest Products’ such as bamboo,

edible wild vegetables, fruits and orchids found in the proposed project area according to District Forest Management Plan of Magway.

125. Due to the high demand for fuelwood and timber as the population increases, nearby forests have been seriously degraded in recent years. There are minimal ecological resources in either of the core subproject areas and no sensitive or endangered species found in either of the core subproject areas or protected ecological zones.

126. A few bird species (Little Egret (Egretta *garzatta),* Cattle Egret *(Bubulcus ibis),* Shikra *(Accipiter badius),* Crested Serpent Eagle (*Spilornis cheela),* Rock Pigeon *(Columba livia)* and Spotted Owlet *(Athene brama))* can be found in the irrigated areas and canal leakage has caused small areas of wetland vegetation. The proposed project interventions do not impact use of the irrigated or adjacent areas by bird species.

D. Physical Cultural Resources

127. No cultural heritage or archaeological sites are recorded within either of the core subproject areas.

E. Socioeconomic Conditions

128. The 2015 population living in Pyawbwe Township (Chaungmagyi) is 265,594 and composed of 50,792 households. There are a total of 9 wards, 75 village tracts and 317 villages with 49,297 houses (Pyawbwe GAD report 2015 June).The 2015 population living in Myothit Township under the Natmauk system is 95,817 and it is composed of 31,482 households. There are a total of 5 wards, 47 village tracts and 169 villages with total of 31,284 houses. (Myothit GAD report 2015 June). Table III- 7 provides overview of economic sectors in the two project areas.

Table III- 7 Population and Labor Statistics of Pyawbwe and Myothit

Township	Livelihoods								Total
	Gov.Staff	Service	Agriculture	Livestock	Trading	Industry	Casual Work	Other	
Pyawbwe	2,815	874	183,273	1,612	2,042	265	5,311	69,402	265,594
Myothit	2,295	2,855	50,142	8,824	350	6,032	23,423	1,896	95,817

129. **Education.** A basic education system from primary school through high school has been established in these two townships of the core subproject areas. A total of 10 high schools, 8 middle schools, 214 primary schools and 16 monastic schools have been set up in Pyawbwe Township with total students of 193,022 and 1,300 teachers. There are insufficient teaching staff for the number of students in the township. A total of 3 high schools, 9 middle schools, 136 primary schools and 2 monastic schools have been set up in Myothit Township. Total students are 28,782 with 1,213 teachers and so the number of teaching staff is much better proportioned in Myothit Township.

130. **Poverty.** The people's socioeconomic status of these two townships is mainly relying upon the dry zone crop productivity annually. Based on the township 2015 General Administration Department (GAD) reports, the poverty rate for Pyawbwe Township is 22 % and 24.9% for Myothit Township. In addition, unemployment rate for Pyawbwe Township is 35.37 %

and 9.5 % for Myothit Township respectively. Table III- 8 provides a summary of the 2015 GAD reports;

Table III- 8 Summary of Poverty Statistics in 2015 GAD Reports

Township	Poverty			Work force		Unemployment	
	Population	poor	poverty %	Workable	At work	unemployed	% of unemployed
Pyawbwe	265,594	58,430	22	196,192	126,790	69,402	35
Myothit	160,710	40,017	24.9	105,972	95,817	10,155	9.5

F. Environmental Quality Baseline

131. Environmental baseline monitoring for surface water quality, ambient air quality, noise or soil quality is non-existent in the two core subproject areas. Based on discussions with the MOECAF ECD, there is a lack of equipment and skilled personnel for environmental testing in the country, and few testing facilities available for environmental sampling or testing.

IV. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Positive Impacts and Environmental Benefits

132. **Direct project beneficiaries**. The implementation of the Project and the development of IAIDP is expected to generate direct irrigation benefits to the core subproject areas on the basis of increases to the irrigated areas and crop yields as a result of the irrigation infrastructure development and agricultural development activities. Other benefits will additionally accrue to the agricultural activities.

133. Primary beneficiaries will be the farming and landless communities (individual farmers, farmer groups, cooperatives) in the irrigation systems in the CDZ, plus the important private sector agribusinesses which are key part of the value chains, especially those involved in input supply, post-harvest operations and marketing. It is important to note that the poor, landless and women will be particularly targeted. Staff of the ID of MOAI will also benefit.

134. Secondary beneficiaries are the GOM staff involved in extension, DOA, AMD and DAR, especially those working in the irrigation systems. Tertiary beneficiaries will be the other players in the various value chains through an improved MIS and greater awareness of the issues as regards to the development of irrigated agriculture.

135. **Positive Impacts**. With proper design and commitment, the proposed project can have positive impacts on food security, household income, health conditions, rural employment; and flood control. It should have multiplier effects on local economic development.

136. **Economic Benefits**. The IAIDP subprojects will be implemented soundly and in line with good international industry technical practices, so benefits should be felt widely. These benefits may be moderate magnitude but of high significance because they will be felt most by poor farmers.Positive economic impacts for the farming households will flow from increased agricultural productivity and some new employment opportunities, and there will be potential for other long-term economic benefits. These would include improved agricultural production on a larger scale and the potential for creating new economic activities through other allied development measures.

137. **Social and Environmental Benefits**. The project will rehabilitate dilapidated irrigation infrastructure and provide direct and indirect environmental benefits. Dangerous and non-functional infrastructure will be repaired or replaced. This will include adjacent roads and bridges which will provide safer access to nearby homes and villages. The direct benefits will include improved irrigation water management and significant training to improve the use of fertilizers and pesticides in the project area. Monitoring of potential waterlogging and other drainage issues will improve the areas downstream of the irrigation perimeters, although there are few existing problems with waterlogging or salinization. The improved cross drainage systems will eliminate localized flood risks and canal failures, as well as convey stormwater safely from nearby residents.

138. **Poverty benefits.** The Project, by its nature of improving environment and public services, is classified as general intervention regarding poverty reduction impact. The Project will not entail disparities and inequalities between the poor and non-poor for their access to the project outputs and the access to the resultant social and economic benefits. Poverty incidence in rural areas is significantly higher than in urban areas, with 85% of the poor living in rural areas. Most poor households are engaged in agricultural activities and/or have members employed as

casual laborers. The major causes of poverty in rural areas include lack of technological progress in agriculture, little value added from exports, fragmentation of farm land and lower farm incomes, small return on physical assets as a result of the low level of agricultural productivity, inadequate infrastructure support, price disincentives, and lack of diversified sources of income because of limited economic opportunities. Agriculture and rural development are essential in reducing poverty in Myanmar as most of the poor live in rural areas and depend on agriculture for their livelihood. Agricultural growth will increase the income of the rural poor both directly, through increased production and additional demand for farm labor, and indirectly, through linkages with non-farm productive activities in the rural areas. The project will address these constraints by improving irrigation infrastructure and irrigation management, and agricultural support services to increase productivity and value for agricultural products.

139. **Gender benefits.** There will be employment in construction of irrigation infrastructure and farm roads. The target will be at least 30% women laborer to be recruited for construction work in irrigation and frontline centers with receiving training on construction. Both male and female will receive equal wage for work of equal value[4] and will have access to water and sanitation facilities for women in all construction sites and all laborers receive occupational safety measures and training. Poor and disadvantaged women and men will be prioritized to get employment in this work. Women will comprise at least 40% of total participants in consultations related decision-making on irrigation system planning, design and implementation. Separate women farmers' meetings will be held to assess their prioritized needs related to location, alignment and access to irrigation infrastructure. Other detailed targets are included in the Gender Action Plan.

B. Screening and Scoping of Potential Impacts – Irrigation Component

140. **Environmental impacts related to the IAIDP.** Potential impacts (positive and negative) and risks were screened during the IEE process in order to: (i) identify the relative significance of potential impacts from the activities of the proposed infrastructure; (ii) establish the scope of the assessment which assists in focusing on major, critical, and specific impacts; and (iii) enable flexibility in regard to consideration of new issues, such as those reflecting the requirements of both the Myanmar's environmental laws, regulations and standards (draft), and ADB's Safeguard Policy Statement (2009). The core subprojects can potentially cause environmental impacts during implementation due to their location, design, construction, and operation and maintenance.

141. From the IAIDP EARF, some of the potential beneficial and adverse environmental impacts at different stages of the core subprojects (design, construction, and operation and maintenance) are presented in Table IV- 1 along with ***annotations in italics relative to IAIDP***, with '**In EMP**' indicating included in core subproject EMP, while '**for detailed design**' means principles in EMP but implementation details during detailed design stage. This is a generic table based on irrigation in general, and some of these issues are not pertinent to the IAIDP.

[4] This is not applicable to work undertaken under a quota system.

Table IV- 1 Potential Adverse Impacts and Relevant Mitigation Measures

Potential Negative Impacts of Subprojects	Relevant Mitigation Measures
Pre-Construction Stage	
Encroachment in to critical habitat or sensitive receptors and high value areas	Avoid critical habitat, sensitive receptors and high value areas while locating irrigation structures during project design. **[*Rehabilitation of existing facilities primarily*]**
Conflict with downstream water use right	Assess water use carefully and ensure that the downstream water use rights are ensured, and international water rights are not violated. ***[Return flows to same rivers and no international issues]***
Potential social conflicts and environmental impacts missed by project design.	Meaningful consultation with the stakeholders and potentially affected people (AP) will be undertaken on the potential environmental and social impacts. Special consultations with the residential community members, villagers, local water management authorities and experts will be held with regard to the possible impacts of proposed infrastructure. ***[Local consultation held in subproject areas and no issues of concern raised with project Additional consultation prescribed in each unit during detailed design].***
Lack of appropriate sizing or scale of proposed infrastructure or not meeting environmental objectives	The project scope has been carefully reviewed and optimized during PPTA based on thorough demand analyzes to make best use of natural resources, especially water and minimize other resource use and environmental impacts: ***[Completed]***
Construction Stage	
Physical Environment	
Change in land use and loss of agricultural land, forest area, and settlement areas	Minimize use of fertile land, forest, private properties, and settlement areas. Subprojects with involuntary resettlement impacts will not be eligible for funding. . ***[Rehabilitation means minimal new land involved, but RP need to be assessed during detailed design.]***
Soil erosion or contamination, and differential compaction by canal and road construction; stockpiles and spoils from earthwork during construction.	To mitigate soil erosion, contractors should prepare and implement a Site Drainage and Soil Erosion Management Plan as part of the contractor site specific EMP. ***[In EMP]***
Soil contamination may result from inappropriate transfer, storage, and disposal of petroleum products, chemicals, hazardous materials, liquids and solid waste.	The EMP should include proper transport and storage requirements for such materials. Measures such as settling ponds, silt fences and screens to prevent sediment transport should be included in the EMP as well as interception ditches, weather limitations, and sediment transport barriers. Spill containment plans should be part of the contractor site specific EMP. ***[In EMP but locations for detailed design]***
Cutting of slope, exposure of surface, and haphazard spoil disposal	Adopt cut slope angle depending upon the soil type, cover exposed areas against rain by mulching, apply bio engineering, restrict spoil disposal on slopes, drainages, agri-fields and forest areas, and manage spoil appropriately. ***[In EMP but locations for detailed design***]
Recover topsoil	Recover topsoil and store for future use in landscaping, covering spoil area or recovery of degraded agriculture land. ***[In EMP but locations for detailed design]***

Potential Negative Impacts of Subprojects	Relevant Mitigation Measures
Quarry and borrow area operation	Proper selection and management of quarry sites as approved by Engineer, rehabilitation, and vegetation of quarry / borrow area after completion of work. ***[In EMP but locations for detailed design]***
Storage of material causing drainage blockage, dust and water pollution, and safety risk	Cover material in stockpile; stockpile at safe area with drainage so as to avoid water pollution; hazardous materials will be stored at safe areas under proper fencing; oil and lubricants will be stored on impervious surface and properly disposed; recover topsoil fur future use before using area for stockpiling. ***[In EMP but locations for detailed design]***
Dust from exposed surface, from construction equipment and vehicles	Use of face mask by workers while working in dust prone areas, cover material to avoid dust generation by wind, sprinkle water where necessary, cover or wet material during transportation. ***[In EMP but locations for detailed design]***
Increase in noise level	Restrict horn near school, health posts, settlement, and forest areas. Locate crusher plant away from such areas. Provide ear plugs to workers working in high noise area. Use noise reduction devices on heavy equipment. Restrict time of construction. ***[In EMP but locations for detailed design]***
Construction waste disposal	Proper management of construction waste, prevention of leakage, and spills of construction chemicals. ***[In EMP but locations for detailed design]***
Sediment disposal from canals and structures	Ensure that sediments do not contain toxic substances (when suspected only) and dispose in approved locations and according to approved disposal plan. ***[In EMP but locations for detailed design]***
Campsite location	Locate campsite away from productive land and forest area, use local labor and local houses as camp, sign and make lease or rental payments to land owner of camp area, proper storage of chemical and materials, and proper disposal of solid waste and wastewater. ***[For detailed design***]
Crusher plant and batching plant location	Locate site away from farm/forest area, away from settlement and sensitive habitat; do not operate at night; water sprinkling to reduce dust; provide compensation to households directly affected by noise and dust of plant. ***[For detailed design***]
Biological Environment	
Cutting of trees	Cutting only essential trees, replacement of local species of tree at 1:1 ratio for every tree cleared from forest area and 1:1 for tree cleared from private land. Responsibility of guarding and raising the seedlings planted on public land will be the responsibility of WUA or village. ***[For detailed design***]
Working in or near forest areas disturbing wildlife	Work only in day time; do not disturb wildlife; make workers aware workers of the need to protect wildlife. ***[In EMP]***
Cutting of tree for cooking and heating	Supply oil for cooking and heating for labors; use local laborers to avoid requiring accommodation, promote improved stoves and bio-gas in project area, and awareness generation. ***[For detailed design***]

Potential Negative Impacts of Subprojects	Relevant Mitigation Measures
Disturbance to endangered and protected wildlife	Compensatory plantation, protect wildlife; do not use horn in forest area, do not work at night in forest areas, and restrict construction crew to harm or kill wildlife. ***[In EMP]***
Socio-Economic Environment	
Loss of agriculture land	Minimize productive land acquisition through alignment and work site selection. Increase productivity and production by agriculture extension, crop diversification and commercialization. ***[For detailed design***]
Loss of private property and displacement of people	Subprojects with no resettlement or involuntary land acquisition will be prioritized. ***[For detailed design***]
Loss/damage of community infrastructure	Restoration or relocation of affected infrastructures in consultation with the local stakeholders without causing hardship to the users. ***[For detailed design]***
Risks of accidents, health risks, injuries / emergency situations, unsanitary camp environment	Prepare occupational health and safety plan. Detailed list of requirements of plan in EMP and establishing and health and safety officer by contractors. ***[In EMP but locations for detailed design]***
Potential conflicts with local communities, increase in consumption of alcohol, prostitution, gambling and crime.	Vigilance, motivation, awareness training to construction workers and local people; provide entertainment facilities to construction workers within camps where necessary; maintain good personal relations with local communities and; respect local culture. Use local laborers to extent possible to minimize need for camps. ***[For detailed design***]
Operation Stage	
Physical Environment	
Soil erosion and slides	Regular maintenance of slope protection structures, appropriate upland farming techniques ***[In EMP]***
Water logging	Regular maintenance of drainage ***[In EMP]***
Risk of accidents	Proper safety structures are provided in settlement areas; fencing of canal structure ***[In EMP but locations for detailed design]***
Sedimentation of canal	Annual cleaning of canal; proper management of removed sediments ***[In EMP but locations for detailed design]***
Soil fertility degradation	Use right type and amount of fertilizer and pesticide, use organic soil conditioner ***[In EMP]***
Biological Environment	
Increase in population resulting into accelerated logging and encroachments	Enforcement of law, vigilance and monitoring, promote bio-gas, LPG, and solar energy. ***[For detailed design***]
Low flow in river affecting aquatic vegetation and fish population	Release of minimum environmental flow in river, and restrict illegal fishing. [***Not applicable, since the natural condition was dry during the dry season]***
Disturbance to wildlife movement pathway due to canal operation in wildlife corridors	Awareness generation to farmers on importance of co-existence with wildlife, and provide wildlife crossings. ***[In EMP]***

Potential Negative Impacts of Subprojects	Relevant Mitigation Measures
Socio-Economic Environment	
Agriculture productivity	Link WUGs with improved agricultural practices. Support farmers with access to improved seed, agriculture inputs and markets. Increase productivity by judicious use of water by enhancing efficiency through on farm water management practices. ***[In Agriculture component]***
Institutionalization of water management groups	Support WUG to perform their function as per their requirements; assist them in their emerging legal status and in evolving to multifunction. ***[In Agriculture component]***
Encroachment of right of way of canal	Awareness program, enforcement of property lines, plant trees in right of way. ***[For detailed design***]
Difficulty in movement of people and separation of community	Provide culverts or bridges as required in consultation with communities ***[For detailed design***]
Safety	Use proper safety measures to prevent accidents at risky locations. Fence dangerous areas of canal. ***[For detailed design***]

142. **Potential Construction Phase Impacts**. Since exact locations of the rehabilitations and associated works such as borrow pits and dump sites are not yet known, the possibility of either temporary or permanent relocation will have to be assessed during detailed design. If necessary a Resettlement Plan (RP) will be prepared and implemented prior to construction. There is a Resettlement and Ethnic Group Framework (REGF) which orients how a resettlement plan is decided on, prepared and implemented. Permanent land acquisition is considered unlikely according to the REGF.

143. Some of the works will also generate temporary and localized known construction impacts related primarily to air pollution/dust, noise, vibration, and access restriction; improper disposal of construction related waste; temporary pollution of soil and surface waters due to accidental spillage of fuel from construction activities; safety hazards including worker safety; damage to natural habitats, aquatic fauna, or existing vegetation. Most of these impacts a can be prevented or reduced to acceptable levels by applying good international construction practices and planning. It is noted that the proposed project improvements relate primarily if not exclusively to rehabilitation of existing irrigation and support facilities, so the aspects of siting and location are not necessarily relevant.

144. **Potential Operation Phase Impacts.** Typical generic long term impacts from operation of irrigation activities may include those related to low flow regime (declining flows for downstream users if irrigation efficiency is increased); flood risk if cross-drainage works are not adequately maintained; greenhouse gas (GHG) emissions if paddy area increases (likely decreasing in IAIDP); soil salinity and decline of soil fertility if irrigation is mis-managed; soil erosion and water logging; stream morphology changes; sedimentation; and increase of pests and weeds (all risks which may increase if irrigation is mis-managed). These impacts may occur under the present regime with old poorly-performing irrigation systems. An objective of the project is to reduce these risks.

145. When an irrigation area is increased by a proposed project, some loss of summer grazing on stubble could occur. The project can promote using irrigated or rainfed land to produce fodder, which can be used for pen-fed feeding of livestock. Also, excessive use of fertilizer and pesticide by farmers is a safety issue for the farmers and may impact the quality of water that drains from agriculture field to adjacent natural watercourses or the groundwater impacting long term drinking water sources located in the project sites.

146. Potential impacts of the infrastructure component for IAIDP operation phase may include soil erosion, waterlogging and potential salinization due to insufficient drainage systems, potential water quality, soil quality and health impacts of overuse of fertilizers and pesticides, canal sedimentation, and safety issues. The IAIDP has been designed to minimize these risks, through its two main components: irrigation infrastructure and management (Supplementary Document 2); and agriculture (Supplementary Document 3). These impacts may also occur as a result of the existing infrastructure which is in poor condition. Although some risks may increase as a result of agricultural intensification, intensive programmes for capacity building in both irrigation management and agricultural components will reduce the risks to below the current level. Improvements to infrastructure will reduce other risks, such as those caused by inadequate cross-drainage.

147. The following sections describe the adverse environmental impacts in detail. Design, construction and operational phase impacts are considered separately.

C. Measures During Project Design And Pre-Construction Phase

148. **Environmental considerations during project design.** A number of measures have been used during the preparation of the IAIDP to improve project characteristics and ensure its environmental sustainability. These measures are discussed below:

(i) The project scope was carefully reviewed and optimized during PPTA to minimize use of natural resources and environmental impacts.
(ii) Meaningful consultation with the stakeholders and potentially affected people (AP) has been undertaken on the potential environmental and social impacts. Special consultations with the residential community members, villagers, local irrigation management authorities and experts were held with regard to the possible impacts of proposed IAIDP infrastructure, with no significant issues raised.
(iii) The GEF pilot program is being included into project design and pilot program results will be integrated into detailed design of IAIDP components.

149. **Measures during pre-construction.** A number of environmental management measures will be implemented in the pre-construction phase (including detailed design) to ensure project's environment management readiness. These include:

(i) Institutional strengthening, including (a) hiring of loan implementation environment consultant (LIEC) within loan administration consultant services by the PMU; and (b) contracting of environmental monitoring entity by the IAs to conduct environment impact monitoring including developing detailed monitoring plan on the basis of the monitoring plan defined in EMP.
(ii) Updating EMP: Mitigation measures defined in this EMP will be updated based on detailed design. This will be the responsibility of the EA.

(iii) Temporary or permanent resettlement. This will be the responsibility of the EA and a resettlement plan will be produced if determined necessary during detailed design. If required, it will also be implemented prior to commencement of construction in the affected areas.
(iv) Contract documents: EMP obligations will be included in tender documents and specifications, referencing the EMP and monitoring plan. This will be the responsibility of the EA.
(v) Environmental Protection Training: Per detailed training program, the LIEC will provide environmental training to the PMU and IAs, while the LIEC and IAs will provided training on EMP requirements to contractors.
(vi) Grievance Redress Mechanism (GRM): The GRM will be adjusted and/or confirmed, and made operational prior to construction. This will be the responsibility of PMU, with support of the LIEC and LISC, and be in place prior to construction.
(vii) Contractor Site-EMP: Following the award of contracts of construction, the contractor will prepare a Contractor EMP (C-EMP), including an emergency preparedness and response plan for construction emergencies and a site environmental health and safety plan, for clearance by IAs.
(viii) Measures to ensure canal operations can be continued during construction phase to the extent practical, if it is anticipated that construction cannot be completed during non-irrigation season.
(ix) Additional consultation with residents and other stakeholders based on detailed design plans.

150. **Utilities Provision**. It is not anticipated that the project will disrupt utilities or any municipal services during construction. The concerned Contractors will consult with relevant departments to check location of utilities in advance of construction at all sites.

D. Environmental Impacts and Mitigation Measures during Construction – Irrigation Component

151. **Resettlement.** The Resettlement and Ethnic Group Framework identifies that subprojects with involuntary resettlement impacts will not be eligible for funding through the Project. All land acquisition will be done with land agreements based on negotiated settlement or voluntary donation.

152. Minor land acquisition in subprojects throughout construction is anticipated. At a minimum, temporary land use will be required for storing construction materials and equipment in different places and at different times during the construction period. Most of the land use will be within rights of way. Minor creation of tracks is foreseen alongside the canals within the rights of way. In some places farms may be using portions of the rights of way for farming and such crops will be affected. In some cases, small areas of land outside of the rights of way may be temporarily needed.

153. The Project will acquire land for the subprojects in an amicable and transparent manner with land owners and users so that involuntary resettlement impacts are avoided. Currently the exact locations are unknown for where land will be required for the core subproject interventions. Details such as the amount of land required, the duration of the land use, and what proportion the land take would be of total land holdings, cannot be currently ascertained because there are no detailed designs. During detailed design, land acquisition requirements will be integrated into decisions about working sites. Noticeable environmental and social constraints such as trees of

value, bus stops, and others can be avoided in the selection of work sites. Efforts can be made to deal with land owners who indicate a predisposition to negotiate and collaborate with the Project.

154. The REGF provides guidance on screening and categorizing land acquisition activities, including the completion of a resettlement checklist and due diligence report, and on monitoring to ensure that land agreements are completed voluntarily. In the in the event that unanticipated involuntary resettlement impacts are found during Project implementation, it does provide guidance for preparing and implementing a resettlement plan in accordance with ADB's 2009 Safeguard Policy Statement.

155. **Impacts on soil.** During construction, the infrastructure components could affect the soil in the project areas through erosion, contamination, and differential compaction. Soil erosion may be caused by roadbed construction; excavation of trenches; stockpiles and spoil from earthwork during construction of infrastructure. Soil contamination may result from inappropriate transfer, storage, and disposal of petroleum products, chemicals, hazardous materials, liquids and solid waste. Borrow and soil disposal locations are included. Table IV- 2 provides preliminary estimates of earthworks in the core subproject areas:

Table IV- 2 Preliminary Estimates of Earthworks in Core Subproject Areas

Item	Chaungmagyi	Natmauk
	Thousand Cubic Feet	
Earthwork excavation, stockpile for reuse (no haulage)	540	1,700
Earthwork excavation and dispose (haulage not exceeding 750 ft)	3,600	16,300
Earthfill, reuse of stockpiled material (no haulage), including compaction	450	1,600
Earthfill, from borrow area (haulage not exceeding 2,000 ft), including compaction	2,600	2,600
Fill, including compaction (with 2000' haulage)	100	100
Excavation and Earth Filling in Tertiary Units	670	4,700

156. **Site Drainage and Soil Erosion Protection Plan.** To mitigate soil erosion, contractors implement the Site Soil Erosion Protection Plan as part of the C-EMP according to the engineering and vegetation measures defined in the EMP. The Plan will include the following measures for control of soil erosion due to construction activities:

a) Surplus earth shall be used for filling at sites defined in plans*;*
b) Excavation width and depth should be minimized to reduce spoil generation. Duration of open trenches should be minimized, and backfill should commence immediately after completion;
c) Use settling ponds, silt fences and screens to prevent sediment transport;
d) Construct intercepting ditches and drains to prevent runoff entering construction sites, and divert runoff from sites to existing drainage;
e) Strip and stockpile topsoil, and cover or seed temporary soil stockpiles; graded soil must be separately stockpiled from other materials and be readily recoverable for reinstatement;
f) Limit construction and material handling during periods of rains and high winds;
g) Properly slope or re-vegetate disturbed surfaces, such as compacted trenches and cut banks;
h) Slope stability must be undertaken and drains and sediment barriers must be installed as necessary and maintained until final reinstatement is completed; and

i) Appropriately set up temporary construction camps and storage areas to minimize the land area required and impact on soil erosion.

157. **Strengthen inspection and monitoring of soil erosion**. Internal soil erosion inspection and monitoring will be conducted by the IAs. The internal and compliance inspection and monitoring results will be submitted to the LIEC to serve as basis for project implementation progress reports and acceptance of construction.

158. Mitigation measures for **soil contamination control** include the following:

a) Properly store petroleum products, hazardous materials and wastes on impermeable surfaces in secured and covered areas, and use the best management practice to avoid soil contamination;
b) Remove all construction wastes from the site to approved waste disposal sites;
c) Establish emergency preparedness and response plan; and
d) Provide spill cleanup measures and equipment at each construction site and require contractors to conduct training in emergency spill response procedures.

159. **Impacts on Hydrology and Water Quality.** The proposed infrastructure components are not expected to cause significant impacts on hydrology and water quality, but the measures for construction site management described below are proposed in the project EMP. All items will be covered in the Water Quality Control Plan as part of C-EMP.

160. **Surface water and groundwater pollution**. Inappropriate storage and handling of petroleum products and hazardous materials, or accidental spills, disposal of domestic wastewater from construction camps, and wash-down water from construction equipment and vehicles may contaminate adjacent surface water or groundwater resources. Infrastructure can disturb surface soils and could affect surface water in the project area through increased sedimentation of the minor streams. Wastewater produced during construction will come from washing aggregates, pouring and curing concrete, wastewater from maintenance and cleaning of mechanical equipment and vehicles.

161. **Water Quality Control Plan.** In addition to the drainage measures outlined above related to soil erosion, this plan will be part of C-EMP and include the following:

a) Contractors will be required to develop and implement contingency plans for control of spills of oil and other hazardous substances (Spill Management Plan);
b) Enclosed drainage around chemical storage areas on construction sites and storage will be on hard surfaces;
c) Fuel storage, maintenance shop and vehicle cleaning areas must be stationed at least 300 m away from the nearest water body and will include enclosed drainage to ensure contaminated water does not cause pollution and storage, maintenance and cleaning activities will be on hard surfaces;
d) Construction wastes and materials (e.g. fuel) will be properly contained during construction on hard surface and fuel tanks will be located in a bunded area which has a capacity of 110% of the fuel tank. Wastes will be stored on hard surface which is protected from rain and wind and waste removed from site and taken to approved disposal facilities;
e) Wastewater collected at construction sites or camps should be put into installed onsite treatment or holding systems.

162. **Air Quality**. Moderate temporary air quality impacts during the construction stage of the project could be anticipated because of fugitive dust generation at construction sites. Minor increases in the level of nitrogen oxides (NOx) and sulphur oxides (SOx) from construction plant and machinery are expected. [Refer to World Bank EHS Guidelines of 2012 for guideline values.] Air quality impacts during construction are likely to result from the following sources:

a) Emissions from construction machinery and equipment, movement of haulage trucks to all construction sites;
b) Fugitive dust and odor from concrete batching plants required for construction or other plant for manufacture of pavement surfaces;
c) Fugitive dust from earthworks such as establishment and use of borrow pits, and back-filling activities;
d) Fugitive dust from loading, unloading and haulage of spoil for disposal; and
e) Dust created by wind acting on unprotected surfaces.

163. The key receptor for air quality impacts is people, who would need to be near the construction works before an impact will occur as the impacts will be localized. There are many small villages near and inside the irrigation perimeters, but is unlikely that many will be found directly adjacent to the rehabilitation sites. During detailed design, potential conflicts with nearby residents will be identified.

164. **Mitigation of impacts to air quality**. The mitigation measures to protect sensitive receptors from air quality issues are:

a) Stockpiles must be managed to reduce dust emissions. The location of the stockpiles must be downwind of sensitive receptors. The stockpiles must be sprayed with water before material is moved. If a stockpile is within 300m of dwellings, additional precautions must be taken including using a reusable stockpile cover and fencing to form a high barrier and prevent wind lifting and dispersing;
b) Construction site management: Water will be sprayed on construction sites and material handling routes where fugitive dust is generated.
c) Transport of materials: Trucks carrying earth, sand or stone will be covered with tarpaulins or other suitable cover. Construction vehicles and machinery will be maintained to a high standard to minimize emissions (note that local standards do not exist for vehicle emissions)
d) Manufacturing plants: Site any plants for the production of concrete or pavement covering such as asphalt at least 500 m from the nearest dwelling and locate downwind.

165. With the above mitigation measures implemented properly, the impact during construction on air quality is anticipated to be acceptable.

166. **Waste management and resource use.** Minimizing waste conserves valuable natural resources. Disposal of construction wastes could have adverse impacts on soil, water and health of contractors and the community. Waste streams will include inert construction wastes (e.g. soil, spoil, debris, concrete) and municipal type wastes (construction workers' food and packaging wastes from construction consumables). Hazardous waste may include fuel containers, oil filters, and oily rags.

167. **Mitigation of impacts from solid waste and resource use.** The potential impacts arising from solid and liquid waste production and disposal will be mitigated through a number of

activities defined in the EMP, and which will be incorporated in the bid documents and construction contracts, and incorporated into the C-EMP:

a) Waste hierarchy: Construction will be subject to the waste hierarchy to ensure efficient use and management of resources. The preference is for prevention of waste at source. This means the effective management of materials on site through good house-keeping and work planning, in order to generate less waste. Waste minimization is the second preferred option. Reuse or recycling options should be considered prior to disposal, separate containers for recyclables shall be used if there is a market for the materials. Disposal of waste which cannot be reused or recycled shall take place at sites authorized by the local authorities.
b) Storage and containment: Provide appropriate waste storage containers for worker's construction wastes; install confined storage points of solid and liquid wastes away from sensitive receptors, regularly haul to an approved disposal facility;
c) Use of contractors: Use a contractor approved by the local authorities to remove all wastes from construction sites;
d) Spoil management: Spoil will be disposed only in sites which are defined in the Borrow and Spoil Management Plan; spoil will not be disposed of on slopes or near pasture land where it may impact on vegetation; rehabilitate and restore spoil disposal sites in accordance with the agreed plan.
e) General Management: Prohibit burning of waste at all times.

168. Contractors will be required cover these issues in a Solid Waste Transport and Disposal Plan as part of their C-EMP, in consultation with the IAs.

169. **Impact on Biological Resources.** The potential impact of construction activities on biological resources is anticipated to be minimal as the environmental baseline showed a lack of significant flora and fauna in the project areas. The measures defined under mitigations of impacts on soil and mitigation on surface and groundwater will effectively protect ecological resources during construction activities.

a) Protect existing vegetation near construction sites;
b) Properly backfill, compact and re-vegetate excavations after installation;
c) Protect existing trees and grassland during constructions; where a tree has to be removed or an area of grassland disturbed, replant trees and re-vegetate the area immediately after construction;
d) Only native plant species of local prevalence will be used for re-vegetation; and
e) Identify, demarcate and protect sites where small animals, reptiles, and birds of common species live such as vegetated roadside areas, trees, inner areas of bridges and river riparian zones, etc.

170. **Cultural Resources.** There are no known cultural resources near the proposed project sites but provisions will be included on handling any cultural resources that might be uncovered incidentally during construction. If paleontological fossils are encountered during construction, all activities will halt and an established action plan will be implemented (notification of local administration and Environmental Conservation Department). Works will recommence only after appropriate measures have been taken as requested by the appropriate authority, and confirmation has been received from them that works may resume.

171. **Health and safety.** Health and safety risks to include noise, dust, construction site safety, traffic safety, as well as occupational health and safety. Dust control is discussed in air quality section. Other health and safety risks are discussed below.

172. **Noise.** The major sources of noise pollution near the project area the general movement of construction vehicles, rollers during re-surfacing, the haulage of construction materials to the construction sites and the use of generators. [Refer to World Bank EHS Guidelines of 2012 which call for residential daytime maximum of 55 dBA and 45 dBA at night, but operations should not be occurring at night.]

173. Construction activities are expected to produce noise levels up to 90 dB (A) within 5m of the construction machinery. For the project, no receptors other than construction workers will be this close to the machinery, and construction workers will use appropriate Personal Protective Equipment (PPE).

174. **Construction noise mitigation.** The potential noise impacts will be mitigated through a number of activities defined in the EMP, which will be incorporated in the bid documents and construction contracts, and verified during monitoring of the implementation of C-EMP:

a) Source control: Maintain all exhaust systems in good working order; undertake regular equipment maintenance;
b) Locate sites for concrete-mixing and similar activities at least 300 m away from sensitive areas;
c) Operate between 8am-6pm only and reach an agreement with nearby residents (few structures or residents are likely based on PPTA but requires verification) regarding the timing of heavy machinery work, to avoid any unnecessary disturbances;
d) Provide advance warning to the community, including residents, school, temple and health facility on timing of noisy activities; seek suggestions from community members to reduce noise annoyance; provide public notification of how construction and operations will incorporate noise considerations; and, disseminate the Grievance Redress Mechanism for handling of noise complaints.;
e) Ensure noise monitoring is undertaken near sensitive receptors, particularly dwellings, temple, school and hospital;
f) All construction workers to use appropriate Personal Protective Equipment (PPE) for high volume noise or lengthy impacts.

175. Issues relating to **construction site safety** can be mitigated as follows:

a) Temporary traffic management, road safety awareness measures employed.
b) Construction site safety: Clear signs will be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials and excavation and raising awareness on safety issues. Heavy machinery will not be used after day light and all such equipment will be returned to its overnight storage area/position before night. All sites will be made secure, discouraging access by members of the public or their animals through fencing or security personnel, whenever appropriate.

176. **Occupational Health and Safety.** Civil works contractors will implement adequate precautions to protect the health and safety of construction workers. The occupational health and safety risks will be managed by applying measures in the following order of preference: avoiding, controlling, minimizing hazards, and providing adequate protective equipment. The contractors will undertake the following activities:

a) Environment Health and Safety Officer: An Environment Health and Safety Officer (EHSO) will be employed to develop, implement and supervise a Health and Safety Management Plan (HSMP), as well as to ensure that the requirements of the EMP are implemented.

b) Implementation of HSMP: The EHSO will ensure that the HSMP is approved and implemented. This includes recording and reporting any occupational health and safety incidents, and reviewing the distribution and use of appropriate Personal Protective Equipment (PPE) and proper training is conducted. At a minimum, the HSMP will include the following provisions:

i. *Clean water.* Provide a clean and sufficient supply of fresh water, for construction and for all houses, camps, offices, laboratories and workshops.
ii. *Sewage and wastewater.* Provide adequate sanitation facilities at all work sites.
iii. *Solid waste.* Provide garbage receptacles at construction sites, which will be periodically cleared and disinfected, properly segregated per waste plan.
iv. *Liquid chemical waste.* Provide receptacles in suitably bunded areas for the storage of liquid chemical waste prior to disposal. Include clear warnings with health risks.
v. *Personal protection.* Provide personal protection equipment (PPE), such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection, in accordance with relevant health and safety regulations, for workers.
vi. *Emergency Preparedness and Response.* An emergency response plan to take actions on accidents and emergencies, including public health emergencies associated with hazardous material spills and similar events will be prepared. Emergency phone contacts will be established.
vii. *Records Management.* A Records Management System that will store and maintain easily retrievable records protected against loss or damage should be established. It will include documenting and reporting occupational accidents, diseases, and incidents. The records will be reviewed during compliance monitoring and audits.
viii. *Safety communication.* Ensure that safety, rescue and health matters are given a high degree of publicity to all persons regularly or occasionally at active construction sites. Posters in Burmese and any local languages drawing attention to relevant health regulations will be made or obtained from the appropriate sources and will be displayed prominently at construction sites.

177. **Temporary Canal Closures.** When construction cannot be accomplished during non-operation periods and canal operations must be maintained, construct temporary bypass arrangements to maintain canal operations during construction.

178. **Other Social Issues.** No other social risks and/or vulnerability are anticipated as a result of the project. The project construction workers will be engaged locally. Prevention and control of transmissible diseases and HIV/AIDS, and community disturbance training and sensitization will be provided to the contractors, as well as drug and human trafficking education will be provided to the local communities, ensured in the loan assurances and monitored in the social action plans. Core labor standards will be implemented. Civil works contracts will stipulate priorities to (i) employ local people for works, (ii) ensure equal opportunities for women and men; (iii) pay equal wages for work of equal value, and pay women's wages directly to them; and (iv) not employ child or forced labor. Specific targets for employment have been included in the IAIDP gender action plan (GAP).

179. All subprojects will be screened for presence of ethnic groups, in accordance with the Resettlement and Ethnic Group Framework. Chaungmagyi and Natmauk have already been screened and no ethnic groups identified. For IAIDP, it is not anticipated that any ethnic group will be negatively affected or disproportionately required to provide land for the project. Rather, the Project will be providing benefits to all households in the form of water access in the

irrigation system area and agricultural development across the township, be they of average, better or lower income, be they an identified ethnic group or not. Nonetheless, while the participation and involvement of all beneficiaries will be promoted, if ethnic groups meet the ADB indigenous people criteria, an ethnic groups plan will be developed with meaningful consultation and direct participation. The REGF provides guidance on the plan contents and the procedures for its preparation, implementation and monitoring.

E. Environmental Impacts and Mitigation Measures during Operations – Irrigation Component

180. **Changes in Groundwater Hydrology.** The application of the irrigation water in the project area could recharge the groundwater of the core subproject vicinity and the groundwater table could rise. But any substantial change in groundwater hydrology is unlikely because the subproject area is already receiving irrigation water and the project will better utilize and distribute the available irrigation water. Changes in groundwater levels will be regularly monitored by the ID.

181. **Drainage Systems.** There are few formal drainage systems in the core subproject areas but the topography and natural drainage minimizes the risks of waterlogging; where necessary drainage infrastructure will be included in the detailed design. There could be small existing areas of salinization due to insufficient drainage systems but the project should not significantly exacerbate these existing problems. Changes in waterlogging downstream of perimeters will be monitored by the ID.

182. **Canal Sedimentation**. Sediment controls are being designed as part of the system rehabilitations. The ID will prepare an operations and maintenance plan to include regular maintenance and removal of deposited sediment. The plan should cover the determination and approval for disposal sites for the removed sediment. The GEF project will provide recommendations for improving watershed characteristics to reduce sediment contribution to the canals.

183. **Hazards associated with the Use of Toxic Chemicals.** Pesticides are toxic chemicals that would be used in the agricultural crops to control insects. From the focused group discussion with the farmers, they seemed to be aware of the toxicity of the pesticides. Use of pesticides in the subproject area is minimum due to cost.

184. Farmers should receive IPM (integrated pest management) training to train the farmers in pest management without the use of pesticides, which can be part of Agriculture component training.

185. **Hazards associated with the Use of Mineral Fertilizer.** The farmers have been using few chemical fertilizers in the crops due to cost. The project intends to carry out training in the crops cultivation to increase the crops yield. Hence the use of chemical fertilizers could increase with project implementation.

186. Given the proper training programs proposed under the Agriculture component, the application doses can be managed to be optimal for the crops without creating any hazard.

187. **Risks of Flooding and Natural Disasters.** The core subproject design will meet all safety standards on prevention of flooding, storms and other potential natural calamity. Maintenance of irrigation works will ensure that regular maintenance will be scheduled for the

works to ensure the operation capacity and that needed repairs are done quickly. Flood damage potential should be reduced by the project.

188. **Canal Safety.** The ID will provide an operations plan with standards for access roads and public access in the perimeters that includes safety measures to protect the public at settlement areas and other dangerous locations in the perimeters, including culverts and other locations. Public education on risks should also be provided.

189. **Agricultural Wastes.** The Agriculture component will provide training on systems to minimize and/or properly dispose of agricultural wastes in an environmentally sound manner.

F. Climate Change and Vulnerability Assessment

190. **Greenhouse Gas Emissions.** Net greenhouse gas emissions from the project will derive from GHGs emitted by agricultural activities – in particular the CH_4, N_2O and CO_2 emissions from rice paddy flooding and cultivation. However, there will not be any significant increase in paddy and agricultural diversification will be promoted. In any case, based on the size of the IAIDP subproject areas, the total GHG emissions will be well below the threshold of 100,000 tons/annum of the ADB SPS 2009. No detailed assessment was performed and no further monitoring is required.

191. **Climate.** The climate of the CDZ can be divided into two periods—the wet season and the dry season. The wet season coincides with the southwest monsoon and lasts from May to October. The dry season is divided into “winter” (November to February) and “summer” (March to April). Mean annual rainfall in the CDZ is lower than in the rest of the country, ranging from 500 to 1000 mm. The CDZ also typically experiences a brief dry spell during the wet season in June/July. The CDZ is characterized by erratic rainfall. Both streamflow and food production are highly susceptible to rainfall variability. It is anticipated that climate change, in conjunction with increased population, may aggravate the imbalance between water demand and supply. However, currently, there is little understanding of how rainfall is spatially distributed within the CDZ and how rainfall patterns have changed or are changing over time.

192. **Local Hydrology**. As noted earlier, water resources available to both the Chaungmagyi and Natmauk core project areas comprise rainfall, releases from the upstream reservoirs and runoff from the unregulated catchments between the dam and the diversion weirs. For rainfall, there is a clearly-defined wet season of duration about 6 months, building to a peak in October. The average annual rainfall is 750mm. There is substantial inter-annual variability in inflows. The very low average inflows from December to April reflect the almost complete lack of rainfall in those months.

193. **Flooding and Extreme Weather Events.** Flooding is a regular phenomenon in Myanmar. Hydro-meteorological hazards have impacted food security of many provinces in Myanmar in the past, and are probably the main triggers. Many of the major floods were coastal in nature from tropical storms, but the CDZ is also impacted. Most of the food insecure zones have rated drought as the major agricultural production problem in the CDZ assessment carried out by WFP (2011).

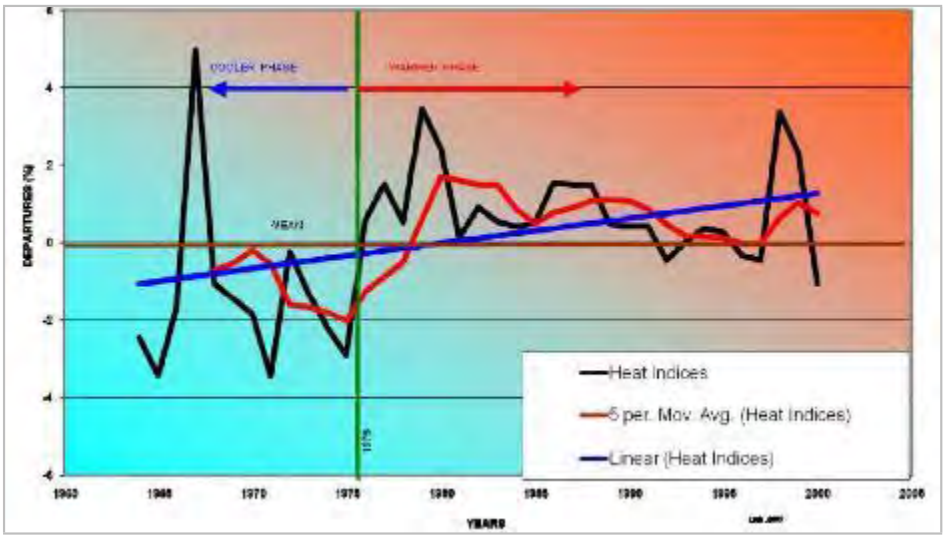
194. Myanmar is exposed to the threats of cyclones and associated surge in the sea-water which cause damage to the coastal areas. The damages were particularly severe in case of Cyclone Nargis. Based on historical records, only about 6.4% (ADPC, 2009) of the cyclones that form in the Bay of Bengal reach or cross the Myanmar coast. Evidences of changes in the

long-term cyclone frequencies are unclear at present, but any increase in frequency can also impact the CDZ. Severe damages were experienced in Myanmar during 2015.

195. **Climate variability, projected climatic changes.** In 2012, Myanmar prepared the "National Adaptation Programme of Action (NAPA)" report giving a country-wide assessment of the risks of climate change and proposed action programs and projects. Myanmar's NAPA therefore specifies 32 priority activities (referred to as Priority Adaptation Projects) for effective climate change adaptation for eight main sectors/themes (i.e. four Project Options per sector/theme), namely: i) Agriculture; ii) Early Warning Systems; iii) Forest; iv) Public Health; v) Water Resources; vi) Coastal Zone; vii) Energy, and Industry; and viii) Biodiversity.

196. NAPA noted that over the last six decades (1951 to 2007), the temperature in Myanmar has increased on average by ~0.08°C per decade. This has been reflected by fewer cold days and more frequent hot days. Despite overall trends of increasing temperatures, five Regions have experienced decreases. Appreciable decreases include Magway (-0.23°C per decade) and Bago (-0.16°C per decade). The highest warming (~0.32°C per decade) has been experienced in the Kayin State. From 1951 to 2000, ~15 heat waves occurred per year. The most extensive heat wave (covering up to 60% of the country) occurred in 1998 during an El Niño Southern Oscillation (ENSO) year. The following Figure IV- 1 provides a summary of temperature increase predictions by NAPA.

Figure IV- 1 Average Summary Of Temperature Increases



Heat Index (black line) indicates more frequent hot years since 1976, with a linear regression shown as the blue line.

197. **Hydrology.** Surface water in the Dry Zone is dominated by the Ayeyarwady River and its tributaries. The Ayeyarwady River, which originates in the north of Myanmar in Kachin state, flows through the Dry Zone, from the north-east to the south. In the north it effectively forms the eastern boundary of the Dry Zone, before flowing west-southwest from Mandalay and then resuming its southerly flow at Bagan. The Chindwin a major tributary enters the Dry Zone to the north of Monywa and flows south to its confluence with the Ayeyarwady to the north-west of Pakokku, almost in the centre of the Dry Zone. There are several other large tributaries, including the Mu, Shweli and Myitnge. Some of these rivers flow all year but many are seasonal.

198. **Flooding**. Flooding is a regular phenomenon in Myanmar. Hydro-meteorological

hazards have impacted food security of many provinces in Myanmar in the past, and are probably the main triggers. There is not a significant historical record of flooding in the CDZ but there was a serious flood in 2002. According to informal information from Meikhtila General Administration Department, this flood caused serious damage to the lives and agricultural farms of local communities residing in Meikhtila Township and Wuntwin Township. A total of less than 5 people from Meikhtila and about 9 people from Wuntwin, a neighboring township of Meikhtila, were killed by this flood but a small amount of farmlands was slightly damaged due to this flood. Families of Thetaw village under the Mongtaing Dam in Meikhtila Township were later relocated to the new area due to this flood.

199. Flooding was also a major problem during 2015 in Myanmar and parts of the CDZ. There is however no dedicated database or information to archive the impacts of these extreme events at provincial and village levels. The global databases such as the CRED EM-DAT are designed to catch only the major events that are significant at global or national scales. From the perspective of food security decisions are significant at different levels.

200. Flooding in the core subproject areas is mitigated by the upstream dams which give some protection to downstream irrigation infrastructure. Most of the damage from flooding in these areas has been caused by inadequate cross drainage, a situation being mitigated by the improved infrastructure.

201. **Droughts.** Drought years with moderate intensity were frequent in the 1980s and the 1990s. Extended dry seasons and increased temperatures have however caused an increase in the prevalence of drought. Severe droughts have increased in frequency from 1990 to 2002. In 2010, severe drought diminished village water sources across the country and destroyed agricultural yields of peas, sugar cane, tomato, and rice.

202. **Increase in extreme high temperatures.** There has been a general increase in temperatures across Myanmar over the last six decades. This has resulted in an increase in extreme high temperature days and thus the prevalence of heat-related disorders. During summer 2010, 1,482 heat-related disorders were reported and 260 heat-related deaths occurred across Myanmar.

203. **Climate variability and change adaptation measures.** The potential for the IAIDP to be affected by future climate change was considered during the IAIDP PPTA IEE preparation through the use of the ADB approved AWARE screening tool. The results of this screening assigned the project with a “medium” climate change risk category and identified the risk of flooding as the most severe potential concern. Other risks of lower concern identified were reduced precipitation (lower dry season rainfall of particular concern as well as delays in onset of monsoon), offshore storms and changes is available solar radiation. Increased rainfall could require a change in cropping while reduced or more erratic rainfall can make crops more vulnerable and less productive.

204. Relative to the potential impacts to IAIDP infrastructure, this screening focuses **drought, increased temperature** and **floods** as the key risk areas siting/design, maintenance and performance. Droughts were identified as affecting water availability and requiring irrigation planning and careful calculation of crop water needs as a response. Floods were identified as dangers to canal walls and structures, which will need to be designed to withstand them. It is noted that irrigation infrastructure by its nature provides some adaptation to climatic variations and are designed to buffer soil moisture deficits and remove the agricultural production risk both in farming systems.

205. **Adaptation.** The Project will continue to use all available water, except during floods – other things being equal this might result in a reduction in crop areas in some years, but the project aims to improve management and hence increase crop area. The IAIDP project area suffers from damages due to inadequate cross drainage, poor embankment construction – which will be addressed in rehabilitation plans (detailed designs will take account of best estimates of flood flows at an appropriate rate of return).

206. The increase in risk of flood damage due to climate change is probably small in comparison to the existing risk due to inadequate original design and poor quality construction – but both will be addressed in detailed design. The redesign and refurbishment of the schemes offers many opportunities to correct this, and to provide robust structures for future flooding. Appropriate return periods and safety factors to allow for climate change will be incorporated in detailed design, and good quality construction will be ensured.

207. The IAIDP is actually designed to mitigate some of these risks that already occur in the subproject areas and performs on its own merits as a mitigatory measure. For the most part irrigation is an adaptation to a very variable climate and thus needs to be flexible to cope with uncertainty. The projected future changes are small compared to existing annual variability in key parameters over the lifetime of the project. Climate variability has the potential to increase, but the greater flexibility built into the system through modernization of infrastructure and better management will address this variability.

208. If there is a delay in the onset in monsoon (currently perceived but not verified) then reservoir operations will need to be adjusted to ensure storage at the end of the dry season. This improvement to reservoir operation will be an important adaptation measure against future drought conditions and higher water demand caused by climate change. Operational plans and operating practices for water allocations and drainage will be prepared by the PMU during implementation, and will be adopted by ID before completion of works on main canals.

209. There is insufficient information currently to determine if cropping may need to be modified in the CDZ based on projected increased temperatures or rainfall. There is no indication that crop patterns will need to change for climatic reason, but the project is designed to cope with diversified cropping. Paddy is the most resilient crop for anticipated rainfall and temperature patterns.

V. ANALYSIS OF ALTERNATIVES

210. Under ADB's Safeguards Policy Statement (2009) there is a requirement to examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and consider the no project alternative. During the project preparation, various alternatives have been proposed, screened against technical, economic, energy efficiency, as well as environmental criteria. In terms of the environmental consideration for the alternatives, the primary objective was to identify and adopt options with the least adverse environmental impacts and maximum environmental benefits.

A. No-Action Alternative

211. The No-Action Alternative would result in continued poor performance in the core subproject area irrigation perimeters with insufficient crop production. The irrigation systems would remain more vulnerable to potential negative climate change impacts. The No-Action Alternative is not a reasonable option if the future food security and resilience of these existing irrigation systems is to be assured.

B. Alternatives for selection of core subprojects

212. The subprojects were ranked by economic viability. The choice of 2 projects to be considered core subprojects and taken to feasibility level was made in the context of choosing projects which were "safely viable", chosen from those with higher IRRs (Natmauk, Mobye, Ngwe Daung, Chaungmagyi, and Thitsone). There were no obvious environmental or social discriminators in the subprojects. The core sub projects not only need to be viable on their own but also be effective demonstrators of the proposed interventions which can be replicated in the pipeline subprojects. As the most viable subprojects which can provide models for other projects in the CDZ, the PPTA team proposed feasibility studies of Natmauk in Magway and Chaungmagyi in Mandalay with the intent of demonstrating a development model for water constrained systems, which was agreed by MOAI.

C. Alternatives for technology alternatives

213. The IAIDP involves rehabilitation of existing irrigation infrastructure and supporting systems like adjacent canal roads. The technologies involved as shown in Chapter III are fairly simple with few available options. The rehabilitation essentially puts the existing irrigation systems back into its full operational potential and the structural improvements will be optimized during detailed design. The interventions now have standard details available for each type, with some examples shown in Annex 6.

214. **Advanced irrigation**. The incorporation of advanced irrigation technology into the main systems has been considered as part of feasibility study and found to be unsuitable and not proposed. The incorporation of automated control and remote monitoring systems within Myanmar is limited by the availability of the expertise and materials required for their maintenance in the future, such that their continued medium or long term use is unlikely. The adoption of systems which offer varying degrees of automation was considered. Such systems could be provided under this subproject and maintained by the ID at a basic level in the short term (following training delivered as part of the subproject) to allow, initially, for local control only. There would remain scope for the development of these systems in time into increasingly automated systems providing networked control as the technical capacity of the ID increases. However, any such development would be beyond the scope of the core subprojects. The

adoption of such systems was ultimately rejected as the benefits provided remote control are unlikely to outweigh the significant setup, operation and maintenance costs. While remote monitoring of canal flows throughout the system has the potential to improve transparency in water distribution which would lead to more equitable distribution, the installation and recurrent costs of flow monitoring systems, such as SCADA, are unlikely to be economically viable in a system such as Natmauk which is limited by available water resources. In addition, significant changes to the basic administrative management of irrigation systems in the CDZ would be required to support any remote monitoring or remote control system.

215. **Alternative control methods.** These methods were also considered and rejected. The systems are currently designed to operate under upstream control (where a constant water level at the upstream side of a regulator is the operational target). Adoption of downstream control (where constant water level at the downstream side of a regulator is the operational target) was considered. The most significant benefit of downstream control is the short response time of the system. Within upstream controlled systems, a requirement for additional supplies at the tail of the system requires operation of gates at the headworks and progressive adjustment of any gated cross-regulators down the system in order to maintain required water levels. There is a considerable time lag between changes to the headworks and any increase or decrease in flow at the tail of the system, at which time the water may no longer be required, resulting in wastage of water. Within downstream controlled systems, dynamic storage is provided throughout the system – an increase in demand from an offtake is immediately met through use of this dynamic storage, allowing for immediate response.

216. A second significant benefit of downstream control is the reduction in system management requirements. Downstream control gates are well suited to passive automation (meaning that the gates are acted upon by the water, i.e. self-regulation – no electrical control is required) and as such allow a reduction in system management requirements and operational losses within the system that are inherent in manually operated upstream control systems. Given the constant water levels in the main system that downstream control aims to achieve, secondary offtakes can also be sized for a constant discharge, resulting in minimized requirements for operation of these offtakes.

217. However, the benefits of downstream control can be outweighed, not only by the higher cost of the gates and costly construction and maintenance requirements that are unavailable in Myanmar, but also in systems suffering from inconsistencies in inflow, sediment inflow and situated in steep terrains – all of which are true for the core subprojects. Within downstream control systems, any shortages of flow favor the downstream reaches of the system – passively controlled gates shall adjust to ensure target water levels are achieved first in the downstream reaches, at the expense of water supplies in the upstream reaches of the system.

218. Given the inconsistencies in inflow, sediment inflow and steep terrains present in areas of the Natmauk system, as well as the additional costs of a downstream controlled system, continued adoption of upstream control is proposed for these core subprojects.

219. **Improved irrigation management.** Inadequate and unreliable water supplies were reported by a majority of water users in this study. This is a very common global problem, but there is no consensus on how best to solve it. It is generally relatively easy to develop or improve small-scale solutions for water management, but in this project the objective is to improve water management on large schemes. The project seeks to improve overall management by simultaneously improving main system management by the ID, enhancing coordination with tertiary unit managers, and making tertiary unit management more responsive

to user needs. Reform and revitalization of formal irrigation systems will depend on a "*clear definition and understanding of the roles, responsibilities, tasks and expectations of the government and the communities, keeping in mind the history of the development of irrigation infrastructure. This will likely require an increase in capacity across the board*" (IWMI, 2012). Although the ID staff at township are skilled and capable of managing the systems, their numbers are limited and resources for active management insufficient. This is unlikely to change substantially, although some improvements may be possible within the existing structure once the infrastructure is improved. However, much greater and more formal involvement of water users, initially through informal groups and later via systematic Water Users' Associations is needed, as set out in Supplementary document 2. It is essential that this is arranged in a way that is not perceived as transferring tasks without the skills, resources or authority to undertake the tasks. International experience suggests that this is not easy and takes a lot of time and patience to build the capacity and willingness to share responsibilities – both ID and water users need to change their ways of working. A three year programme of consultation, capacity building and support is proposed in the project

220. The long term approach is to set up formal WUAs (with legal status) for each distributary canal and adjacent minors and direct offtakes from the main canal. The first WUAs will be set up during the implementation of the project (Output 1) and the ID will be trained in the process during the project so that they can continue the process of establishing WUAs in other distributary canals and in other systems outside the IAIDP project area. Coordination at this level is essential to improve water management; this WUA needs to agree an operating schedule with the main canal inspector which is consistent with their requirements and the overall system water delivery schedule. Management below the outlet should remain the responsibility of the farmers, as at present. The existing farmer groups could be formalized into Water User Groups as subsidiary groups within the WUA. The ID should remain responsible for operation of gates on the main canal to ensure delivery of water in accordance within the agreed plan, but the WUA and farmers should be responsible for subsequent management. This is a change in theory from the current situation (where the ID manages Distributary canals), but may not differ in practice.

221. Several options have been considered for the irrigation management component:
    a) do nothing (continue with current management system)
    b) establish PIM according to a standard model across the entire command area
    c) strengthen ID management with full management down to tertiary outlet level
    d) Build on current arrangements for participation through *myaung gaungs* (as described in Supplementary Document 2), to test an improved system and gradually extend across the command area

222. The 'do nothing' option [Option a] will not meet the requirements for sustainable management of infrastructure constructed through the project. It will thus not contribute to the objectives of the project and is not considered further. Establishment of PIM across the command area [Option b] would not be possible in the short term. There is not yet a legal basis for water users associations, there is little local appreciation of the implications of such groups, and the practicalities of establishing user groups across the entire area would make this option unrealistic. Although the existing system assumes that the ID is fully responsible down to the outlet to farmer managed water courses, in practice they have too few field staff to be fully effective and there are too few control structures. The limitations of control structures will be relieved through the infrastructure component, but these will require more operation rather than less than at present. Government funding constraints preclude deployment of significantly more staff and thus management is likely to remain weak unless participation by water users is

increased. Option c is thus not considered a viable option. Although the short term maintenance needs will be relatively low, this time needs to be used for building up water user capacity for management to ensure sustainability. Option d will allow for a gradual build-up of local capacity in the form of WUAs for operation from distributary canal downwards and free ID resources for asset management. This is the preferred option.

223. **Construction Materials.** The most significant construction materials include concrete, reinforcement and earth fill. The works detailed in the preceding sections (with the exception of part of the tertiary development that will be implemented by the farmers) have been designed assuming implementation by an international contractor with experience in constructing reinforced concrete irrigation structures. Consideration was given to proposing construction of brick masonry structures to allow construction to be completed, at least in part, by the ID staff base, and to ensure ID staff have the required skills to maintain properly the structures in the future. However, reinforced concrete structures have been proposed due to concerns over the quality of brick which is locally available, the increased life span of reinforced concrete structures over even good quality brick masonry structures and the reduced structural maintenance requirements. In order to reduce the cost and impact of obtaining earth fill from borrow areas, the stockpiling and reuse of material excavated for the construction of hydraulic structures has been considered. However, material excavated from the canal, or stripped from embankment tops will not be suitable for construction and must therefore be disposed of.

224. **Sediment Management.** While the canals have been designed to achieve, so far as is reasonably possible, a level of continuous flushing (i.e. maintaining flow velocities to run sediment throughout the system), works to reduce the incoming sediment load to the system are required at the head of the main canals. The feasibility study proposes the provision of settling basins at the head of the main canals. These basins aim to induce siltation by reducing flow velocities by providing an over wide and over deep reach at the head of the canal. Given the timeframe to complete the feasibility design, a regime of sediment sampling was not possible, and in the absence of any detailed sediment data, the design of the sediment management system has been completed to a conceptual level for the purpose of estimating an approximate cost. A regime of sediment sampling would be undertaken as part of the detailed design, and the most suitable sediment management technique shall be designed in detail, with consideration of alternative sediment management techniques, including vortex tubes and improved operational management at the weir. Single sediment basins were sized and costed on conceptual basis. Consideration was given to providing twin basins with each basin provided with upstream and downstream closure gates to provide isolation of each basin separately while allowing the canal to flow at full capacity through the second basin. This would allow for mechanical excavation of the basins. However, this option was rejected due to the recurrent cost and environmental impact of disposing of the sediment locally in the long term, since the single basin technique flushes sediment into the system and does not require disposal.

VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Legislative Framework for Public Consultation and Information Disclosure

225. Meaningful public participation and consultation in the evaluation of project planning, feasibility study, design and implementation is an important environmental safeguards' requirement; it can directly reflect the public's perceptions on environmental quality in the project's area of influence.

226. Relevant provisions in the Environmental Protection Law of Myanmar and the Regulations on the Administration of Construction Project Environmental Protection (Order of the State Council, No. 253) require that domestic environmental impact assessments shall solicit the opinions of units concerned and inhabitants of a proposed project construction site. Myanmar National Development and Reform Commission (NDRC) issued a requirement for "Social Risk Assessment of Large Investment Projects" in August 2012, which emphasizes the importance of public consultation in an effective manner, and requires that the results of public consultation are clearly summarized in the domestic safeguards reports, including the dates of consultations, number of stakeholders, who the stakeholders are, and the comments received.

227. ADB's Safeguard Policy Statement (2009) also has detailed and strict requirements on meaningful participation, consultation and information disclosure. The consultation process for this project therefore followed both the Myanmar requirements and the ADB SPS requirements.

B. Public Consultation

228. One round of public consultation for the proposed IAIDP was conducted in July and August of 2015 by the PPTA national environmental consultant in each core subproject affected area. The full results of the public consultation are provided in Annex 3 to the IEE along with some photos and lists of participants in each meeting.

229. Public consultation meetings (PCMs) with concerned departments were held at the township level at the meeting halls of the GAD offices in Pyawbwe Township (Chaungmagyi system) and Myothit Township (Natmauk system). A total of 40 participants (33 men, 7 women) from affected departments attended the PCMs and discussed their views and opinions on proposed IAIDP interventions by ADB team.

230. Focus group discussions (FGDs) were conducted for the IAIDP in 22 villages, 11 in each core subproject area based on accessibility, and coverage of irrigation perimeters including all main canals. At total of 759 participants (540 men, 219 women) discussed their views on the proposed IAIDP interventions. Administrative support was provided by the General Administration Department (GAD) and Irrigation Department of Pyawbwe Township (Chaungmagyi system, 4-9 Aug 15) and Myothit Township (Natmauk system, 21-26 July 15). Village administration organized the meetings for ensuring the full participation of all stakeholders concerned even though farmers were busy with their farm works during the monsoon season. The ADB team explained the background and introduction, objectives, institutional structure, proposed intervention activities, public consultation and grievance redress mechanism, environmental assessment of the IAIDP to the participants with flipcharts. The participants asked some questions regarding the facts that were not clear to them and the PPTA national environmental consultant provided answers and clarifications.

231. At the FGDs, many attended (see Annex 3) and from seven to 13 participants were actively involved in the detailed discussions in each village location. All participants indicated that they need adequate irrigation water for their crop production from the existing canals in a timely manner in summer and monsoon. The participants hoped that the project will assist with renovation of all canals and its associated structures including village roads and bridges across the canals. The bridges have not been functioning well for years, and they also hoped for establishment of new canals and water collecting ponds.

232. The FCD participants were not worried about potential negative impacts (construction or operation) of the proposed intervention activities and they did not think proposed project activities would seriously affect their farmland usage and environment. In fact, they believed it would positively affect socioeconomic condition of the communities in the target project areas by upgrading the irrigated structures and agricultural practices. Proposed IAIDP activities of renovating canals and other rehabilitation activities, as well as activities related to improving agricultural crop production practices were warmly welcomed by the farmers. Some villages requested help in getting quality paddy seeds and other better yield varieties with affordable prices in a timely manner. Farmers also indicated that they need capacity building training, such as effective utilization of irrigated water and systematic allocation of water, best practices for crop production, etc.

233. The public consultations indicated that the majority of the potential APs support the project and project components and believe they would benefit the local economy, raise residents' living quality, improve local environmental conditions, and effectively protect the local environment.

C. Future Information Disclosure and Public Consultation Program

234. Information disclosure and public consultation relating to environment safeguards will continue throughout project implementation. Farmers will be consulted during detailed design regarding preferences and options. Additional public consultation will be required in the core subproject areas once detailed designs have been completed so that exact impact areas can be shown.

235. Future information disclosure is shown in Table VI- 1.

Table VI- 1 Future IAIDP Information Disclosure

Project Documents	Means of Communication	Resp. Party	Frequency	Audience(s)
Project Data Sheet	ADB's website	ADB	semiannually	General Public
Reports and Recommendations of the President	ADB's website	ADB	upon approval by the Board	General Public
Legal Agreements	ADB's website	ADB	upon signing	General Public
Social Monitoring Reports	ADB's website	ADB	routinely disclosed	General Public, project-affected people in particular
Major Change in Scope	ADB's website	ADB	upon approval of such change	General Public

Project Documents	Means of Communication	Resp. Party	Frequency	Audience(s)
Completion Report	ADB's website	ADB	upon circulation to the Board	General Public
Evaluation Report	ADB's website	ADB	upon circulation to Management and the Board	General Public

VII. GRIEVANCE REDRESS MECHANISM

A. Introduction

236. A grievance redress mechanism (GRM), consistent with the requirements of the ADB Safeguard Policy Statement (2009) will be established to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. In addition to serving as a platform to resolve grievances, the GRM has been designed to help achieve the following objectives: (i) open channels for effective communication, including the identification of new environmental issues of concern arising from the project; (ii) demonstrate concerns about community members and their environmental well-being; and (iii) prevent and mitigate any adverse environmental impacts on communities caused by project implementation and operations. The GRM is accessible to all members of the community including workers of contractors.

B. Proposed Grievance Redress System

237. The proposed GRM follows the existing approach taken for managing complaints about local issues by members of the public in Myanmar. Residents' complaints or concerns are generally taken to local government (village and township level) representatives for resolution, therefore this system is integrated into the GRM.

238. In their capacity as IAs, the ID and DOA will establish a Public Complaints Unit (PCU) within the PMU prior to construction to deal with complaints from affected people (AP) such as nearby residents, construction workers, and others. PMU staff (in particular the LIEC, the LISC, and the Gender and Social Specialist), and the contractor's land negotiators will have roles to play in explaining and helping community members use the GRM.

239. The PMU will be responsible for ensuring the setting up and coordination of the GRM at a local level and will staff the PCU. The LIEC and LISC will coordinate its set up and the Gender and Social Specialist will be responsible for the day to day PCU activities: maintaining the grievance register, organizing investigations, acknowledging and communicating results to the affected person, and monitoring for the closing out of the issue.The PMU will be the key contact point for local government representatives who may require information about the project or who have an issue they would like to discuss. The PMU will issue public notices to inform the people and organizations within the project area of the GRM. The PCU's phone number, fax, address, email address will be disseminated.

240. The PMU will have facilities to maintain a complaints database and communicate with contractors, supervision engineers, ministry staff and representatives of affected local village

and township governments.

C. GRM Steps and Timeframe

241. Procedures and timeframes for the grievance redress process are as follows and shown in **Figure VII-1**.

a. **Stage 1: Access to GRM**. If a concern arises, the AP may resolve the issue of concern directly with the contractor, or make his/her complaint known to either the PCU directly, or through the local village or township government, whichever level of authority he/she is most comfortable with;

b. **Stage 2: Official Complaint to PCU**. If a complaint is filed at local government level, the government representative will submit an oral or written complaint to the PCU. For an oral complaint the PCU must make a written record. For each complaint, the PCU must assess its eligibility. If the complaint is not eligible, for instance if it is determined that an issue is outside the scope of the project, PCU will provide a clear reply within five working days to the AP;

c. **Stage 3: PCU Complaint Resolution.** The PCU will register the eligible complaint informing the respective local and district government, the PMU, contractors, and ADB. The PCU, with support of the loan implementation environment consultant (LIEC) or the LISC (depending on the issue), will take steps to investigate and resolve the issue. This may involve instructing the contractor to take corrective actions. Within seven days of the redress solution being agreed upon, the contractor should implement the redress solution and convey the outcome to the PMU and ADB;

d. **Stage 4: Stakeholder Meeting.** If no solution can be identified by the PCU or if the AP is not satisfied with the suggested solution under Stage 3, within two weeks of the end of Stage 3, the PCU will organize a multi-stakeholder meeting under the auspices of the head of local government, where all relevant stakeholders will be invited. The meeting should result in a solution acceptable to all, and identify responsibilities and an action plan. The contractor should implement the agreed redress solution and convey the outcome to the PMU and ADB within seven working days.

The invitees to this meeting will depend on the nature of the complaint. For example if the complaints relate to health, land disputes, or labor issues, the appropriate specialist in this field will be invited to the stakeholder meeting. This may include officers from the Department of Agricultural Land Management and Statistics (land rights issues), Myanmar Chamber of Commerce (business/commercial issues), various NGOs (gender or equity issues), Ministry of Health (health issues), MOECAF (environmental issues), and Ministry of Labor (labor issues);

e. **Stage 5: District Administration Officer Resolution.** If the multi-stakeholder meeting cannot resolve the problem, and the AP remains unsatisfied, the PCU will set up a meeting with the District Administration Officer to identify a solution.

242. The PCU will record the complaint, investigation, and subsequent actions and results. The PMU will include this information in the quarterly EMP progress reports. In the construction period and the initial operational period covered by loan covenants the EA will periodically report complaints and their resolution to ADB in the quarterly project progress reports and

annual environmental monitoring reports.

243. Tracking and documenting of grievance resolution within the PCU will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) dedicated staff to update the database routinely; (iii) periodic reviews of complaints so as to recognize grievance patterns, identify any systemic causes of grievances, promote transparency, publicize how complaints are being handled, and periodically evaluate the overall functioning of the mechanism; (iv) processes for informing stakeholders about the status of a case; and (v) procedures to retrieve data for reporting purposes, including the periodic reports to the EA and ADB.

244. **Members and Responsibilities of the PCU**. The responsibilities of the PCU are implemented by the PMU, who is the PCU focal point. In addition to the PMU, the members of the PCU will be those in a position to resolve complaints and besides PMU will include representatives of: (i) regional government; and (iii) relevant local government representatives. The responsibilities of the PCU are as follows:

- The PCU will instruct contractors and construction supervisors to refer any complaints that they have received directly to the PCU. Similarly, the PCU will coordinate with local government departments to capture complaints made directly to them;
- The PMU, as the focal point of the PCU, will log complaints and date of receipt onto a complaints database and inform the IA and the Contractor.
- The PCU will investigate the complaint to determine its validity and to assess whether the source of the problem is because of project activities, and identify appropriate corrective measures and responsible persons;
- The PCU will inform the AP of investigation results and the action taken;
- If a complaint is transferred from local government agencies, the PMU will submit an interim report to local government agencies on status of the complaint investigation and follow-up action within the time frame assigned by the above agencies;
- The PCU will review the contractor's response to the identified corrective measures, and the updated situation;
- The PCU will undertake additional monitoring, as necessary, to verify as well as review that any valid reason for complaint does not reoccur.

245. Affected persons, if not satisfied with the GRM results, always have legal recourse to judicial processes as a last resort.

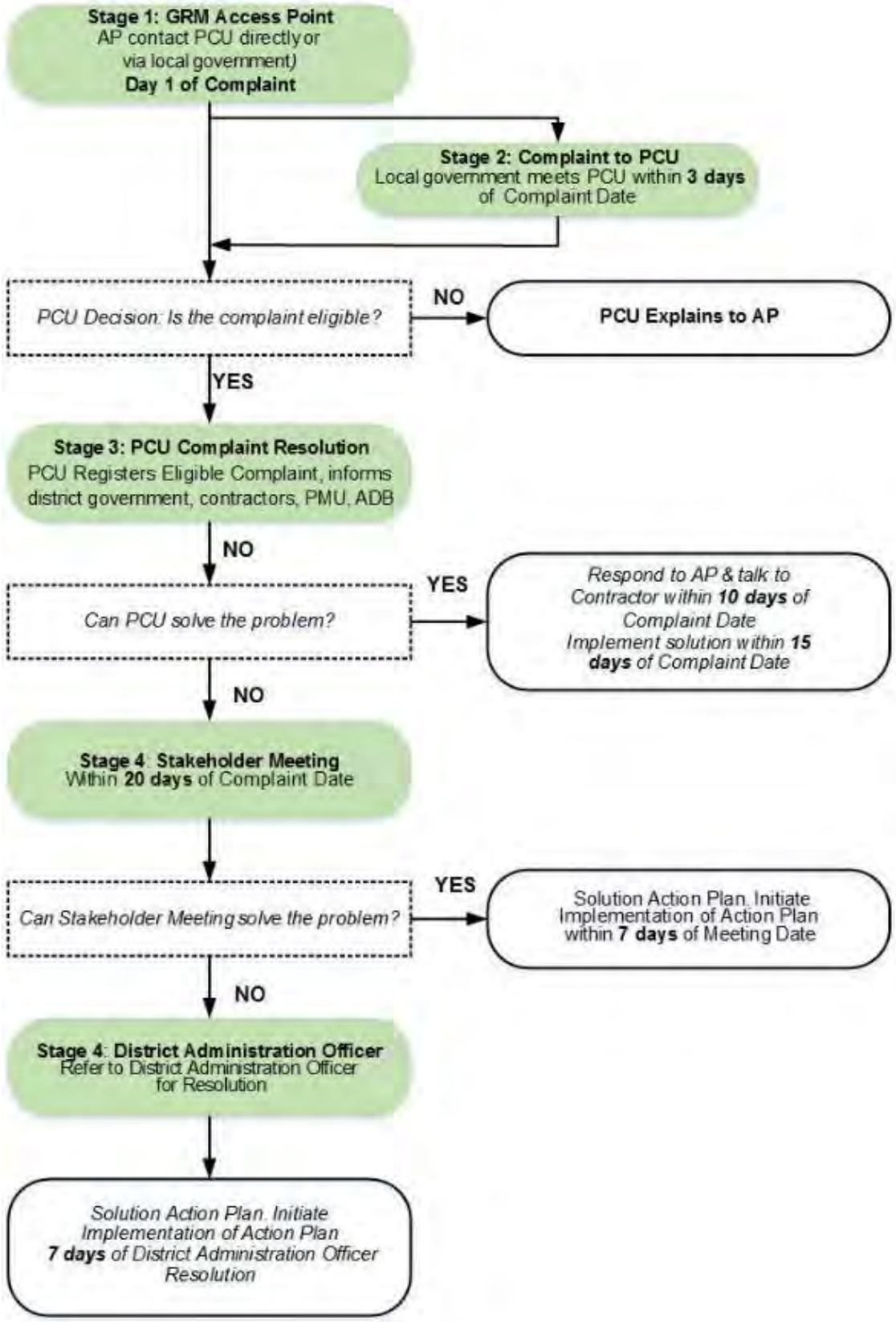
246. If efforts to resolve disputes using the GRM remain unresolved or unsatisfactory, AHs also have the right to directly discuss their concerns or problems with the ADB Environment, Natural Resources and Agriculture Division (SEER), Southeast Asia Department at ADB Headquarters through the Philippines Country Office.

247. As well, ADB's Accountability Mechanism allows people affected by ADB-supported Projects to submit complaints to ADB. This is a separate resolution mechanism from the GRM described above. The Accountability Mechanism provides an independent forum that allows people to voice their problems and seek resolution, and report alleged violations of ADB's operational policies and procedures.

248. The Accountability Mechanism has two separate but related phases. First is problem solving, led by ADB's special Project facilitator, to assist Project-affected people in finding

solutions to their problems. Second is compliance review led by a three-member panel that investigates alleged violations of ADB's operational policies and procedures, including safeguard policies, that have already resulted in, or are likely to result in, direct adverse and material harm to Project-affected people. It recommends how to ensure Project compliance with these policies and procedures.

Figure VII- 1 Proposed Project GRM



Source: ADB Study Team

VIII. CONCLUSIONS

A. Rationale and benefits

249. **Direct project beneficiaries**. The implementation of the Project and the development of IAIDP is expected to generate direct irrigation benefits to the core subproject areas based on the increased irrigated and harvested area, with yield increase due to the agricultural development component.

250. Primary beneficiaries will be the farming and landless communities including individual farmers, farmer groups, cooperatives and later water user groups (WUGs) as they are formed in the irrigation systems in the CDZ, plus the important private sector agribusinesses which are part of the value chains, especially those involved in input supply, post-harvest operations and marketing. It is important to note that the poor, landless and women will be particularly targeted.

251. Secondary beneficiaries are the MOAI staff involved in extension, maintenance, and research), especially those working at the irrigation systems level. Tertiary beneficiaries will be the other players in the various value chains through an improved MIS and greater awareness of the issues as regards to the development of irrigated agriculture.

252. **Positive Impacts.** With proper design and commitment, the proposed project can have positive impacts on food security, household income, health conditions, and rural employment. It should have multiplier effects on local economic development and water governance..

253. **Economic Benefits**. The IAIDP subprojects will be implemented soundly and in line with good international industry technical practices, so benefits should be felt widely. These benefits may be moderate magnitude but of high significance because they will be felt most by poor farmers.Positive economic impacts for the farming households will flow from increased agricultural productivity and some new employment opportunities, and there will be potential for other long-term economic benefits. These would include improved agricultural production on a larger scale and the potential for creating new economic activities through other allied development measures.

254. **Social and Environmental benefits.** The project will rehabilitate dilapidated irrigation infrastructure and provide direct and indirect environmental benefits. Dangerous and non-functional infrastructure will be repaired or replaced. This will include adjacent roads and bridges which will provide safer access to nearby homes and villages. The direct benefits will include improved irrigation water management and significant training to improve the use of fertilizers and pesticides in the project area. Monitoring of potential waterlogging and other drainage issues will improve the areas downstream of the irrigation perimeters, although there are few existing problems with waterlogging or salinization. The improved cross drainage systems will eliminate localized flood risks and canal failures, as well as convey stormwater safely from nearby residents.

255. **Poverty benefits.** The Project, by its nature of improving environment and public services, is classified as general intervention regarding poverty reduction impact. The Project will not entail disparities and inequalities between the poor and non-poor for their access to the project outputs and the access to the resultant social and economic benefits. Poverty incidence in rural areas is significantly higher than in urban areas, with 85% of the poor living in rural areas. Most poor households are engaged in agricultural activities and/or have members employed as

casual laborers.

256. **Gender benefits.** There will be employment in construction of irrigation infrastructure and farm roads. The target will be at least 30% women laborer to be recruited for construction work in irrigation and frontline centers with receiving training on construction. Both male and female will receive equal wage for work of equal value. Women will have access to water and women-only sanitation facilities at construction sites. Aall laborers, women and men, will receive occupational safety measures and training. Poor and disadvantaged women and men will be prioritized to get Project employment. Women will comprise at least 40% of total participants in consultations related decision-making on irrigation system planning, design and implementation. Separate women farmers' meetings will be held to assess their prioritized needs related to location, alignment and access to irrigation infrastructure. At least 25% skilled and 75% unskilled job opportunities will be created at local level on canal, drainage, cart bridges, access roads to dam construction/rehabilitation and maintenance. Other detailed targets are included for the local irrigation management systems.

B. Anticipated environmental impacts and mitigation measures

257. The core subprojects can potentially cause environmental impacts during implementation due to their location, design, construction, and operation and maintenance.

258. **Potential Construction Phase Impacts**. Since exact locations of the rehabilitations and associated works such as borrow pits and dump sites are not yet known, the possibility of either temporary or permanent relocation will have to be assessed during detailed design. The Resettlement Framework indicates that this is unlikely. Some of the works will also generate temporary and localized known construction impacts related primarily to air pollution/dust, noise, vibration, and access restriction; improper disposal of construction related waste; temporary pollution of soil and surface waters due to accidental spillage of fuel from construction activities; safety hazards including worker safety; damage to natural habitats, aquatic fauna, or existing vegetation. Most of these impacts are related to construction activities and can be prevented or reduced to acceptable levels by applying good international construction practices and planning. It is noted that the proposed project improvements relate primarily if not exclusively to rehabilitation of existing irrigation and support facilities, so the aspects of siting and location are not necessarily relevant.

259. **Potential Operation Phase Impacts.** The major potential impacts of the infrastructure component for IAIDP during operation phase may include soil erosion, waterlogging and potential salinization due to insufficient drainage systems, potential water quality, soil quality and health impacts of overuse of fertilizers and pesticides, canal sedimentation, and safety issues. The IAIDP project design has incorporated both design and agriculture support features which will minimize these potential operational impacts.

260. Other potential operation phase impacts were reviewed and not considered problematic with proper mitigation. These included changes in groundwater hydrology, drainage impacts and waterlogging, canal sedimentation, hazards associated with use of toxic chemicals and mineral fertilizers, canal safety, agricultural wastes, and risk of flooding and natural disasters from climate change as well as other potential climate change impacts.

261. **Mitigation and Monitoring Program.** Mitigation measures and a monitoring program were defined for all identified impacts, and are included in the EMP of the project IEE. The EMP sets out the procedures and plans to carry out mitigation measures and monitoring during

sequential stages of the project including pre-construction, construction and operation. It consists of two major plans, one for implementing mitigation measures and the other for conduct environmental monitoring. For each impact, appropriate mitigation measures are described. Monitoring and supervision will be undertaken to ensure that environmental impacts will be minimized to acceptable levels.

262. **EMP Implementation Responsibilities.** The MOAI will be the executing agency (EA) for the project and will oversee overall project implementation and management activities to ensure smooth and timely implementation and completion of project activities. The EA will guide and coordinate closely with other government agencies and the ADB for the timely resolution of any issue and completion of the project within the target dates, expediting the procurement process, and organizing and chairing the Project Steering Committee (PSC) meetings. The EA will designate a project management unit (PMU) Director to oversee the day-to-day management of the project and liaise with all relevant government offices. The EA will also designate a Chairman of PSC that will provide overall supervision to project implementation. The PMU will be established at the MOAI. On behalf of the executing and implementing agencies, the PMU will assume day-to-day management of the project and will be responsible for coordinating and implementing project activities, including procurement, recruitment, disbursement, contract administration, monitoring and reporting. The ID and DOA will be the implementing agencies.

C. Risks and Assurances

263. Environmental risks, and the assurances required to address these risks, have been identified during IEE. The majority of environmental risks relate to design features and operational plans which will avoid or mitigate impacts, but which rely on the implementers' commitment and capacity to implement and consistently follow-up. The remainder relate to the likelihood of unexpected negative impacts.

264. Commitments by the executing agency will be incorporated into the loan documentation as loan covenants to ensure that the measures are implemented in a timely and complete fashion, including :

a. the Borrower has incorporated the relevant provisions from the EMP into the Works contract;
b. involuntary resettlement impacts will be avoided. Land agreements will be completed using negotiated settlement or voluntary donation. Land acquisition will be undertaken according to the Resettlement and Ethnic Groups Framework.
c. EMP update and submission to ADB for clearance and disclosure prior to civil works;
d. Conduct of detailed geo-hydrological assessments during engineering design; and
e. GEF demonstration project results integrated into engineering design.

265. The overriding assurance required is that the executing agency and the local government bodies as appropriate will ensure that the full range of effective measures set out in the project IEE and EMP are undertaken, and guarantees that the environmental management provisions and the environmental monitoring plan will be implemented effectively during project implementation, and that the implementation reports of the environmental management and monitoring plan in accordance with ADB requirements will be submitted in a timely fashion. Part of this monitoring and management commitment will be a commitment to implement and maintain an appropriate GRM.

D. Conclusion

266. The IEE concludes that the project will not have any significant, long term or irreversible negative impacts on the physical, biological or socio-economic environment. The project will have short term negative impacts during construction which can be mitigated to an acceptable level through mitigation measures which seek to reduce the potential for harm to the environment and human health. These measures relate primarily to implementing good construction practice as well as meeting the particular needs of the project area through consultation with affected people. Good practice through comprehensive training and appropriate technological design will also contribute significantly to reducing the operational impacts of the project. The project itself is a mitigatory measure against future climate change risks identified.

267. The project will have significant positive environmental benefits. With proper design and commitment, the proposed project can have positive impacts on food security, household income, health conditions, rural employment; and flood control. It should have multiplier effects on local economic development and water governance. In some isolated cases, leakage from irrigation systems can also assist with supplying water to local shallow well systems.

References:

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World Bank Group's Environmental, Health and Safety Guidelines

ANNEX I – ENVIRONMENTAL MANAGEMENT PLAN

A. Objectives

1. This environmental management plan (EMP) has been prepared for the ADB supported Irrigated Agriculture Inclusive Development Project (IAIDP), in line with ADB's SPS 2009. Specific measures are developed in relation to the design, construction and operation of each project component and the impacts identified in relation to physical, biological, cultural and socio-economic resources, as discussed in chapter on Anticipated Impacts and Mitigation Measures of the IAIDP Initial Environment Examination (IEE).

2. The environmental management plan (EMP) for the project defines mitigation and monitoring measures and describes the institutions, responsibilities and mechanisms to monitor and ensure compliance. Such institutions and mechanisms will seek to ensure continuous improvement of environmental protection activities during preconstruction, construction, and operation of the project in order to prevent, reduce, or mitigate adverse impacts. The EMP will be reviewed and updated if there are any changes during the detailed design. The final IEE and EMP will be disclosed on ADB's website following any required updates.

B. Roles and Responsibilities

3. **Executing Agency (EA)**. The Ministry of Agriculture and Irrigation (MOAI) will be the executing agency (EA) for the project and will oversee overall project implementation and management activities to ensure smooth and timely implementation and completion of project activities. The EA has overall responsibility for the project and therefore is ultimately responsible for ensuring the implementation of the mitigation in the EMP and for ensuring compliance with loan covenants. The EA will guide and coordinate closely with other government agencies and the ADB for the timely resolution of any issue and completion of the project within the target dates, expediting the procurement process, and organizing and chairing the Project Steering Committee (PSC) meetings. The EA will designate a project management unit (PMU) Director to oversee the day-to-day management of the project and liaise with all relevant government offices. The EA will also designate a Chairman of PSC that will provide overall supervision to project implementation.

4. **Project Steering Committee (PSC).** The PSC will be established by the EA. The PSC will be chaired by the designated official from the EA and composed of senior officials of the government. The PSC will meet quarterly to (i) approve annual budgets and plans for the project; (ii) review progress in project implementation; (iii) guide and support project implementation; and (iv) provide coordination between ministries and agencies involved in project implementation. The operational cost of the PSC will be funded by EA. ADB will attend the PSC meetings as observer, as needed.

5. **Project Management Unit (PMU)**. The PMU will be established at MOAI in Naypyitaw. On behalf of the executing and implementing agencies, the PMU will assume day-to-day management of the project and will be responsible for coordinating and implementing project activities, including procurement, recruitment, disbursement, contract administration, monitoring and reporting. The PMU will be headed by a Project Manager and will comprise full-time core staff, including environmental management staff The PMU Director will guide and supervise the work of the PMU. The PMU consultants will be recruited under the guidance of the EA and ADB. The EA will provide a furnished, air conditioned/heated office space with communication and

other support facilities as in-kind contribution for project implementation and management. The Project Manager will guide and supervise the work of the PMU. The PMU consultants will be recruited under the guidance of the EA and ADB. The EA will provide a furnished, air conditioned/heated office space with communication and other support facilities as in-kind contribution for project implementation and management.

6. **Implementing Agency (IA)**. The Irrigation Department (ID) and Department of Agriculture (DOA) will be the implementing agencies.

7. **LIEC**. The Project will procure the services of a loan implementation environment consultant (LIEC) to provide support in (i) project implementation including updating the project EMP; (ii) training; (iii) coordinating (or performing) the conduct of regular environmental compliance monitoring (air and noise) in compliance with the monitoring plan; (iv) annual project EMP progress reporting; and (v) identifying environment-related implementation issues and necessary corrective actions. The Terms of Reference for the LIEC is attached to the EMP. The LIEC will work closely with other staff in the PMU, especially the Monitoring and Evaluation Specialist, the Loan Implementation Social Consultant and the Gender and Social Specialist.

8. **Civil works contractors** will be required to formulate contractor EMPs (C-EMP) with management systems for adverse impacts, e.g., dust control, noise control, traffic management, addressing as minimum the requirements of this EMP and the IEE. The C-EMP will be renewed on a yearly basis, submitted to PMU and LIEC for review, and to MOECAF or ECD (if desired). Each civil work contractor will appoint an environment, health and safety officer (EHSO) to coordinate contractor EMP implementation. To ensure that the contractors comply with the EMP provisions, the PMU with the help and technical support of LIEC, will prepare and provide the following specification clauses for incorporation into the bidding procedures: (a) a list of environmental management requirements to be budgeted by the bidders in their proposals; (b) environmental clauses for contractual terms and conditions; and (c) the full EMP in Burmese. Contractors will submit monthly contractor EMP implementation reports to the PMU, and provide information including reports, monitoring results or other information relating to EMP implementation as requested by the PMU and LIEC. **Table EMP-1** provides environmental responsibilities

Table EMP-1 Environmental Responsibilities

Phase	Responsible Agencies	Environmental Responsibilities
Project Preparation	EA, PPTA team	Prepare EARF for IAIDP future subprojects. Conduct IEE per ADB SPS 2009 for core subprojects
	ADB	Review and approve IEE, including EMP. Disclose on ADB website. Review and approve EARF.
Detailed Design	Design organisations	Incorporation of environmental mitigation measures in detailed designs, and bidding documents. Prepare land estimates and locations of suggested site.
	PMU, IAs, LIEC	Update EMP based on detailed design.
	ADB	Approve updated EMP as well as detailed design documents.
Tendering	PMU, IA, tendering company, design	Incorporate mitigation measures, EMP and land acquisitions clauses in tendering documents, civil contracts and contractors' construction management plans.

Phase	Responsible Agencies	Environmental Responsibilities
	institutes	
	LIEC, ADB	Review tendering documents and final EMP requirements; confirm project's readiness.
Construction	EA, IA	Advise on implementation of mitigation measures
	Contractors, EHSO	Prepare C-EMP. Implementation of mitigation measures and conduct internal monitoring/supervision. Complete (sign) and implement land agreements according to the REGF.
	PMU	Coordinate GRM; supervise EMP implementation; conduct regular site inspections; conduct training; support LIEC in preparing annual environmental progress report
	Licensed entity or LIEC	Conduct quarterly environmental monitoring, prepare monitoring report [No current ECD licensed monitoring entities]
	LIEC	Advise on the mitigation measures; provide comprehensive technical support to PMU, EA and IA for environmental management; conduct training; conduct annual EMP compliance review; prepare annual environmental progress reports.
	ADB	Conduct review missions; review and approve annual environmental progress reports, including disclosure
	MOECAF-ECD	Conduct inspections of all construction projects relative to compliance with Myanmar regulations and standards (if possible)
Operation	PMU	Conduct EMP compliance review, instruct IA on environmental management requirements; prepare annual environmental progress report for first year of operation
	IAs	Implementation of mitigation measures as defined in EMP
	IAs or PMU	Conduct environmental monitoring following approved monitoring plan
	ADB	Review and approve environmental progress report, disclose on ADB project website

Abbreviations:
ADB = Asian Development Bank; LIEC = Loan Implementation Environmental Consultants; PMU = Project Management Unit; EA = Executing Agency; IA = Implementing Agency; MOECAF = Ministry of Environmental Conservation and Forestry; ECD=Environmental Conservation Department, under MOECAF; IEE = Initial Environmental Examination; EMP = Environmental Management Plan; EHSO = Environment, Health and Safety Officer; EARF = Environmental Assessment Review Framework; RP = Resettlement Plan.

9. **Assessment of project readiness.** Before construction, the LIEC and IAs will assess the project's readiness in terms of environmental management based on a set of indicators (**Table EMP-2**), and report it to ADB and the PMU. This assessment will demonstrate that environmental commitments are being carried out and environmental management systems are in place before construction starts, or suggest corrective actions to ensure that all requirements are met.

Table EMP-2. Project Readiness Assessment Indicators

Indicator	Criteria	Assessment
Environmental assessment approvals	• The IEE is approved ADB and by ECD (if requested), IEE is validated to conform with the Myanmar environmental requirements	Yes No
Land details to help contractors	• Resettlement checklist and due diligence report completed	Yes No

Indicator	Criteria	Assessment
bid with an understanding of land needs	• Land amounts estimated and preferred site works locations identified ing detailed design) and implemented	
Land agreements completed	• Training on REGF provided to contractors'	Yes No
EMP update	• The EMP was updated after detailed design, and approved by ADB and ECD (if required at that time)	Yes No
Compliance with loan covenants	• The borrower complies with loan covenants related to project design and environmental management planning	Yes No
Public involvement effectiveness	• Meaningful additional consultation completed in affected areas. • GRM established with entry points	Yes No Yes No
Environmental Supervision in place	• LIEC is in place	Yes No
Bidding documents and contracts with environmental safeguards	• Bidding documents and contracts incorporating the environmental activities and safeguards listed as loan assurances • Bidding documents and contracts incorporating the impact mitigation and environmental management provisions of the EMP	Yes No Yes No
Environmental training has been implemented to PMU, IAs and contractors	• Training completed to PMU and IAs • Training completed to contractors	Yes No Yes No
Contractor readiness	• Contractor EMP (C-EMP) has been prepared and approved • Health and Safety Management Plan (HSMP) established for construction sites • Environment, Health and Safety Officers (EHSO) appointed • Assessment of potential disruption to utilities services conducted • Stakeholder interviews to confirm issues if services are disrupted	Yes No Yes No Yes No Yes No Yes No
EMP financial support	• The required funds have been set aside to support the EMP implementation according to the financial plan.	Yes No

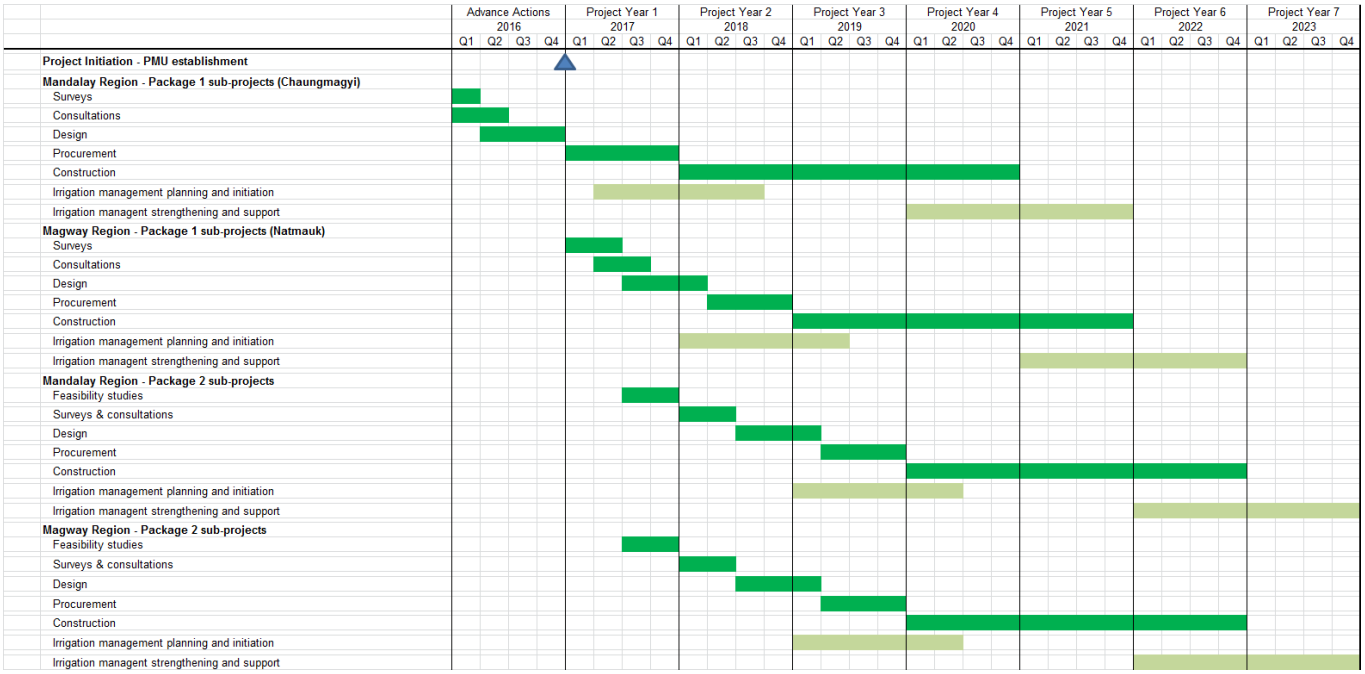
Source: Study Team

Abbreviations:

ADB = Asian Development Bank; LIEC = Loan Implementation Environmental Consultants; PMU = Project Management Unit; EA = Executing Agency; IA = Implementing Agency; MOECAF = Ministry of Environmental Conservation and Forestry; ECD=Environmental Conservation Department, under MOECAF; IEE = Initial Environmental Examination; EMP = Environmental Management Plan; EHSO = Environment, Health and Safety Officer; EARF = Environmental Assessment Review Framework; RP = Resettlement Plan

10. A partial project implementation schedule is shown in **Table EMP-3** outlining several issues important to the implementation of the EMP.

Table EMP-3 Partial IAIDP Project Implementation schedule



C. Summary of Environment Impacts Mitigation Plan

11. This section describes the potential environmental issues and impacts during the detailed design, pre-construction, construction and operation phases of IAIDP components, as identified during the Initial Environmental Examination (IEE), as well as corresponding mitigation measures designed to minimize the impacts. The recommended mitigation measures consist of actions, activities, plans and documents (including Contractor's EMP) that need to be undertaken, observed, obtained, prepared to prevent, mitigate, or compensate for, the salient adverse impacts enumerated in the IEE. The broad measures are outlined below; while the specific measures are presented in the Environmental Mitigation Plan (**Table EMP-4**):

a) incorporating in detailed design adequate considerations and conditions relative climate change and seismicity to sustain the structural integrity and effective operations of completed works;
b) ensuring the engagement of an environment-responsible Contractor by incorporating the SPS-compliant EMP into the bidding documents, for use as basis in the preparation of the Contractor's C-EMP by the selected Contractors, addressing as minimum the requirements of the EMP. C-EMP is to be quantitatively and qualitatively evaluated against the EMP and cleared by PMU prior to the commencement of any work on site. The contract for civil works to explicitly stipulate the obligation to institute the mitigation measures properly and carry out environmental monitoring according to the EMP. The Contract to stipulate some tie-up of progress payment and collection of performance bond with the performance in the implementation of the C-EMP;
c) a C-EMP that ensures good and environment-friendly engineering practices that avoid first, and (if unavoidable) mitigate, adverse impacts; and commitment from Contractor to fully implement the C-EMP;
d) quality construction supervision and environmental monitoring by the IAs and the PMU (environmental monitoring to be outsourced to licensed entity if possible or included in

LIEC TOR if not);

e) sufficient funds for sustained quality of operation and maintenance; and
f) observance of the grievance redress mechanism and prompt action, with resolution of lodged grievances.

12. The Environmental Mitigation Plan points out that most measures are the usual good engineering practices. The effectiveness of the measures will be evaluated based on the results of the environmental monitoring and inspection to determine whether they should be continued or improvements should be made. Improvements need to be confirmed through stipulated environmental management procedures.

Project stage/aspect	Potential Impacts and/or Issues	Locations	Mitigation measures	Implementation Agencies	Supervision Responsibilities	Monitoring Indicators	Estimated Cost In USD
A. Project Preparation and IEE Development							
1. IEE and feasibility stage	IEE preparation	BOTH	Submit IEE to ECD for review and comment (no current review requirements)	PPTA consultants	ECD, ADB	Approval of IEE (by ECD if desired) and by ADB	No additional cost
	Public consultations	BOTH	Conduct consultations on all component projects	PPTA consultants	Local government	Report on public consultations in IEE, Approval of IEE	No additional cost
	GRM	BOTH	Prepare GRM and validate requirements with EA and IAs	PPTA consultants	EA	Approval of IEE	No additional cost
B. Detailed Design Stage							
Loan Implement. Environ. Consultant	Engagement of LIEC	BOTH	Engage a Loan Implementation Environment Consultant (LIEC)	PMU	EA, ADB	LIEC engaged	Included in PMU budget
Update IEE and EMP if necessary	Incorporating EMP in detailed design and updating EMP and based on detailed design decisions	BOTH	Mitigation measures defined in this EMP will be reviewed, updated and incorporated into the detailed design to minimize adverse environmental impacts. If necessary, update IEE/EMP based on design decisions.	Design Institutes, LIEC, IAs	PMU, ADB	ADB approval of updated IEE/EMP following detailed design	Detailed design institute budget
Land acquisition preparations	Estimate amount of land take required temporarily and permanently and identify preferred locations for site activities	BOTH	Include land details and requirement to complete land agreements with negotiated settlement or voluntary donation according to the REGF in tender and contract documents. Sign land agreements prior to construction activities commencing on the plot.	Design Institutes, LISC, IAs	PMU, ADB	ADB approval of resettlement checklist and safeguard due diligence report.	Detailed design institute budget
Seismicity	Review seismic zone rating for project area and Myanmar structural standards	BOTH	Incorporating in detailed design adequate considerations and conditions relative seismicity to sustain the structural integrity and effective operations of completed works.	Design Institutes, LIEC, IAs	PMU, ADB	ADB approval of updated IEE and designs following detailed design	Detailed design institute budget
Climate change	Review potential impacts of climate change on various design features	BOTH	Incorporating in detailed design adequate considerations and conditions relative to climate change using recommended climate adaptation measures and good engineering design practices including: a) detailed designs will take account of best estimates of flood flows at an appropriate	Design Institutes, LIEC, IAs	PMU, ADB	ADB approval of updated IEE and designs following detailed design	Detailed design institute budget

			rate of return, including for the design of cross drainage b) good quality construction methods prescribed c) appropriate water allocation and management of systems prescribed d) GEF pilot recommendations for impact of watershed management on water availability, and potential reduction of sedimentation will be investigated e) the project is designed to cope with diversified cropping f) irrigation system O&M systems developed				
GEF sediment reduction techniques	Integrating results of GEF pilot project into detailed design	BOTH	Detailed design includes best practices for improved sediment reduction and control based on GEF pilot project.	Design Institutes, LIEC, IAs	PMU, ADB	ADB approval of updated IEE and designs following detailed design	Detailed design institute budget
Bidding documents	Bidding documents and IEE and EMP requirements	BOTH	Include EMP obligations in tender documents and specifications, referencing the EMP and monitoring plan.	IAs, PMU, LIEC	PMU, EA	Approved Bidding documents	No additional cost
	Grievance Redress Mechanism	BOTH	Implement GRM, appoint a GRM coordinator, brief contractors and affected people on GRM procedures before construction begins for rehabilitated facilities	PMU, LIEC	EA, ADB	Operational GRM	Included in construction cost and PMU budget
	Additional consultation in core subproject areas	BOTH	Conduct additional public consultation based on detailed design decisions and updated EMP and take feedback. Also explain the GRM for complaints.	Design institutes, LIEC	Local government	Report on public consultations in updated IEE, Approval of IEE	Detailed design institute budget
	Environmental Protection Training	BOTH	Provide training to PMU, IAs and contractors on implementation and supervision of environmental mitigation measures per recommended training program in tiered fashion.	a. LIEC to PMU, b. PMU and LIEC to IAs c. IAs and LIEC to contractors	EA, ADB	Training duration	Included in training budget
	Assign environmental control and monitoring responsibilities	BOTH	Prior to construction, assign responsibilities related to control and internal monitoring for rehabilitated facilities	PMU, IAs	EA, ECD	Responsibilities assigned	Included in PMU budget
	Environmental operation and supervision manual	BOTH	Prior to construction, contractors required to produce an environmental operation and supervision manual including HSMP for approval	Contractors	PMU, ECD	Approved operation and supervision plans	Included in construction cost

	Contractor prepares specific Contractor EMP (C-EMP) prior to construction	BOTH	Prior to construction, contractors required to produce an site specific contractor EMP (C-EMP) for each project site	Contractors	PMU, ECD	Approved C-EMP	Included in construction cost
	Monitoring entity	BOTH	PMU hires licensed monitoring entity if available or adds task to LIEC TOR	PMU	EA, ADB	Monitoring entity engaged	Included in PMU budget
C. Construction Stage							
0. Land acquisition (prior to construction on plots)	Good community relations from fair land transactions	BOTH	Negotiate, sign and implement land agreements.	Contractor	PMU, LISC, IEP	IEP's inception report with verification methocology and their final report approved by ADB	Included in PMU budget Land acquisition costs in contractor's budget
1. Soil	Soil erosion, excavation, spoil disposal	BOTH	Site Drainage and Soil Erosion Protection Plan to be prepared by the contractor; Surplus earth shall be used for filling at sites defined in plans; Excavation width and depth should be minimized to reduce spoil generation. Duration of open trenches should be minimized, and backfill should commence immediately after completion; Use settling ponds, silt fences and screens to prevent sediment transport; Construct intercepting ditches and drains to prevent runoff entering construction sites, and divert runoff from sites to existing drainage; Strip and stockpile topsoil, and cover or seed temporary soil stockpiles; graded soil must be separately stockpiled from other materials and be readily recoverable for reinstatement; Limit construction and material handling during periods of rains and high winds; Properly slope or re-vegetate disturbed surfaces, such as compacted trenches and cut banks; Slope stability must be undertaken and drains and sediment barriers must be installed as necessary and maintained until final reinstatement is completed; and	Contractor	IA, PMU, LIEC, Supv	Visual inspection, monitoring report	Included in construction cost

			Appropriately set up temporary construction camps and storage areas to minimize the land area required and impact on soil erosion.				
	Soil damage, contamination	BOTH	Properly store petroleum products, hazardous materials and wastes on impermeable surfaces in secured and covered areas, and use the best management practice to avoid soil contamination; Remove all construction wastes from the site to approved waste disposal sites; Establish emergency preparedness and response plan; and Provide spill cleanup measures and equipment at each construction site and require contractors to conduct training in emergency spill response procedures.	Contractor	IA, Supv, LIEC	Visual inspection, monitoring report	Included in construction cost
2. Surface water and Wastewater	Wastewater from construction sites	BOTH	Wastewater from construction site will be discharged approved sediment ponds or holding areas and not discharged directly to ditches and streams. In addition to the drainage measures outlined above related to soil erosion, a water quality control plan will include the following: Contractors will be required to develop and implement contingency plans for control of spills of oil and other hazardous substances (Spill Management Plan) as part of their C-EMP; Enclosed drainage around chemical storage areas on construction sites and storage will be on hard surfaces; Fuel storage, maintenance shop and vehicle cleaning areas must be stationed at least 300 m away from the nearest water body and will include enclosed drainage to ensure contaminated water does not cause pollution and storage, maintenance and cleaning activities will be on hard surface; Construction wastes and materials (e.g. fuel) will be properly contained during construction on hard surface and fuel tanks will be located in a bunded area which has a	Contractors	PMU, Supv, LIEC	On-site drainage control devices	Included in construction cost

			capacity of 110% of the fuel tank. Wastes will be stored in a hard surface area which is protected from rain and wind and waste removed from site and taken to approved disposal facilities. Wastewater collected at construction sites or camps should be put into sewerage systems (not likely) or appropriate onsite treatment or holding systems installed.				
3. Air quality	Air pollution mainly dust due to use of heavy vehicles. Areas may be susceptible to fugitive dust.	BOTH	Stockpiles must be managed to reduce dust emissions. The location of the stockpiles must be downwind of sensitive receptors. The stockpiles must be sprayed with water before material is moved. If a stockpile is within 300m of dwellings, additional precautions must be taken including using a reusable stockpile cover and fencing to form a high barrier and prevent wind lifting and dispersing; Construction site management: Water will be sprayed on construction sites and material handling routes where fugitive dust is generated. Transport of materials: Trucks carrying earth, sand or stone will be covered with tarpaulins or other suitable cover. Construction vehicles and machinery will be maintained to a high standard to minimize emissions (note that local standards do not exist for vehicle emissions) Manufacturing plants: Site any plants for the production of concrete or pavement covering such as asphalt at least 500 m from the nearest dwelling and locate downwind.	Contractor, licensed entity	PMU, LIEC, Supv	Citizen and worker complaints. Visual inspection reports by monitoring entity	Included in construction cost PMU budget
4. Solid waste	Construction and domestic wastes generated on construction sites	ALL	Develop and implement a Solid Waste Management Plan for conventional and potentially hazardous wastes. Waste hierarchy: Construction will be subject to the waste hierarchy to ensure efficient use and management of resources. The preference is for prevention of waste at source. Waste minimization is the second preferred option. Reuse or recycling options should be considered prior to disposal,	Contractor, IAs	PMU, LIEC, Supv	Visual inspection, Monitoring report	Included in construction cost

			separate containers for recyclables shall be used if there is a market for the materials. Disposal of waste which cannot be reused or recycled shall take place at sites authorized by the local authorities. Storage and containment: Provide appropriate waste storage containers for worker's construction wastes; install confined storage points of solid and liquid wastes away from sensitive receptors, regularly haul to an approved disposal facility; Use of contractors: Use a contractor approved by the local authorities to remove all wastes from construction sites; Spoil management: Spoil will be disposed only in sites which are defined in the Borrow and Spoil Management Plan; spoil will not be disposed of on slopes or near pasture land where it may impact on vegetation; rehabilitate and restore spoil disposal sites in accordance with the agreed plan. General Management: Prohibit burning of waste at all times.				
6. Biological resources	No significant flora and fauna but measures to protect existing resources	BOTH	Protect existing vegetation near construction sites; Properly backfill, compact and re-vegetate excavations after installation; Protect existing trees and grassland during constructions; where a tree has to be removed or an area of grassland disturbed, replant trees and re-vegetate the area immediately after construction; Only native plant species of local prevalence will be used for re-vegetation; Identify, demarcate and protect sites where small animals, reptiles, and birds of common species live such as vegetated roadside areas, trees, inner areas of bridges and river riparian zones, etc.	Contractor, IAs	PMU, LIEC, Supv	Visual inspection, Monitoring report	Included in construction cost
7 Cultural Resources	None identified but measures if uncovered	BOTH	If paleontological fossils are encountered during construction, all activities will halt and an established action plan will be implemented (notification of local	Contractor, IAs	PMU, LIEC, Supv	Visual inspection, Monitoring report	Included in construction cost

			administration and Environmental Conservation Department). Works will recommence only after appropriate measures have been taken as requested by the appropriate authority, and confirmation has been received from them that works may resume				
8. Noise	Noise from construction activities	BOTH	a) Source control: Maintain all exhaust systems in good working order; undertake regular equipment maintenance; b) Locate sites for concrete-mixing and similar activities at least 300 m away from sensitive areas; c) Operate between 8am-6pm only and reach an agreement with nearby residents regarding the timing of heavy machinery work, to avoid any unnecessary disturbances; d) Provide advance warning to the community, including residents, school, temple and hospital on timing of noisy activities. Seek suggestions from community members to reduce noise annoyance; Public notification of construction operations will incorporate noise considerations; information procedure of handling complaints through the Grievance Redress Mechanism will be disseminated; e) Ensure noise monitoring is undertaken near sensitive receptors, particularly dwellings, temple school and hospital; f) All construction workers to use appropriate Personal Protective Equipment (PPE) for high noise or lengthy exposure.	Contractors, IAs, licensed entity	PMU, LIEC, Supv	Citizen complaints, Monitoring report	Included in construction cost
10. Groundwater monitoring	Establish baseline at beginning of project and quarterly thereafter	BOTH	Pesticides have potential adverse, but likely small environmental impacts on groundwater quality. The analysis of water samples for pesticides is extremely expensive. As a result the detailed design team will choose which pesticides to include in water sample analysis. To be included, the pesticide must be used in the locality, it must have environmental fate characteristics that could result in groundwater impacts and it must	Contractors, IAs, licensed entity	PMU, LIEC, Supv	Monitoring report	Included in construction cost

			have a laboratory analytical method that is possible to undertake physically, chemically and financially.				
11. Construction Site safety	Health and safety of workers for new and rehabilitated facilities, also protecting visitors, nearby residents	BOTH	Temporary traffic management, road safety awareness measures employed. Construction site safety: Clear signs will be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials and excavation and raising awareness on safety issues. Heavy machinery will not be used after day light and all such equipment will be returned to its overnight storage area/position before night. All sites will be made secure, discouraging access by members of the public through fencing or security personnel, whenever appropriate.	Contractors	PMU, Administration, LIEC, Supv	Number of incidents and complaints	Included in construction cost
Occupational Health and Safety	Precautions to protect the health and safety of construction workers	BOTH	Environment Health and Safety Officer: An Environment Health and Safety Officer (EHSO) will be employed to develop, implement and supervise a Health and Safety Management Plan (HSMP), as well as to ensure that the requirements of the EMP are implemented. Implementation of HSMP: The EHSO will ensure that the HSMP is approved and implemented. This includes recording and reporting any occupational health and safety incidents, and reviewing the distribution and use of appropriate Personal Protective Equipment (PPE) and proper training is conducted. At a minimum, the HSMP will include the following provisions: i. Clean water. Provide a clean and sufficient supply of fresh water, for construction and for all houses, camps, offices, laboratories and workshops. ii. Sewage and wastewater. Provide adequate sanitation facilities at all work sites. iii. Solid waste. Provide garbage receptacles at construction sites, which will be periodically cleared and disinfected. iv. Liquid chemical waste. Provide	Contractors	PMU, Administration, LIEC, Supv	Number of incidents and complaints	Included in construction cost

			receptacles in suitably bunded areas for the storage of liquid chemical waste prior to disposal. Include clear warnings with health risks. v. Personal protection. Provide personal protection equipment (PPE), such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection, in accordance with relevant health and safety regulations, for workers. vi. Emergency Preparedness and Response. An emergency response plan to take actions on accidents and emergencies, including public health emergencies associated with hazardous material spills and similar events will be prepared. Emergency phone contacts will be established. vii. Records Management. A Records Management System that will store and maintain easily retrievable records protected against loss or damage should be established. It will include documenting and reporting occupational accidents, diseases, and incidents. The records will be reviewed during compliance monitoring and audits. viii. Safety communication. Ensure that safety, rescue and health matters are given a high degree of publicity to all persons regularly or occasionally at active construction sites. Posters in Burmese and any other language appropriate for the contractors drawing attention to relevant health regulations will be made or obtained from the appropriate sources and will be displayed prominently at construction sites. iv. Labor profile and workers' rights: Contractor to report monthly on workfore including workers' place of origin;, gender; ethnicity; type of contract: full-time; part,time; un skilled, semi-skilled, skilled, management, administration. Ensure workers have contracts; correct and timely pay; no use of excessive overtime. ,				

12. Socio-economic impacts	Temporary Canal Closures	BOTH	When construction cannot be accomplished during non-operation periods and canal operations must be maintained, construct temporary bypass structures to maintain canal operations during construction.	Contractor	IAs, LIEC, Supv	Visual inspection, Monitoring report	Included in construction cost
	Construction and operational traffic access and plan for works	BOTH	Develop detailed construction and operation traffic management plans, to maintain public access during construction	IA, Supv	PMU, EA, Supv	Approved and implemented plans	Included in construction cost
13. GRM	Grievance Redress Mechanism	BOTH	Implement the GRM	PMU	EA, ADB	GRM Reports	Included in construction cost, PMU budget
D. Operation Stage							
1. Groundwater levels	Potential rise in groundwater levels	BOTH	Changes in groundwater levels will be regularly monitored by the ID.	IA	EA	Changes in levels of groundwater monitoring wells	Included in IA operational budget
	Waterlogging potential downstream	BOTH	Changes in waterlogging downstream of perimeters will be monitored	IA	EA	Changes in waterlogging downstream	Included in IA operational budget
2. Canal sedimentation	Sediment deposition in canals and structures	BOTH	The ID will prepare an operations and maintenance plan to include regular maintenance and removal of deposited sediment. The plan should cover the determination and approval for disposal sites for the removed sediment.	IA	EA	Operations and maintenance plan prepared and implemented	Included in IA operational budget
3. Pesticide usage	Overuse of pesticides causing land and water degradation	BOTH	Farmers receive IPM (integrated pest management) training which ispart of Agriculture component training.	IA	EA	Monitoring amounts used and purchase records	Included in IA operational budget
	Continue groundwater monitoring	BOTH	Pesticides have potential adverse, but likely small environmental impacts on groundwater quality. The analysis of water samples for pesticides is extremely expensive. As a result the detailed design team will choose which pesticides to include in water sample analysis. To be included, the pesticide must be used in the locality, it must have environmental fate characteristics that could result in groundwater impacts and it must have a laboratory analytical method that is	IAs, licensed entity	PMU, IAs	Monitoring report	IA budget

			possible to undertake physically, chemically and financially.				
4. Fertilizer usage	Overuse of fertilizers causing land and water degradation	BOTH	Given the proper training programs under the Agriculture component, the application doses can be managed to be optimum for the crops.	IA	EA	Monitoring amounts used and purchase records	Included in IA operational budget
5. Flooding and natural disasters	Potential impacts due to increased flooding and natural disasters	BOTH	Maintenance of irrigation works will ensure the operation capacity and that needed repairs are done quickly. Operating rules for reservoirs will reduce the risk of flooding	IA	EA	Reservoir operational data	Included in IA operational budget
6. Canal safety	Canal safety near public access areas	BOTH	The ID will provide an operations plan with standards for access roads and public access in the perimeters that includes safety measures to protect the public at settlement areas and other dangerous locations in the perimeters, including drop structures and other locations. Public education on risks should also be provided.	IA	EA	Operations plan prepared. Public education conducted. Accident records	Included in IA operational budget
7. Agricultural wastes	Management of agricultural waste	BOTH	The Agriculture component will provide training on systems to minimize and/or properly dispose of agricultural wastes in an environmentally sound manner.	IA	EA	Monitoring practices and complaints	Included in IA operational budget

Table EMP-4. Summary of Potential Environmental Implications, IAIDP Core Subprojects

Abbreviations:
ADB = Asian Development Bank; LIEC = Loan Implementation Environmental Consultants; PMU = Project Management Unit; EA = Executing Agency; IA = Implementing Agency; MOECAF = Ministry of Environmental Conservation and Forestry; ECD=Environmental Conservation Department, under MOECAF; IEE = Initial Environmental Examination; EMP = Environmental Management Plan; EHSO = Environment, Health and Safety Officer; EARF = Environmental Assessment Review Framework; RP = Resettlement Plan; Supv = Supervision Consultants (may be same as design), LISC = Loan Implementation Social Consultant, IEP = Independent External Party

13. Cost estimates for mitigation measures, environmental monitoring, public consultations, and capacity building are summarized in **Table EMP-5**. The compliance monitoring costs will be borne by the IAs as part of their implementation functions. Internal monitoring costs will be borne by the contractors and the IAs. Independent monitoring costs will be from the PMU consultancy budget. Before implementing a monitoring plan, responsible agencies will present a more detailed breakdown of the estimated budget. During project implementation, the budgets will be adjusted based on actual requirements. Contractors will bear the costs of all mitigation measures during construction, which will be included in the tender and contract documents. The IAs will bear the costs related to mitigation measures during operation. Costs related to environmental supervision during construction and operation will be borne by the IAs and the operators. Costs for capacity building will be borne by the project as a whole.

Table EMP-5: Cost Estimates For The Environmental Management Plan

Item (total of 2 core subprojects)	Estimated Costs (USD)	Source of Funds
Environmental mitigation (including C-EMP and other plans)	26,000	Contractor budget
Environmental monitoring	4,000	PMU budget, IA budget
Public consultations	2,000	PMU budget
Environmental management consultancy	15,000	PMU budget
Training	3,000	PMU budget
Total	50,000	

D. Environmental Monitoring and Inspection

14. Environmental monitoring and inspection will consist of: (i) environmental impact monitoring; and (ii) EMP performance verification. Environmental impact monitoring will cover ambient air quality and noise, surface water quality and community health and safety prior to construction and during construction; and workers health and safety during construction. EMP performance verification will monitor and verify the performance of the Design Consultant, Contractor, Operator, and PMU in complying with, or adhering to, the C-EMP and EMP. The Environmental Monitoring and Inspection Plan is presented as **Table EMP-6**.The LIEC will working with the Monitoring and Evaluation Specialist to ensure the environmental and monitoring plan is embedded in the project performance management system.

Table EMP-6. Environmental Monitoring and Inspection Management Plan

Environmental Media/Issue	Location, Parameters, Monitoring Technique	Responsibility & Frequency
Pre-Construction Phase		
Project readiness	• **Method:** Review of PMU's and contractor's readiness to implement all component projects based on assessment of Project Readiness Indicators	LIEC – once before construction

Environmental Media/Issue	Location, Parameters, Monitoring Technique	Responsibility & Frequency
	• **Parameters:** Readiness indicators	
Construction Phase		
Land Acquisition	• **Method, Location:** Observation of land agreement meetings • **Parameters:** Amount of land acquired, number of land agreements; amount of money paid for land acquisition; satisfaction of land owner; compliance with REGF	Gender and Social Consultant, LISC – when land agreements are occurring
Soil erosion and contamination	• **Method, Location:** Visual inspection of all component projects • **Parameters:** (i) adequacy of soil erosion prevention measures; (ii) adequacy of soil contamination prevention techniques; (iii) evidence of excessive soil erosion or soil contamination	EHSO - daily PMU – bi-weekly LIEC - yearly
Solid and liquid waste management	• **Method, Location:** Visual inspection of all component projects • **Parameters:** (i) adequacy of solid and liquid waste management, storage and containment system; (ii) presence of solid waste dumps, waste fires	EHSO - daily PMU – bi-weekly LIEC - yearly
Construction site health and safety	• **Method, Location:** Visual inspection and interviews with construction workers and contractors at all component projects • **Parameters:** (i) adherence to the approved Health and Safety Management Plan (HSMP); (ii) performance of the EHSO; (iii) worker complaints and concerns.	EHSO - daily PMU – bi-weekly LIEC - yearly
Community health and safety	• **Method, Location:** Visual inspection of all component projects, informal interviews with nearby residents • **Parameters:** (i) adherence to approved temporary traffic management plan; (ii) adequacy of construction site signage and fencing; (iii) adequacy of temporary noise mitigation measures; (iv) accidents involving public and workers; (v) emergencies and responses; (v) public complaints - noise, air pollution, construction site safety, localized flooding, etc.	PMU – bi-weekly LIEC - yearly
Induced traffic disturbance	• **Method, Location:** Visual inspection at all component projects, informal interviews with affected people, consultation of local traffic police • **Parameters:** (i) adequacy of, and compliance with, the approved temporary traffic control and operation plan; (ii) satisfaction of affected people.	PMU – bi-weekly LIEC - yearly
Air quality	• **Method, Location:** Air quality monitoring adjacent to all component projects' site boundaries, inside boundaries of sensitive receptors if available	Licensed entity if available or LIEC if not – quarterly

Environmental Media/Issue	Location, Parameters, Monitoring Technique	Responsibility & Frequency
	• **Parameters:** Dust, [PM_{10}, $PM_{2.5}$ if qualified entity located for monitoring]	
Noise	• **Method, Location:** Noise monitoring, on pavements adjacent to all component projects, inside sensitive receptors if available • **Parameters:** dB(A) sound levels	Licensed entity if available or LIEC if not – quarterly
Groundwater Monitoring	• **Method, Location:** Groundwater monitoring for pesticides at beginning of project and quarterly thereafter. • **Parameters:** Pesticides have potential adverse, but likely small environmental impacts on groundwater quality. The analysis of water samples for pesticides is extremely expensive. As a result the detailed design team will choose which pesticides to include in water sample analysis. To be included, the pesticide must be used in the locality, it must have environmental fate characteristics that could result in groundwater impacts and it must have a laboratory analytical method that is possible to undertake physically, chemically and financially.	Licensed entity if available or LIEC if not – quarterly
EMP Compliance Monitoring	• **Method, Location:** Review of project's adherence with EMP and loan covenants • **Parameters:** EMP and loan covenants	PMU, LIEC - yearly
Construction Completion and Operation Phase		
Post-construction site inspection	• **Method, Location:** Visual inspection, post-construction environmental condition assessment at all component projects • **Parameters:** Post Construction Environmental Condition	IAs – twice: one week before completion, once after completion
Vegetation	• **Method, Location:** Visual inspection of all component projects' revegetation • **Parameters:** Grass growth and health	IAs – 4 times during first year of operation
Interview with AP	• **Method, Location: Method, Location**: Interview with potentially affected people (AP) adjacent to all component projects; • **Parameters: (i)** Overall satisfaction with project outputs; (ii) concerns and complaints.	IAs– twice during first year of operation

Source: Study Team

E. Institutional Strengthening and Training

15. The most logical place to start with this institutional strengthening and training will be at the Project Management Unit (PMU) once in place for the IAIDP. The project PMU staffing includes a Loan Implementation Environmental Consultant (LIEC) on an intermittent basis and one of the first tasks of the LIEC will be training the PMU and IAs in ADB Safeguards. This work

will initially focus on the implementation of the core subproject EMP, and expanded to the screening and management of future subprojects under the EARF. It is likely that the new ECD systems and standards being developed with ADB support will be finalized and put into place during the life of the IAIDP. As such, training will be expanded to include national systems as well as ADB environmental management and safeguard systems as they become operational. The training strategy will include a "cascade" approach using a "training of trainers" with first training the PMU by the LIEC, then the PMU and LIEC training of the IAs, and finally the IAs training the construction contractors with assistance by the LIEC. **Table EMP-7** provides summary of institutional strengthening measures.

16. **Training.** Training materials will be translated into the national language. In doing so, a set of teaching materials and a cadre of trainers is left behind. This will provide the basic capital necessary to undertake training but does not provide for the operating funds. Financial resources to deliver the training programs are provided for in the PMU budget. The PPTA team has prepared a translated version of the EMP requirements as a starting point for the future training program. The EA, PMU, IAs and contractors will receive training in environmental management, environmental monitoring and supervision, mitigation planning, emergency response, public consultation and Grievance Redress Mechanism, occupational and community health and safety, and other environmental management techniques. The training topics, methods, and estimated costs for IAIDP are described in **Table .** Training will be managed by the LIEC with support of other experts under the loan implementation consultant services.

Table EMP-7. Proposed Institutional Strengthening Measures

Target Agencies	Institutional strengthening measures	Timing
EA, IAs, PMU	• Defining institutional arrangements for environmental management, monitoring, and supervision • Defining positions and responsibilities	During project detailed design
Licensed laboratory	• Recruiting and contracting licensed entity for environmental monitoring before, during and after construction [if available]	Prior to project implementation
LIEC	• Recruiting and contracting one national LIEC for environmental management, environmental training, EMP compliance review, and reporting	Prior to project implementation
Contractors, EHSO	• Hire Environment, Health and Safety Officers for each construction site. • Develop Health and Safety Management Plans (HSMP)	Prior to project implementation

Table EMP-8 Training Program

Training Topic	Targeted Agencies	Timing/Trainers	Duration, Costs
Workshop by LIEC on ADB Safeguards - implementing core subproject EMP as well as screening under EARF. • Complete review of ADB safeguard requirements, from design to construction to operations. IAIDP Core Subproject EMP discussed in detail and requirements for inclusion in bidding documents.	PMU	Mobilization of PMU. Conducted by LIEC	1 X 1 day, $1,000
EMP Implementation: • ADB SPS 2009 requirements • Myanmar new environmental requirements with ECD. • Construction Phase Mitigation • Roles and Responsibilities, Monitoring, Supervision and Reporting Procedures. • Public consultation • Grievance Redress Mechanism: Roles and Responsibilities, Procedures • Occupational and Community Health and Safety, Emergency Preparedness and Response • Contractor Engagement and Management, including EMP Enforcement • Reporting requirements. Screening of Subprojects With EARF: • Preparation of rapid environmental assessments along with pre-feasibility studies • Determination of whether subproject requires an IEE or can be managed under EARF.	IAs	Prior to implementation and during project implementation. Conducted by PMU and LIEC	2 x 1 day, $2,000
Contractor requirements: • Preparation of contractor EMP (C-EMP) for each project area complying with project IEE/EMP. • Provision of Environmental Health and Safety Officer (EHSO) • Pollution Control and Environmental Monitoring, Inspection and Reporting including required mitigations of EMP. • GRM requirements	Contractors and their identified EHSOs	Prior to implementation and during project implementation. Conducted by IAs with assistance from the LIEC	2 x 1 day, $2,000

F. Environmental Reporting

17. **Quarterly environmental monitoring reports.** The licensed entity (if available by time of implementation, or LIEC if not) will prepare concise reports presenting the results of the monitoring of air, noise and groundwater quality, with a short assessment of

compliance/non-compliance with World Bank EHS standards and Myanmar ambient environmental air and noise standards, when finalized.

18. **Yearly environmental progress reports.** To ensure proper and timely implementation of the EMP and adherence to the agreed environmental covenants, the PMU shall submit to ADB yearly environmental progress reports, based on quarterly progress reports of the PMU and the quarterly reports of the licensed laboratory. The LIEC will support the PMU in developing the annual reports. The report should confirm the project's compliance with the EMP, local legislation such as EIA requirements, and identify any environment related implementation issues and necessary corrective actions, and reflect these in a corrective action plan. The performance of the contractors will also be reported on with respect to environmental protection and impact mitigation. The operation and performance of the project GRM, environmental institutional strengthening and training will also be included in the quarterly environmental performance report. **Table EMP-9** summarizes the reporting requirements.

Table EMP-9. Reporting Requirements

Report	Frequency	Purpose	From	To
Contractor's Progress Report	Monthly	Satisfy EMP	Contractor	PMU
Environmental Monitoring Report	Quarterly	Monitoring of air, noise and pesticides in groundwater	Licensed entity (if available) or LIEC	PMU
Annual Environmental Progress Report	Annually	Adherence to Environmental Covenants and EMP	PMU , LIEC	ADB

G. Mechanisms for Feedback and Adjustment

19. Based on environmental monitoring and reporting systems in place, the PMU shall assess whether further mitigation measures are required as corrective action, or improvement in environmental management practices are required. The effectiveness of mitigation measures and monitoring plans will be evaluated by a feedback reporting system. The PMU will play a critical role in the feedback and adjustment mechanism. If the PMU identifies a substantial deviation from the EMP, or if any changes are made to the project scope that may cause significant adverse environmental impacts or increase the number of affected people, then the PMU shall immediately consult ADB to identify EMP adjustment requirements.

H. Grievance Redress Mechanism

20. A grievance redress mechanism (GRM), consistent with the requirements of the ADB Safeguard Policy Statement (2009) will be established to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. In addition to serving as a platform to resolve grievances, the GRM has been designed to help achieve the following objectives: (i) open channels for effective communication, including the identification of new environmental or social issues of concern arising from the project; (ii) demonstrate concerns about community members and their environmental and socio-economic well-being; and (iii) prevent and mitigate any adverse environmental impacts on communities caused by project implementation and operations. The GRM is accessible to all members of the community including workers of contractors.

21. The proposed GRM follows the existing approach taken for managing complaints about local issues by members of the public in Myanmar. Residents' complaints or concerns are generally taken to local government (village and township level) representatives for resolution, therefore this system is proposed for the GRM.

22. In their capacity as IAs, the Irrigation Department (ID) and Department of Agriculture (DOA) will establish a Public Complaints Unit (PCU) within the PMU prior to construction to deal with complaints from affected people (AP) throughout implementation of the project. PMU staff (in particular the LIEC, the LISC, and the Gender and Social Specialist), and the contractor's land negotiator will have roles to play in explaining and helping community members use the GRM.This can include nearby residents, construction workers, village and township government, etc.

23. The PMU will be responsible for ensuring the setting up and coordination of the GRM at a local level and will staff the PCU. The LIEC and LISC will coordinate its set up and the Gender and Social Specialist will be responsible for the day to day PCU activities: maintaining the grievance register, organizing investigations, acknowledging and communicating results to the affected person, and monitoring for the closing out of the issue.The PMU will be the key contact point for local government representatives who may require information about the project or who have an issue they would like to discuss. The PMU will issue public notices to inform the people and organizations within the project area of the GRM. The PCU's phone number, fax, address, email address will be disseminated.

22. The PMU will have facilities to maintain a complaints database and communicate with contractors, supervision engineers, the environmental inspectors of ECD and representatives of affected local governments.

23. Procedures and timeframes for the grievance redress process are as follows and shown in **Figure EMP- 1**.

a. **Stage 1: Access to GRM**. If a concern arises, the AP may resolve the issue of concern directly with the contractor, or make his/her complaint known to either the PCU directly, or through the local government, whichever level of authority he/she is most comfortable with;

b. **Stage 2: Official Complaint to PCU**. If a complaint is filed at local government level, the government representative will submit an oral or written complaint to the PCU. For an oral complaint the PCU must make a written record. For each complaint, the PCU must assess its eligibility. If the complaint is not eligible, for instance if it is determined thatan issue outside the scope of the project, the PCU will provide a clear reply within five working days to the AP;

c. **Stage 3: PCU Complaint Resolution.** The PCU will register the eligible complaint informing the respective local and district government, the PMU, contractors, and ADB. The PCU, with support of the loan implementation environment consultant (LIEC), will take steps to investigate and resolve the issue. This may involve instructing the contractor to take corrective actions. Within seven days of the redress solution being agreed upon, the contractor should implement the redress solution and convey the outcome to the PMU and ADB;

d. **Stage 4: Stakeholder Meeting.** If no solution can be identified by the PCU or if the AP

is not satisfied with the suggested solution under Stage 3, within two weeks of the end of Stage 3, the PCU will organize a multi-stakeholder meeting under the auspices of the head of local government, where all relevant stakeholders will be invited. The meeting should result in a solution acceptable to all, and identify responsibilities and an action plan. The contractor should implement the agreed redress solution and convey the outcome to the PMU and ADB within seven working days.

The invitees to this meeting will depend on the nature of the complaint. For example if the complaints relate to health, land disputes, or labor issues, the appropriate specialist in this field will be invited to the stakeholder meeting. This may include officers from the Department of Agricultural Land Management and Statistics (land rights issues), Myanmar Chamber of Commerce (business/commercial issues), various NGOs (gender or equity issues), Ministry of Health (health issues), MOECAF (environmental issues), and Ministry of Labor (labor issues).

e. **Stage 5: District Administration Officer Resolution.** If the multi-stakeholder meeting cannot resolve the problem, and the AP remainsunsatisfied, the PCU will set up a meeting with the District Administration Officer to identify a solution.

24. The PCU will record the complaint, investigation, and subsequent actions and results. The PMU will include this information in the quarterly EMP progress reports. In the construction period and the initial operational period covered by loan covenants the EA will periodically report complaints and their resolution to ADB in the quarterly project progress reports and annual environmental monitoring reports.

25. Tracking and documenting of grievance resolution within the PCU will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) dedicated staff to update the database routinely; (iii) periodic reviews of complaints so as to recognize grievance patterns, identify any systemic causes of grievances, promote transparency, publicize how complaints are being handled, and periodically evaluate the overall functioning of the mechanism; (iv) processes for informing stakeholders about the status of a case; and (v) procedures to retrieve data for reporting purposes, including the periodic reports to the EA and ADB.

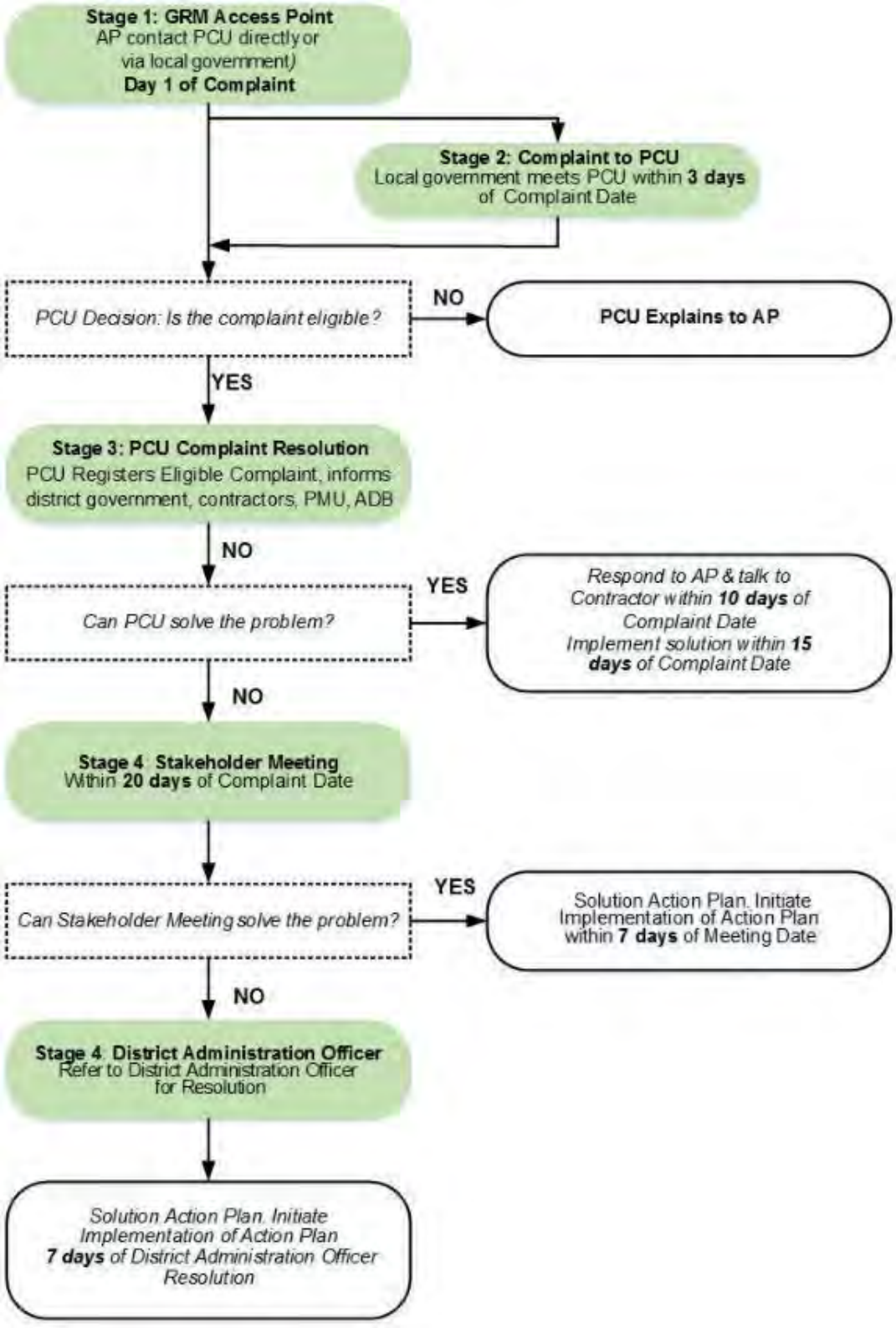
26. **Members and Responsibilities of the PCU.** The responsibilities of the PCU are implemented by the PMU, who is the PCU focal point. In addition to the PMU, the members of the PCU will be those in a position to resolve complaints and besides PMU will include representatives of: (i) regional government; and (iii) relevant local government representatives. The responsibilities of the PCU are as follows:

- The PCU will instruct contractors and construction supervisors to refer any complaints that they have received directly to the PCU. Similarly, the PCU will coordinate with local government departments capture complaints made directly to them;
- The PMU, as the focal point of the PCU, will log complaints and date of receipt onto a complaints database and inform the IA and the Contractor.
- The PCU will investigate the complaint to determine its validity and to assess whether the source of the problem is because of project activities, and identify appropriate corrective measures and responsible persons;
- The PCU will inform the AP of investigation results and the action taken;
- If a complaint is transferred from local government agencies, the PMU will submit an interim report to local government agencies on status of the complaint investigation and

follow-up action within the time frame assigned by the above agencies;

- The PCU will review the contractor's response to the identified corrective measures, and the updated situation;
- The PCU will undertake additional monitoring, as necessary, to verify as well as review that any valid reason for complaint does not reoccur.

Figure EMP- 1 Proposed Project GRM



Source: ADB Study Team

27. Affected persons, if not satisfied with the GRM results, always have legal recourse to judicial processes as a last resort.

28. If efforts to resolve disputes using the GRM remain unresolved or unsatisfactory, AHs also have the right to directly discuss their concerns or problems with the ADB Environment, Natural Resources and Agriculture Division (SEER), Southeast Asia Department at ADB Headquarters through the Philippines Country Office.

29. As well, ADB's Accountability Mechanism allows people affected by ADB-supported Projects to submit complaints to ADB. This is a separate resolution mechanism from the GRM described above. The Accountability Mechanism provides an independent forum that allows people to voice their problems and seek resolution, and report alleged violations of ADB's operational policies and procedures.

30. The Accountability Mechanism has two separate but related phases. First is problem solving, led by ADB's special Project facilitator, to assist Project-affected people in finding solutions to their problems. Second is compliance review led by a three-member panel that investigates alleged violations of ADB's operational policies and procedures, including safeguard policies, that have already resulted in, or are likely to result in, direct adverse and material harm to Project-affected people. It recommends how to ensure Project compliance with these policies and procedures.

APPENDIX TO THE EMP: TERMS OF REFERENCE FOR LOAN IMPLEMENTATION ENVIRONMENT CONSULTANT (LIEC, NATIONAL 12 PERSON-MONTHS, INTERMITTENT)

The specialist will have a minimum of 5 years practical experience in the implementation of EMPs and environmental monitoring, ability to work with a multidisciplinary team and dealing with all aspects of site-related environmental issues, and excellent communication skills. Previous experience as a National Environment Specialist for at least one ADB funded project in Myanmar is desirable. The LIEC will facilitate the implementation of the EMP and ensure the grievance redress mechanism functions effectively. The expert will perform the following with respect to environmental management:

a) Review IEE and project EMP as well as Myanmar general environmental assessments to understand the environmental issues associated with the project area;
b) Consult with PMU to identify if there are any changes in the project sites or baseline environmental conditions. Assess impacts of any changes and update EMP;
c) Assist the PMU in obtaining all necessary domestic environmental approvals to allow the projects to proceed, as required;
d) Assist PMU in establishing Grievance Redress Mechanism (GRM) in accordance with GRM procedure defined in the IEE, coordinate consultation with local stakeholders as required, informing them of imminent construction works, updating them on the latest project development activities, GRM, etc. Facilitate consultation between the contractor and local stakeholders with respect construction scheduling, and proposed mitigation measures to control dust, and to minimize disruption to local traffic;
e) Review Tender and Contractor Documents to ensure all required environmental specifications have been included, update as required;
f) Prepare environmental audit checklists for weekly and monthly supervision of the EMP by the PMU, and review contractor-EMPs to confirm compliance with the project EMP;
g) Coordinate the conduct of periodic air/noise environment compliance monitoring by licensed monitoring entities, as defined in the monitoring program. [Note That Monitoring May Need To Be Done By LIEC And LOE Adjusted If No Licensed Entities Available In Myanmar By Time Of Implementation]
h) On behalf of PMU, prepare annual EMP progress reports for ADB. The reports should review progress with project implementation, results of checking and monitoring, identify problems encountered, actions taken/or proposed to be taken to resolve problems and activities programmed for next monitoring period. Include sampling results and discussion in the monitoring reports and advise/support the contractor in taking remedial actions if any of the test results are not within the required limits;
i) Conduct training events for PMU and contractors on the requirements and implementation of the EMP in accordance with the training plan defined in the project EMP;
j) Conduct regular site visits to the project area during the construction period and conduct EMP compliance inspections (in accordance with monitoring and inspection plan defined in the EMP).

ANNEX 2 – SUMMARY OF CORE SUBPROJECT CONDITIONS

[Information from field interviews and not independently confirmed.]

Data	Natmauk	Chaungmagyi
1. Irrigation System		
Region/State	Magway	Mandalay
District	Magway	Yamethin
Township	Natmauk/Myothit	Pyawbwe
Irrigation scheme	Formal canal	Formal canal
Location	Lon: 95.242545 E Lat: 20.191692 N	Lon: 95.575924 E Lat: 20.370104 N
Type irrigation	Formal irrigation (100%); 1 (2) crop/yr Scheme name: Natmauk	Formal irrigation (80%); 1 (2) crop/yr Scheme name: Chaungmagyi
Irrigation source	Surface and groundwater	Surface & groundwater
Command area irrigated (max %)	Total design area: 25,000ac Current irrigated area (2014); 18,500ac	Total design area: 7,000ac Current irrigated area (2014); 6,000ac
Irrigation method	Monsoon & summer paddy - flood irrigation	Monsoon - flood irrigation
Main constraints	Irrigation channels broken & difficult to repair, sandy soils. Large conveyance losses Poor water distribution between H, M,T Low rainfall in 2014	Lack of water especially during 2014 Parts of systems have not had summer paddy for last 5 years Decline in cultivation of cotton due to lack water Salinity not general an issues in this system
Priority works	Severe sedimentation upstream of the main canal intakes at weir, uncontrolled inflows between dam and weir. flood damage to the RMC as there is insufficient cross drainage.	System in relatively good condition down to distributary cabal level, with LMC operable & RMC heavily silted. Ungated structures provide little degree of control
2. Agro-ecology / environment		
Altitude	190 masl	212 masl
Soil type	Clay to sandy loam	Clay loam to sandy loam
Soil fertility level	Medium (20% to poor (80%)	Medium-high
Depth groundwater	20-40m	>20-70m
Salinity - % land affected	Nil	Nil
Irrigation system topography	Mostly level but some areas need to be levelled, no consolidation works were mentioned by villagers	System generally level in most areas; however not level for some areas, needs levelling;
3. Farming System		
Type farming system	Predominantly cropping system; with some mixed irrigated cropping & small scale livestock	Mixed irrigated cropping & livestock; predominantly crops
Main on-farm activities (prioritised)	Monsoon paddy Summer paddy Sesame Green gram Chick pea Groundnut Livestock	Monsoon paddy Summer paddy Cotton Sesame Green gram Sunflower Chick pea Onion Livestock

Data	Natmauk	Chaungmagyi
Total income % mainly from this activity	90%	70-80% (low % in tail areas)
Average farm size - irrigated (ac)	2.0-6.0ac (3-5 plots)	3-5 ac irrigated; 3.0ac rainfed (4-5 plots)
Off-farm activities	Mainly on-farm Migration Some laboring	Mainly on-farm Trading Laboring Migration, Hair cleaning/grading – export to China
Land owned & cultivated by farmer (%)	90-95% Some sharecropping (5-10% land area) to landless (20 basket paddy or 420 kg/ac). No land renting	>90% Some sharecropping (10% land area) to landless (20 basket paddy or 420 kg/ac). Also rent land
Input supply	Easy to obtain inputs from Natmauk, Myothit & Taungdwingyi towns, but expensive Farmers need finance to purchase inputs, a major problem; from MADB & PACT	Very easy to obtain inputs from Pyawbwe town, but expensive One small outlet in the system village on main road
Market system	Most farmers only sell paddy to local rice mill for processing. Other crops sold to traders who either collect produce (e.g., sesame) or the farmer takes to the nearby town (Taungdwingyi or even Magway) for sale with brokers or in the market.	Only paddy sold in the village, other crops are sold in Pyawbwe & Meiktila towns which are close by. The commodities sold include sesame, chick pea, onion, tomato. Note the three major crops are paddy, cotton & sesame. Some brokers store commodities in the major town near the irrigation system. there is some contract farming with some brokers
Processing facilities	Have rice mills, oil extraction (sesame & groundnut), paddy thresher, animal feed chopper	Small scale rice mills in the larger villages, but other mills situated close by, usually paddy milled for home consumption. No grain drying facilities. Cotton ginning done in Pyawbwe town
Livestock importance	Moderate	Moderate
Average livestock No/HH	2 cattle (oxen), 1 pig, 5-8 chickens [10-12 total]	2-5 cattle (oxen), 1 pig, 5-10 chickens [10-12 total]
Land cultivation	Some farmers for initial cultivation use tractors (2 wheel), but most cultivation is done by draught power; many farmers have more than 1 pair oxen; cost hiring pair oxen Ks 4,000 per morning per acre.	Use both power tillers and draught power on paddy lands; draught power accounts for 70% of land cultivation; cost for one pair oxen to plough for half day Ks 5,000 – plough in this time 0.3 acre or harrow 0.5 acre. Some of the larger hire tractors from the AMD service which has three large tractors for hire.
Extension advice	DOA provides limited technical advice on GAP (fertiliser & plant protection); most farmers need good quality seeds & finance however. Finance is a big problem.	DOA provides little advice, private fertiliser & pesticide traders provide advice to farmers; ID gives some advice during water delivery in monsoon season. There is a poorly equipped Frontline Centre in the system which is used for meetings and a few trainings – it needs upgrading.
NGO activity	PACT provides micro-finance; no other NGOs.	FAO & AVSI have a technology dissemination program; Mercy Corps many health issues; no PACT
Farmer training	Main constraint is the lack of mobility for the extension staff to travel from	Farmers want more advice on better water management & crop diversification

Data	Natmauk	Chaungmagyi
	Township centre. Need advice on two main crops – paddy & cotton, also on irrigated water management, utilisation of good quality seeds, marketing (MIS) There are a number of demonstration plots for paddy and other crops from the DOA.	– want information on how to grow and improved seeds of HYV. Very little awareness of GAP Main constraint is the lack of mobility for the extension staff to travel from Township centre There are a number of demonstration plots for paddy and other crops from the DOA Chaungmagyi Farm & the DICD Cotton Research Station.
4. Cropping Pattern		
Crops grown	Major: paddy – monsoon (80%), Secondary: summer paddy (15-20%), sesame, groundnuts, lablab beans Minor: vegetables Winter fallow:80% Not grown (but would like to grow): only grow existing crops as are familiar Note: that paddy and some sesame are irrigated crops rest (groundnuts, green gram, sorghum) are rainfed crops, grown on uplands around irrigated lands.	Major: paddy – monsoon (80%), Secondary: sesame, cotton, onion, green gram, sunflower pulses Minor: summer paddy vegetables Winter fallow:80% Not grown (but would like to grow): only grow existing crops as are familiar with them. Note: that paddy & onion mainly are irrigated the rest are rainfed, some water is occasionally provided to cotton
Most profitable crops (prioritised)	Sesame, paddy (summer) if can grow this crop)	Onion, tomato, pulses & oilseeds depending on the prevailing market prices, paddy is mainly grown for home consumption.
Length fallow period	No real fallow depends on water availability	No real fallow depends on water availability. More fallow land at the tail end of the system
Cropping intensity	Irrigated lowland 133% singe & some double cropping (monsoon paddy + summer paddy); rainfed 150% (sesame, green gram & groundnut,)	Irrigated 125% Rainfed 150% Double & single cropping
Changes in cropping pattern last 5 years	The system was constructed in 1995 which brought upland areas into irrigated land. Profitability of paddy declined due to cost of inputs. Farmers fixed on summer paddy cultivation	No change, only incidence of drought is increasing impacting on the availability of water in the dam; very little summer paddy is grown; greater reliance on groundwater sources irrigation in recent years
Priority crops for fertiliser application	Mainly paddy, on which apply both chemical & FYM	Mainly FYM on paddy, chemical fertilisers on some paddy & other cash crops (cotton, vegetables). Farmers consider fertilisers as too expensive.
Pesticide use	Low use of pesticides, but mainly on stem borer of paddy	Low use some pesticide use on tomato & other vegetables. A lot of pesticides are applied to cotton
Improved seed use	Mainly using own traditional monsoon paddy cvs & some hybrid paddy. Not for other crops Seed provided by DOA, which has also a demo plot for hybrid rice.	Only have seed of traditional cvs; hybrid rice has just been introduced recently. The lack of availability of improved quality seed for major crops grown is a major constraint for farmers.
Factors influencing crop choice	Crop adaptability to soil & weather conditions Expect increased income Importance to farmers of paddy for subsistence	Most crop choice based on home consumption & then after which for cash sale Farmers need more advice on technologies & on more profitable crops

Data	Natmauk	Chaungmagyi
	Prefer to still grow existing crops, farmers are risk averse. Request to get information on crop alternatives	If had more water would grow summer paddy and cotton
5. Crop Water Management		
Water scheduling	Water scheduling depends on sharing system with ID organizing with village groups; sometimes there are conflicts;	The farmers coordinate & negotiate with the ID for water; farmer on upper plots close to canal get water first then to then below;
Water charges	Pay by the acre Ks 1950/ac for paddy per season & Ks 900 for other crops (e.g., maize & groundnut). Responsibility is with the ID to collect the charge.	Pay by the acre Ks 1950/ac for paddy per season Responsibility is with the ID to collect the charge.
Crop pre-watered	Done for paddy lands prior to transplanting	Done for paddy lands prior to transplanting
Responsibilities of water manager	ID and myaunggaung only responsible for controlling of water supply; does not provide any other services to the farmers.	ID and myaunggaung only responsible for controlling of water supply; does not provide any other services to the farmers.
Constraints in water supply - time of yr	Can even be problems of water availability in the monsoon, severe shortage during the summer season especially during years of limited rainfall.	Can even be problems of water availability in the monsoon, severe shortage during the summer season especially during years of limited rainfall..
Farmers consider which priority crops for available water	Paddy mainly, but would like to have supplementary water for other important crops grown currently under rainfed conditions.	Paddy mainly, but would like to have supplementary water for other important crops grown currently under rainfed conditions.
Quality of water management	Management of on field irrigation system which is done by myaunggaung usually to satisfaction of the other users; there can however be problems due to shortages water	Management of on field irrigation system which is done by myaunggaung usually to satisfaction of the other users, although not entirely fair. No conflicts over water were mentioned.
If get more water would farmers change crops	The main crop preferred will always be paddy in summer season, but this can be down to pressure from DOA.	As crops mostly for home consumption still keen to grow the crops which they are familiar with, particularly summer paddy & cotton.
Farmers irrigation knowledge	The farmers are fully aware of growing irrigated paddy but not for other crops for which further advice is required.	Farmers are fully aware of growing irrigated paddy and the irrigation of crops like onion and a range of vegetables; further advice would be useful however.
On-farm water losses	Nil on-farm but can be as high as 75% on the main & DY's according to farmers, due to earthen channels. Conveyance loss 40-50%	0-10% on-farm; but can be high on the main & DY's because of earth built channels.
6. General Comments		
Constraints to irrigated agriculture	Water shortage & some conflicts Lack of alternative crops to grow Lack of proper understanding of crop water management for alternative crops. The layout of the field plots with cascading plots causing problems for proper water management High cost of inputs Marketing problems & low prices for	Micro-finance a big issue; limits imposed by MADB Marketing problems & low costs of commodities High cost of inputs hence farmers use very little inputs Land consolidation not an issue with farmers High labour costs mainly at harvesting & threshing time

Data	Natmauk	Chaungmagyi
	commodities Micro-finance	Farm power needs & mechanisation
Main constraints overall (prioritised)	Lack of knowledge on new crop technologies & new cash crops Improve & better water supply especially to tail areas of the system Need help to better manage the distribution of water, currently not fair. Need finance, micro-finance to farmers Market development & proper value chains, value addition	Need help to better manage the distribution of water, currently not fair with multiple users Need finance, micro-finance to farmers Market development & proper value chains, value addition Lack of knowledge on new crop technologies & new cash crops Improved seed supply needed Large water losses due to poor state of channels & delivery ditches Mechanisation where appropriate.

ANNEX 3 – AGENCY AND PUBLIC CONSULTATION PROGRAM

Public consultation. A total of 22 focus group discussions-FGDs with prepared questionnaires were conducted in each 11 villages of Myothit Township and Pyawbwe Township from July 21 to August 9, 2015.

Process of Public consultation meetings in the villages of Myothit Township

Public consultation meetings (PCMs) and focus group discussion FGDs for the IAIDP in the selected 11 villages were conducted by the ADB team with administrative support of GAD and Irrigation Department of Myothit Township from July 21 to July 26. Village administration organized the meetings for ensuring the full participation of all stakeholders concerned even though farmers were busy with their farm works during the monsoon. Please see the list of participants attended the PCMs and focus group discussion in the villages.

Firstly, the national consultant self-introduced to the participants and gave thanks to the participants for their attendance. Then the consultant briefly presented the background and introduction, objectives, institutional structure, proposed intervention activities, public consultation and grievance redress mechanism, environmental assessment of the Irrigated Agriculture Inclusive Development Project to the participants with flipcharts. Then, the participants asked some questions regarding the facts that were not clear to them. Some farmers thought that the project would lend money to the farmers. As no more questions were raised by the participants, the meetings were ended by the closing speech of the national consultant.

After the PCMs with a large number of villagers, the consultant started a series of FCDs with farmers including women. At the FCDs, at least 7 to 9 participants and 10 to 13 participants were involved in discussion and answering the prepared questionnaire. Proposed project interventions had been welcomed by all villages and no complaints and worries were expressed about the potential negative impacts of the project implementation period and after the project intervention. Farmers from all visited villages requested the project to help in renovation and replacement of canals and its accessories structures for ensuring getting irrigated water for their crops. Farmers from some villages requested the project to help them in getting irrigated water in both of seasons by renovating or establishing new check dams or weirs through harvesting of water from the streams but their proposed interventions were not in the targeted Natmauk irrigation system.

Details of discussion points / requests by participants at FGDs in villages of Myothit

(1) Magyihtoo

During the discussions with farmers of Magyihtoo, farmers requested to help in getting quality rice seeds, financial inputs such as loans, secure market for the profit of farmers from the private business companies or the government. In addition, farmers requested the project to help in renovation of canals which are not functioning due to poor or lack of proper maintenance by the water user groups and ID staff concerned. These include DY1, DO3, DO4, DO5, DO6 and DO7 which are urgently needed for renovation works such as removing of silt along the canals.

(2) Pay kan Gyi

Farmers from Paykan Gyi during the discussions requested the project to help in renovation of DY2 and DO3 for attaining irrigated water in both seasons. In addition, the farmers also requested the project to assist in establishment of a bridge at the RD 45000 feet post on DY2

that will be very supportive for transportation of all things from the farms to the village. Farmers think that the proposed project activities will be beneficial to them by receiving knowledge, awareness and inputs support from the project and they also would like to contribute 10% of man power (labor) and/or cash for accomplishing the project activities if possible. For example, farmers are willingly to contribute their labor inputs by removing trees at the time of canal renovation or construction period if necessary. Generally all participants are in support of the proposed project.

(3) Tatkone

Farmers from Tatkone during the discussions requested the project to help in establishment of new weir or check dam at the lower site of Shwepanpin stream which is flowing throughout the year and if it is established, irrigated area for the farmers may increase up to 30000 acre but this expected area is just farmers' opinion and not calculated based on the real ground and In addition, farmers also requested to help in renovation of DY 4 and DY5 by removing silt along the canal.

(4) Lelu

Farmers requested the project to help in renovation of existing checks and shutters at the DY3. Level of WCs at DY3 is not systematic and so it is urgently needed to renovate these. In addition, check should be established at DY3 and DY6. Similarly, DY5 and DY6 are attached and so it is poor in water release and DY6 should be straightly constructed for more irrigated water. In addition, farmers also requested the project to renovate 5 bridges at DY3 and 2 bridges at DY6 which are broken and made of palm wood.

(5) Pay Kan Kone

Farmers requested the project to help in leveling of farm ground for attainment of adequate irrigated water from the water courses and they also pointed out that upper site of DY5 is urgently needed for removal of silts along the canal. At the junction of DY7 and DY8, the shutter is not properly functioning and so it is necessary to renovate or replace with the new one if possible. In addition, farmers requested the project to help in establishment of checks at DO11 B and DO12 B as these canals are not really functioning. Farmers also requested the project to help in ensuring getting quality rice seeds with affordable market price. Furthermore, farmers also requested the project to assist in systematic ways of drainage water from DO1, DO2 and DO3. The silt should be removed from the place between RD 16000 and RD 17000 of RMC.

(6) Taloke Pin

Farmers requested the project to help in establishment of a new canal along the upper site of DY1 for more irrigated water which is about 1 furlong far from DY1. If it is established, irrigated area may increase up to over 300 ac. The estimate length for this canal may be 1.5 mile and this proposed place is also located beside the Magyi Kone Gyi village development road. In addition, farmers realized that it is necessary to strengthen the institutional capacity of water user groups for more efficient management and usage of irrigated water. Farmers are also interested to work with agriculture production companies as a partnership as the business firms if possible. Furthermore, farmers discussed that WC 6,7 and 8 at DY 1 are not functioning well and the shutter is also about to be broken and so they requested the project to help in renovation of these canals.

(7) Kan Gyi

Farmers from Kan Gyi during the FGD requested the project to help in renovation of WCs at DY2 as it is not functioning and there is no shutter. In addition, DO10 is also necessary to renovate and it is about 2 miles in length. A farmer (Ex-agriculture staff) also pointed out that baseline data

of irrigated area are not correct and some farmers also requested the project to help in improving knowledge and skill of proper chemical fertilizers and pesticides application and good agriculture practices.

(8) In Ywar Gyi
Farmers requested the project to help in establishment of gates at DO8 and DO9 and if possible the water should be distributed to the left side of LMC by establishing new canals.

(9) Kan Tha Lay
Farmers from Kan Tha Lay during the FGD requested the project to assist in renovation of DO1, DO2 and DY2 for more attainment of irrigated water as these canals are much silted for a long time. In addition, farmers also requested the project to help in renovation of Pauk Kan pond (small pond about 0.5 acre in area) and to renovate the DO12. Farmers also requested to help in establishment of new road from farm to the village for efficient transportation of their products and others. Similarly, a woman farmer also requested to help in improving institutional capacity of water user groups for more efficient and effective irrigated water allocation and management in the village.

(10) Chauk Kya
Farmers from Chauk Kya during the FGD requested the project to help in establishment of Sun weir located west of Myolulin and north of Sitaw village and estimate length for this weir may be 3450 feet and the depth of sand may be up to 50 feet. But, the villagers had already requested the Irrigation Department to help in construction of this weir as this workload is beyond the capacity of villagers.

(11) Pa Ti Kone
Farmers from Padi Kone during the focus group discussion requested the project to help in renovation of DY5, DY6, Mina 7A and 7B, Mina 6. In addition, a drop should be established at the Aung Swe weir if possible. If it is established, irrigated area may increase up to 150 ac. Similarly, farmers also requested the project to help in renovation of checks between Drop No.8 and Drop No.9 and also requested to help in establishment of check at DO24. Furthermore, a farmer also requested the project to include provision of planting and production of wheat for the farmers in the project design. Another farmer also requested the project to help in getting quality rice seeds in a timely manner.

List of participants at the public consultation meeting at the township level in Myothit

Sr.	Name	Department	Sex	Position
1	U Maung	General Administration	M	Deputy officer
2	U Thaung Naing Oo	Industrial Crop Development	M	Township officer
3	U Tun	Agricultural Mechanization	M	In charge
4	U Win Aung	Forest Department	M	Ranger
5	U Thaung Tin	Fire Brigade	M	Township officer
6	U Zaw Lwin	Myanmar Economic Bank	M	Township officer
7	U Min Naing	Township Development	M	Executive officer
8	U Thein Win	SLRD	M	Asst. township officer
9	U Tine Chit	Myanmar Post & Telecomms	M	In Charge
10	U Win Naing	Township planning department	M	Deputy officer
11	Daw Khin Mya Zin	Township Auditor office	F	Auditor
12	U Tin Htay Aung	Agriculture Development Bank	M	Manager
13	U Maung Cho	Dryzone Greening	M	Forester

Sr.	Name	Department	Sex	Position
14	Daw Ei Phyo Thaw	Township Law office	F	Law Officer
15	Daw Hnin Wai Oo	Township information	F	Township officer
16	Daw Khin Thwe Eiswe	Rural Development	F	Engineer
17	Daw Pyone Kyi	Road Transport	F	Township officer
18	U Tin Win	Cooperative Department	F	Township officer
19	U Soe Thu	Immigration Department	M	Township officer
20	U La Ho	Myanmar Police Force	M	DSP
21	Daw Than Naing	Traditional medicine	F	Traditional medicine
22	Dr. Aye Mya phyu Swe	Livestock Breeding & Veterinary	F	Dep township officer
23	U Maung Oo	Electrical power	M	Township elec pwr off
24	U Thein Zaw Min	Sports and physical	M	In Charge
25	U Thuka Aung	Myanmar Post	M	Station officer
26	U Maung Win	Agriculture Department	M	Township officer
27	U Kyaw Zaya	Health Department	M	Asst. Doctor
28	U Swe Thein Aye	Education Department	M	Asst. Education off.
29	U Tun Naing	Township Justice Office	M	Deputy judge

List of participants at the FCDs in the villages of Myothit Township

(1) Magyi Htoo

Sr.	Name	Occupation	Sex	Village
1	U Ye Thway	Farmer	M	Magyihtoo
2	U Than Htun Oo	Farmer	M	Magyihtoo
3	U Tin Min Oo	Farmer	M	Magyihtoo
4	U Kyaw Myaing	Farmer	M	Magyihtoo
5	U Hla Htay	Farmer	M	Magyihtoo
6	Daw Paw Me	Farmer	F	Magyihtoo
7	Daw Ohn Yin	Farmer	F	Magyihtoo
8	Daw Hlaing	Farmer	F	Magyihtoo
9	Daw Myint San	Farmer	F	Magyihtoo
10	Daw Nan Yu Swe	Farmer	F	Magyihtoo
11	Daw New Ni Aung	Farmer	F	Magyihtoo
12	Daw Mya Yi	Farmer	F	Magyihtoo
13	Daw Yin Htay	Farmer	F	Magyihtoo
14	U Aung Tin Lin	Farmer	M	Magyihtoo
15	U Lun Tin	Farmer	M	Magyihtoo
16	Daw Kyin Htwe	Farmer	F	Magyihtoo
17	Daw Thein New	Farmer	F	Magyihtoo
18	Daw Swe	Farmer	F	Magyihtoo
19	U Naing Maung	Farmer	F	Magyihtoo
20	Daw Ngwe Myaing	Farmer	F	Magyihtoo
21	Daw Htwe Kyi	Farmer	F	Magyihtoo
22	Daw Nyo	Farmer	F	Magyihtoo
23	Daw Sein May	Farmer	F	Magyihtoo
24	Daw Lwin Mar Oo	Farmer	F	Magyihtoo
25	Daw Than Aye	Farmer	F	Magyihtoo
26	Daw Tin Moe Oo	Farmer	F	Magyihtoo
27	Daw Tin Ngwe	Farmer	F	Magyihtoo
28	Daw Htay Kyi	Farmer	F	Magyihtoo
29	U Kyaw Thein	Farmer	M	Magyihtoo
30	Daw Khin Zin	Farmer	F	Magyihtoo
31	U Zaw Win	Farmer	M	Magyihtoo

Sr.	Name	Occupation	Sex	Village
32	U Zin Ko oo	Farmer	M	Magyihtoo
33	U Nay Zar tun	Farmer	M	Magyihtoo
34	U San Maung	Farmer	M	Magyihtoo
35	U Myint Lwin	Farmer	M	Magyihtoo
36	Daw Khin Mar Aye	Farmer	F	Magyihtoo
37	U Than Lwin Oo	Farmer	M	Magyihtoo
38	U Kyauk Khe	Farmer	M	Magyihtoo
39	Daw San Aye	Farmer	F	Magyihtoo
40	U Aung Than	Farmer	M	Magyihtoo
41	Daw Mya San	Farmer	F	Magyihtoo
42	U Kyi Thein	Farmer	M	Magyihtoo
43	U Myint Thein	Farmer	M	Magyihtoo
44	Daw Shwe Yoke	Farmer	M	Magyihtoo
45	U Hla Phone	Farmer	M	Magyihtoo
46	U Maung Thein	Farmer	M	Magyihtoo
47	U Tin Myint Aung Kyi	Farmer	M	Magyihtoo
48	U Kyaw Moe	Farmer	M	Magyihtoo
49	U Nyunt Tun	Farmer	M	Magyihtoo
50	Daw Khin Tint	Farmer	F	Magyihtoo
51	U Win Htay	Village Tract Administrator	M	Magyihtoo
52	U Thaung Myint	Village Honorable person	M	Magyihtoo
53	U Khin Maung Soe	Village Honorable person	M	Magyihtoo
54	U San Kyu	Village Support Committee	M	Magyihtoo
55	Daw Myaing	Farmer	F	Magyihtoo
56	Daw Than Htwe	Farmer	F	Magyihtoo
57	Daw Marlar	Farmer	F	Magyihtoo
58	Daw Khin Htay	Farmer	F	Magyihtoo
59	Daw Mya Win	Farmer	F	Magyihtoo
60	Daw Shaw Su	Farmer	F	Magyihtoo
61	Daw Ma Su	Farmer	F	Magyihtoo
62	Daw Soe	Farmer	F	Magyihtoo
63	Daw Wine Tin	Farmer	F	Magyihtoo
64	Daw Khin Myint	Farmer	F	Magyihtoo
65	Daw Khin Htay Myint	Farmer	F	Magyihtoo
66	Daw Tin Myint	Farmer	F	Magyihtoo
67	Daw Khin Hla	Farmer	F	Magyihtoo
68	Daw Wai Htay	Farmer	F	Magyihtoo
69	Daw Ohn Kyi	Farmer	F	Magyihtoo
70	Daw Win	Farmer	F	Magyihtoo
71	U Aung Myint Thein	Farmer	F	Magyihtoo
72	Daw Su Mar	Farmer	F	Magyihtoo
73	Daw Khin Htay Myint	Farmer	F	Magyihtoo
74	Daw Thida	Farmer	F	Magyihtoo
75	Daw Aye Khing	Farmer	F	Magyihtoo
76	Daw Mar Chaw	Farmer	F	Magyihtoo
77	Daw Tin Yi	Farmer	F	Magyihtoo
78	U Aung Lwin	Farmer	M	Magyihtoo
79	U Aung Soe	Farmer	M	Magyihtoo
80	U Tun Naing	Farmer	M	Magyihtoo
81	U Sein Tun	Farmer	M	Magyihtoo
82	U Tin Aung	Farmer	M	Magyihtoo
83	Daw Khin Aye	Farmer	F	Magyihtoo

Sr.	Name	Occupation	Sex	Village
84	U Kyi Win	Farmer	F	Magyihtoo
85	Daw Mar Tuu	Farmer	F	Magyihtoo
86	U Khin Maung Aye	Farmer	M	Magyihtoo
87	U Thein Tun	Farmer	M	Magyihtoo
88	Daw Hla Win Kyi	Farmer	M	Magyihtoo
89	U Zaw Lwin	Farmer	M	Magyihtoo
90	U Aung Than Win	Farmer	M	Magyihtoo
91	U Myint Thaung	Farmer	M	Magyihtoo
92	U Kyaw Han	Farmer	M	Magyihtoo
93	U Aung Min	Farmer	M	Magyihtoo
94	U Kan Nyunt	Farmer	M	Magyihtoo
95	U Zaw Min	Farmer	M	Magyihtoo
96	U Hla tun	Farmer	M	Magyihtoo
97	U Sein Aung	Farmer	M	Magyihtoo
98	U Zaw Win	Farmer	M	Magyihtoo
99	U Naing	Farmer	M	Magyihtoo
100	U Aung Thin	Farmer	M	Magyihtoo
101	Daw Myint Yi	Farmer	F	Magyihtoo
102	U Min Naing	Farmer	M	Magyihtoo
103	U Soe Min	Farmer	M	Magyihtoo
104	Daw Thein Myaing	Farmer	F	Magyihtoo
105	Daw Khin Myint	Farmer	F	Magyihtoo
106	Daw Phyu Sin	Farmer	F	Magyihtoo
107	U Han Nyunt	Farmer	M	Magyihtoo
108	U Tin Aung Win	Farmer	M	Magyihtoo
109	U Than Soe Aung	Farmer	M	Magyihtoo
110	U Aung San Win	Farmer	M	Magyihtoo
111	U Han Min Htay	Farmer	M	Magyihtoo
112	U Soe Naing	Farmer	M	Magyihtoo
113	Daw Ma Htay	Farmer	F	Magyihtoo
114	Daw Myint San	Farmer	F	Magyihtoo
115	Daw Yin Htay	Farmer	F	Magyihtoo
116	U Mya Aung	Farmer	M	Magyihtoo
117	U Tun An	Farmer	M	Magyihtoo
118	U Thaung Htay	Farmer	M	Magyihtoo
119	U Nyunt Win	Farmer	M	Magyihtoo
120	U Ko Nge	Farmer	M	Magyihtoo
121	U Tin Aung	Farmer	M	Magyihtoo
122	U Myo Lwin	Farmer	M	Magyihtoo
123	U Khin Maung Soe	Farmer	M	Magyihtoo
124	U Win Shwe	Farmer	M	Magyihtoo
125	U Min Kyaing	Farmer	M	Magyihtoo
126	U Zaw Oo	Farmer	M	Magyihtoo
127	U Kan Kywet	Farmer	M	Magyihtoo
128	Daw Mya Win	Farmer	F	Magyihtoo
129	Daw Htay Yi	Farmer	F	Magyihtoo
130	U Aung Thein	Farmer	M	Magyihtoo

(2) Pay Kan Gyi

r.	Name	Occupation	Sex	Village
1	U Khin Maung Soe	Farmer	M	Pay Kan Gyi
2	U Aye Gyi	Farmer	M	Pay Kan Gyi

r.	Name	Occupation	Sex	Village
3	U Myinnt Oo	Farmer	M	Pay Kan Gyi
4	U San Tun	Farmer	M	Pay Kan Gyi
5	U Moe Kyaw Aung	Farmer	M	Pay Kan Gyi
6	U Myint Thein	Farmer	M	Pay Kan Gyi
7	U Tin Maung Soe	Farmer	M	Pay Kan Gyi
8	U Kyaw Htoo	Farmer	M	Pay Kan Gyi
9	U Zaw Lwin	Farmer	M	Pay Kan Gyi
10	U Tin Myint	Farmer	M	Pay Kan Gyi
11	Daw Ma Htay	Farmer	F	Pay Kan Gyi
12	Daw Yi Aye	Farmer	F	Pay Kan Gyi
13	Daw Than Swe	Farmer	F	Pay Kan Gyi
14	Daw Thida Aye	Farmer	F	Pay Kan Gyi
15	Daw Nyunt Wai	Farmer	F	Pay Kan Gyi
16	Daw Yi Cho	Farmer	F	Pay Kan Gyi
17	Daw Hla San Yi	Farmer	F	Pay Kan Gyi
18	U Maung Htwe	Farmer	F	Pay Kan Gyi
19	Daw Khin Than Win	Farmer	F	Pay Kan Gyi
20	Daw Myint Khin	Farmer	F	Pay Kan Gyi
21	Daw Kyi Tin	Farmer	F	Pay Kan Gyi
22	Daw Tin Myat Soe	Farmer	F	Pay Kan Gyi
23	Daw Htwe Yin	Farmer	F	Pay Kan Gyi
24	U Shwe Htay	Farmer	M	Pay Kan Gyi
25	U Zaw Moe	Farmer	M	Pay Kan Gyi
26	U Soe Lwin	Farmer	M	Pay Kan Gyi
27	U Aye Min Thu	Farmer	M	Pay Kan Gyi
28	Daw San Htay	Farmer	F	Pay Kan Gyi

(3) Tat Kone

Sr.	Name	Occupation	Sex	Village
1	U Nyan Myint	Village Administrator	M	Tat Kone
2	U Aung Yin	Chairman – Village support	M	Tat Kone
3	U Kyaw Win Sein	Farmer	M	Tat Kone
4	U Saw Maung	100 Household Head	M	Tat Kone
5	U Kyaw Gyi	Secretary – Village Support	M	Tat Kone
6	U Tin Saing	Township Support Committee	M	Tat Kone
7	U Aung Hlaing	Farmer	M	Tat Kone
8	U Kyaw Hein	Farmer	M	Tat Kone
9	U Nay Win	Farmer	M	Tat Kone
10	Daw Ohn Shwe	Farmer	F	Tat Kone
11	Daw Wine	Farmer	F	Tat Kone
12	Daw Khin Saw Pyay Thanda	Agriculture Staff	F	Tat Kone
13	Daw Mya Thazin	Farm worker	F	Tat Kone
14	Ma Aye Tha	Farm worker	F	Tat Kone

(4) Lelu

Sr.	Name	Occupation	Sex	Village
1	U Soe Yin	Farmer	M	Lelu
2	U Kan Se	Farmer	M	Lelu
3	U Sein Win	Farmer	M	Lelu
4	U Zaw Lwin	Farmer	M	Lelu

Sr.	Name	Occupation	Sex	Village
5	U San Hlaing	Farmer	M	Lelu
6	U Thein Zaw Oo	Farmer	M	Lelu
7	U Myint Aung	Farmer	M	Lelu
8	U Han Lin	Farmer	M	Lelu
9	Daw Khin Saw Pyay Thanda	Farmer	F	Lelu
10	U Pyo Chein	Farmer	M	Lelu
11	U Kyaw Thu	Farmer	M	Lelu
12	U Kan Myint	Farmer	M	Lelu
13	U Bo Ye	Farmer	M	Lelu

(5) Pay Kan Kone

Sr.	Name	Occupation	Sex	Village
1	U Thien Myint	Farmer	M	Pay Kan Kone
2	U Win Naing	Farmer	M	Pay Kan Kone
3	U Yan Aung	Farmer	M	Pay Kan Kone
4	Daw Thin Khaing	Farmer	F	Pay Kan Kone
5	Daw Khin Nwe Win	Farmer	F	Pay Kan Kone
6	U Aung Tin Lin	Farmer	M	Pay Kan Kone
7	Daw Khaing Sabe	Farmer	F	Pay Kan Kone
8	U Min Htike	Farmer	M	Pay Kan Kone
9	U Maung	Farmer	M	Pay Kan Kone
10	U Kyaw Soe Win	Farmer	M	Pay Kan Kone
11	U Kyaw Win	Farmer	M	Pay Kan Kone
12	U Tin Tun	Farmer	M	Pay Kan Kone
13	U Tin Myint	Farmer	M	Pay Kan Kone

(6) Ta Loke Pin

Sr.	Name	Occupation	Sex	Village
1	U Aung Ko Myint	Dy-Assistant officer Agriculture	M	Myothit
2	U Tun Yi	Farmer	M	Myothit
3	U Khin Maung Htwe	10 Household Head	M	Myothit
4	U Myint Soe	Farmer	M	Myothit
5	U Nyan Myint	Farmer	M	Myothit
6	U Tin Tun	Farmer	M	Myothit
7	U Tin Lin	Farmer	M	Myothit
8	U Kyaw Htoo	Farmer	M	Myothit
9	U Shwe Maung	Farmer	M	Myothit
10	U Sein Maung	Farmer	M	Myothit
11	Daw Hla Win Kyi	Farmer	F	Myothit
12	Daw Win Tine	Farmer	F	Myothit
13	U Han Tin	Farmer	M	Myothit
14	Daw Khin San Wai	Farmer	F	Myothit
15	U Tin Hla	Farmer	M	Myothit
16	Daw Shwe Kyi	Farmer	F	Myothit
17	U Soe Tint	Farmer	M	Myothit
18	Daw Sein Kyawt	Farmer	F	Myothit
19	U Aung Myint Kyi	Farmer	M	Myothit
20	U Kyaw Hlaing	Farmer	M	Myothit
21	U San Gyi	Farmer	M	Myothit
22	U Mya Aung	Farmer	M	Myothit
23	U Tha Po	Farmer	M	Myothit

Sr.	Name	Occupation	Sex	Village
24	U Soe Aung 1	Farmer	M	Myothit
25	U Win Myint Kyu	Farmer	M	Myothit
26	U Maung Than Soe	Farmer	M	Myothit

(7) Kan Gyi

Sr.	Name	Occupation	Sex	Village
1	U Khin Maung Thet	Village Tract Administrator	M	Kan Gyi
2	U San Nu	Farmer	M	Kan Gyi
3	Daw Khaing Marlar	Clerk- GAD	F	Myothit
4	U Khin Soe Myint	Farmer	M	Kan Gyi
5	U Hla Tun Aung	Farmer	M	Kan Gyi
6	U Aung Kyaw Moe	Farmer	M	Kan Gyi
7	U Htay Myint Aung	Farmer	M	Kan Gyi
8	U Tin Tun Aung	Farmer	M	Kan Gyi
9	U Zaw Moe	Farmer	M	Kan Gyi
10	U Maung Oo	Farmer	M	Kan Gyi
11	U Khin Soe Tint	Farmer	M	Kan Gyi
12	U Kyaw Hmway	Farmer	M	Kan Gyi
13	U Bo San	Farmer	M	Kan Gyi
14	Daw May Myat Nwe	Headmistress Primary School	F	Kan Gyi
15	Daw Kyi	Farmer	F	Kan Gyi
16	U Zaw Min	Farmer	M	Kan Gyi
17	U Aung Ko Myint	Dy Assistant officer Agriculture	M	Myothit
18	Daw Khin Nyein Aye	Farmer	F	Kan Gyi
19	U Thet Lwin Oo	Farmer	M	Kan Gyi
20	U Khin Maung Yin	Farmer	M	Kan Gyi

(8) Ywar Gyi

Sr.	Name	Occupation	Sex	Village
1	U Ngwe Maung	Village Tract Administrator	M	In Ywar gyi
2	U Aung Ko Myint	Dy Assistant Officer Agriculture	M	Myothit
3	U Kyaw Soe	Village Support Committee	M	In Ywar Gyi
4	U Pauk Kyaing	Farmer	M	In Ywar Gyi
5	U Khin Maung Kyi	Farmer	M	In Ywar Gyi
6	U Mar Khin	Farmer	M	In Ywar Gyi
7	U Paing	Farmer	M	In Ywar Gyi
8	U Nyunt Tin	Farmer	M	In Ywar Gyi
9	U Tha Myint	Farmer	M	In Ywar Gyi
10	U Aung Din	Farmer	M	In Ywar Gyi
11	U Ye Myint	Farmer	M	In Ywar Gyi
12	U Myint Than	Farmer	M	In Ywar Gyi
13	U Myint Soe	Farmer	M	In Ywar Gyi
14	U Shwe	Farmer	M	In Ywar Gyi
15	U Soe Lin	Farmer	M	In Ywar Gyi
16	U Htay Naing Soe	Farmer	M	In Ywar Gyi
17	U Kaung Shein	Farmer	M	In Ywar Gyi
18	U Kyaw Win Sein	Farmer	M	In Ywar Gyi
19	U Aung Tin Sein	Farmer	M	In Ywar Gyi
20	U Nya Pwar	Farmer	M	In Ywar Gyi
21	U Naing	Farmer	M	In Ywar Gyi
22	Daw Thin Yi	Farmer	F	In Ywar Gyi
23	U Tun Myint Kyi	Farmer	M	In Ywar Gyi
24	U Sar Tin	Farmer	M	In Ywar Gyi

Sr.	Name	Occupation	Sex	Village
25	U Kauk Tin	Farmer	M	In Ywar Gyi
26	U Myint Swe	Farmer	M	In Ywar Gyi
27	U Nyo	Farmer	M	In Ywar Gyi
28	U ohn Maung	Farmer	M	In Ywar Gyi
29	U Kyi Khaing	Farmer	M	In Ywar Gyi
30	U Kywet Ni	Farmer	M	In Ywar Gyi
31	U Nge	Farmer	M	In Ywar Gyi
32	U Aung Min Win	Farmer	M	In Ywar Gyi
33	U Khin Maung Yin	Field Staff – ID	M	In Ywar Gyi
34	U Tin Nyunt	Farmer	M	In Ywar Gyi
35	U Ye Kyi	Farmer	M	In Ywar Gyi
36	Daw Myint Yi	Farmer	F	In Ywar Gyi
37	Daw Hla Lay	Farmer	F	In Ywar Gyi
38	Daw Htwe Nyo	Farmer	F	In Ywar Gyi
39	U Sein Win	Farmer	M	In Ywar Gyi
40	U Kyi Lin	Farmer	M	In Ywar Gyi
41	U Khin Maung Yi	Farmer	M	In Ywar Gyi
42	U San Hmuu	Farmer	M	In Ywar Gyi
43	U Kan Hla	Farmer	M	In Ywar Gyi
44	U Zaw Lwin	Farmer	M	In Ywar Gyi
45	U Maung Zaw	Farmer	M	In Ywar Gyi
46	Daw Pyar	Farmer	F	In Ywar Gyi

(9) Kan Tha Lay

Sr.	Name	Occupation	Sex	Village
1	U Thet Cho Oo	Village Tract Administrator	M	Kan Tha Lay
2	Daw Khaing Marlar	Clerk GAD	F	Myothit
3	U Sein Win	Farmer	M	Kan Tha Lay
4	U Hla Soe	Farmer	M	Kan Tha Lay
5	U Bo Tin	Farmer	M	Kan Tha Lay
6	Daw Wine Yi	Farmer	F	Kan Tha Lay
7	U Kauk Ya	Farmer	M	Kan Tha Lay
8	Daw Pu	Farmer	F	Kan Tha Lay
9	Daw Hnin Yi	Farmer	F	Kan Tha Lay
10	Daw Kyi Win	Farmer	F	Kan Tha Lay
11	Daw Aye Khaing	Farmer	F	Kan Tha Lay
12	Daw Le Win	Farmer	F	Kan Tha Lay
13	U Naing Oo	Farmer	F	Kan Tha Lay
14	Daw Sein Aye	Farmer	F	Kan Tha Lay
15	Daw Swe Mar	Farmer	F	Kan Tha Lay
16	Daw Zar Ni Aung	Farmer	F	Kan Tha Lay
17	Daw Marlar Aung	Farmer	F	Kan Tha Lay
18	U Kyaw Naing Oo	Farmer	M	Kan Tha Lay
19	U Thein Aye	Farmer	M	Kan Tha Lay
20	U Aung Naing Win	Farmer	M	Kan Tha Lay
21	Daw Than Maw	Farmer	F	Kan Tha Lay
22	Daw Wine	Farmer	F	Kan Tha Lay
23	U Soe Naing	Farmer	M	Kan Tha Lay
24	Daw Nyunt	Farmer	F	Kan Tha Lay
25	Daw Win Aye	Farmer	F	Kan Tha Lay
26	Daw Kyi Myint	Farmer	F	Kan Tha Lay
27	Daw Yu	Farmer	F	Kan Tha Lay
28	Daw Moe Wa	Farmer	F	Kan Tha Lay

Sr.	Name	Occupation	Sex	Village
29	Daw Mar Aye	Farmer	F	Kan Tha Lay
30	Daw Kyi Sein	Farmer	F	Kan Tha Lay
31	U Hla Moe	Farmer	M	Kan Tha Lay
32	U Tin San	Farmer	M	Kan Tha Lay
33	U Aung San Win	Farmer	M	Kan Tha Lay
34	Daw Aye Kyu Ma	Farmer	F	Kan Tha Lay
35	Daw Swe Win	Farmer	F	Kan Tha Lay
36	U Nyunt Wai	Farmer	M	Kan Tha Lay
37	U Aung Ko Myint	Dy Assistant officer Agriculture	M	Myothit

(10) Chauk Kyar

Sr.	Name	Occupation	Sex	Village
1	U Aung Soe Win	Village Tract Administrator	M	Chauk Kyar
2	U Nu Hla	Honorable person	M	Chauk Kyar
3	U Thaug Nyunt	Honorable person	M	Chauk Kyar
4	U Kyi Win	Honorable person	M	Chauk Kyar
5	U Maung Tun	Village Support committee	M	Chauk Kyar
6	U Aung Thein Win	Village Support committee	M	Chauk Kyar
7	U Tun Soe	Clerk GAD	M	Chauk Kyar
8	U Hla Win	10 Household Head	M	Chauk Kyar
9	U Kyaw Min Tun	10 Household Head	M	Chauk Kyar
10	U Htay Win	10 Household Head	M	Chauk Kyar
11	U Nyan Hla	10 Household Head	M	Chauk Kyar
12	U Myint Maung	10 Household Head	M	Chauk Kyar
13	U Kyaw Htay Oo	Clerk- High School	M	Chauk Kyar
14	U Kyi Lin	Farmer	M	Chauk Kyar
15	U Kyaw San	Farmer	M	Chauk Kyar
16	U Kyaw Than	Farmer	M	Chauk Kyar
17	U Tun Hla	Farmer	M	Chauk Kyar
18	U Kyaw Htin	Farmer	M	Chauk Kyar
19	U Tin Ohn	Farmer	M	Chauk Kyar
20	U Htay Myint	Farmer	M	Chauk Kyar
21	U Htay Aung Win	Farmer	M	Chauk Kyar
22	U Kyaw Soe	Farmer	M	Chauk Kyar
23	U Maung Kyi	Farmer	M	Chauk Kyar
24	Daw Ma Aye	Farmer	F	Chauk Kyar
25	Daw Tin Kyi	Farmer	F	Chauk Kyar
26	Daw Khin Myint Yi	Farmer	F	Chauk Kyar
27	Daw Khin Htwe Yi	Farmer	F	Chauk Kyar
28	Daw Than Win	Farmer	F	Chauk Kyar
29	Daw Win	Farmer	F	Chauk Kyar
30	Daw Than Htay	Farmer	F	Chauk Kyar
31	Daw Ma Ohn	Farmer	F	Chauk Kyar
32	Daw Tin Oo	Farmer	F	Chauk Kyar
33	Daw Tin San	Farmer	F	Chauk Kyar
34	U Tin Htun	Farmer	M	Chauk Kyar
35	U Kyaw Hlaing	Farmer	M	Chauk Kyar
36	U Tun Hla	Farmer	M	Chauk Kyar
37	U Win Thein	Farmer	M	Chauk Kyar
38	U Han Sein	Farmer	M	Chauk Kyar
39	U Maung Htay	Farmer	M	Chauk Kyar
40	U Kyaw Min Htike	Farmer	M	Chauk Kyar
41	Daw Yu Wai	Farmer	F	Chauk Kyar

(11) Pa Ti Kone

Sr.	Name	Occupation	Sex	Village
1	U Thein Swe Myint	Village Administrator	M	Pa Ti Kone
2	U Myint Lwin	Clerk GAD	M	Pa Ti Kone
3	U Aung Zaw	Chair - Village Support committee	M	Pa Ti Kone
4	U Win Maung	Farmer	M	Pa Ti Kone
5	U Than Naing	Farmer	M	Pa Ti Kone
6	U Win Myint	Farmer	M	Pa Ti Kone
7	U Kan Nyunt	Farmer	M	Pa Ti Kone
8	U Soe Myint	Farmer	M	Pa Ti Kone
9	U Bo Tint	Farmer	M	Pa Ti Kone
10	U Bo Myint	Farmer	M	Pa Ti Kone
11	U Khin Maung Thein	Farmer	M	Pa Ti Kone
12	U Tin Ngwe	Farmer	M	Pa Ti Kone
13	U Tin Tun	Farmer	M	Pa Ti Kone
14	U Tin Myint	Farmer	M	Pa Ti Kone
15	U Kyi Win	Farmer	M	Pa Ti Kone
16	U Pho Thaung	Farmer	M	Pa Ti Kone
17	U Tin Aung Kyi	Farmer	M	Pa Ti Kone
18	U Aung Win	Farmer	M	Pa Ti Kone
19	U Maung	Farmer	M	Pa Ti Kone
20	U Chit Thee	Farmer	M	Pa Ti Kone
21	U Than Oo	Farmer	M	Pa Ti Kone
22	U Hla Thaung	Farmer	M	Pa Ti Kone
23	U Zaw Paing	Farmer	M	Pa Ti Kone
24	U Than Chaung	Farmer	M	Pa Ti Kone
25	U Pyuu	Farmer	M	Pa Ti Kone
26	U San Maung	Farmer	M	Pa Ti Kone
27	U Kyi Lwin	Farmer	M	Pa Ti Kone
28	U Htay Maung	Farmer	M	Pa Ti Kone
29	U Tun Kyaing	Farmer	M	Pa Ti Kone
30	U Thaung Nyunt	Farmer	M	Pa Ti Kone
31	U Hla Myo Tun	Farmer	M	Pa Ti Kone
32	U Zaw Min Htet	Farmer	M	Pa Ti Kone
33	U Myint Swe	Farmer	M	Pa Ti Kone
34	U Thaung Kyi	Farmer	M	Pa Ti Kone
35	U Pho Thee	Farmer	M	Pa Ti Kone
36	U Han Thein	Farmer	M	Pa Ti Kone
37	U Aung Thaung	Farmer	M	Pa Ti Kone
38	U Tin Soe	Farmer	M	Pa Ti Kone
39	U Zaw Lin	Farmer	M	Pa Ti Kone
40	U Nga Chun	Farmer	M	Pa Ti Kone

Process of Public consultation meetings in the villages of Pyawbwe Township

Public consultation meetings (PCMs) and focus group discussion (FGDs) for the IAIDP in the selected 11 villages were conducted by the ADB team with administrative support of GAD and Irrigation Department of Pyawbwe Township from August 4 to August 9. Village administration organized the meetings for ensuring the full participation of all stakeholders concerned even though farmers were busy with their farm works such as harvesting for sesame and tomatoes during the period of the public consultation meeting. Please see the list of participants attended the PCMs and focus group discussion in the villages.

Firstly, the national consultant self-introduced to the participants and gave thanks to the participants for their attendance. Then the consultant briefly presented the background and introduction, objectives, institutional structure, proposed intervention activities, public consultation and grievance redress mechanism, environmental assessment of the Irrigated Agriculture Inclusive Development Project to the participants with the flipcharts. Then, the participants asked some questions regarding the facts that were not clear to them. Some farmers were confused that the project would lend the money to the farmers. As no more questions are raised by the participants, the meetings were ended by the closing speech of the national consultant.

After the PCMs with a large number of villagers, the consultant started a series of FCDs with farmers including women. At the FCDs, at least 10 to 12 participants and 15 to 18 participants were involved in discussion and answering the prepared questionnaire. Proposed project interventions had been welcomed by all villages and no complaints and worries were expressed about the potential negative impacts of the project implementation period and after the project intervention. Farmers from all visited villages requested the project to help in renovation and replacement of canals and its accessories structures for ensuring getting irrigated water for their crops. Farmers from some villages requested the project to help them in getting access to the roads by renovating or constructing bridges across the canals existed in their villages if it is possible. In addition, some villages also requested to help in getting quality paddy seeds and other better yielded variety with affordable prices in a timely manner. Furthermore, farmers realized that they need capacity building trainings such as effective utility of irrigated water and systematic allocation of water, best practices for crop production etc.

Details of discussion points/ requests by the participants at the FGDs in villages of Pyawbwe

(1) Ywar Tan (Right Main Canal- RMC)

During the discussions with farmers of Ywar Tan, farmers requested to help in getting quality paddy, beans and pulses seeds with affordable price within the market, for ensuring the profit from crop production. In addition, farmers requested the project to help in renovation of canals which are not functioning due to poor or lack of proper maintenance by the water user groups and ID staff concerned. These include DY4, DO5 and DY6, which are urgently needed for renovation works such as removing of silts along the canals. All water courses WCs at DY4 and WC 1, WC 2 WC 3 and WC 4 at DY5 are necessary to renovate and to clean the silt. The drops at the DY5 and DY6 are also broken and necessary to renovate. In addition, WC1, WC2, WC3 and WC4 at DY6 are also badly in need of renovation. Moreover, the bridge connecting from DY6 to Field No. 112 is also broken and necessary to renovate with brick and concrete for the long term use and easy access to transportation of agricultural products. Similarly, the bridge across the right main canal of Chaungmagyi is also necessary to renovate. Again, the bridge across the DY6 connecting from Ywar Tan to Field No.111 is also necessary to renovate. In addition, the bridge connecting from Field No. 112 to Chaung Kan Gyi village is also necessary to renovate. Similarly, the bride at the base of DY is also necessary to renovate. Farmers are very happy to know that the IAD project would help in increasing agricultural production and family income of the farmers with ADB loan and government support. They are not absolutely worried about the potential negative impacts of the project activities as the project is just rehabilitation of existing canal structures and replacing with new ones that could not seriously affect their farm land usage and even positively affect socioeconomic of the communities in the target project area. So, proposed project activities of renovating canals and/or replacement of existing canals, distributory outlets, drops, gate, etc., and activities of improving agricultural crop production

practices have been warmly welcomed by the farmers.

(2) Kone Thar (RMC)

Farmers from Kone Thar during the discussions requested the project to help in getting quality paddy, beans and pulses seeds with affordable price within the market, for ensuring the profit from crop production. In addition, farmers requested the project to help in renovation of canals which are not running due to poor or lack of proper maintenance by the water user groups and ID staff concerned. These include DY4, DO5 and DY6, which are needed for renovation works such as removing of silts along the canals. All water courses WCs at DY4 and WC 1, WC 2 WC 3 and WC 4 at DY5 are necessary to renovate and to clean the silt, rubbish and bushes. The drops at the DY5 and DY6 are also broken and necessary to renovate. In addition, WC1, WC2, WC3 and WC4 at DY6 are also badly in need of renovation. Moreover, the bridge connecting from DY6 to Field No. 112 is also broken and necessary to renovate with brick and cement for the long term use and better access to transportation of agricultural products. Similarly, the bridge across the right main canal RMC is also necessary to renovate. Again, the bridge across the DY6 connecting from Ywar Tan to Field No.111 is also necessary to renovate. In addition, the bridge connecting from Field No. 112 to Chaung Kan Gyi village is also necessary to renovate. Similarly, the bridge at the base of DY is also necessary to renovate. Farmers are very pleased to know that the government will be helping in increasing agricultural production of the farmers with support of ADB loan in future. In addition, they are not worried about the potential negative impacts of project activities during and after the construction period as they do not think it would happen. So, proposed project activities of renovating canals and/or replacement of existing canals, distributory outlets, drops, gate, etc., and activities of improving agricultural crop production practices have been warmly welcomed by the farmers.

(3) Thit Seik Pin (Left Main Canal- LMC)

Farmers from Thit Seik Pin during the discussions requested the project to help in renovation of DY 1, DY2, DY3 and DY 4 as all of these canals are not well functioning from head to tail for a long time. In addition, WC 1 to WC7 is also necessary to renovate urgently for more attainment of irrigated water in future. Similarly, drop No. 7 at the WC7 of DY 2 is also badly in need of renovation. Farmers from this village are very delighted to know that the Ministry of Agriculture and Irrigation will be helping in increasing agricultural production of the farmers with support of ADB loan in future. In addition, they are not concerned about the potential negative impacts of project activities during and after the construction period as they do not think it would damage to their farm land and even help improve socioeconomic condition of the farmers in future. In addition, they also would like to give their time and labor inputs during the construction period as much as they can. So, proposed project activities of renovating canals and/or replacement of existing canals, distributory outlets, drops, gate, etc., and activities of improving crop production practices and value chain development have been warmly welcomed by the farmers.

(4) Chaung Ma Gyi (LMC)

Farmers requested the project to help in renovation of DY3, DY4 and DY5 as the drops and WCs are broken and are necessary to renovate urgently. In addition, the spill way system is not properly functioning. It is necessary to build a bridge connecting from Chaung Ma Gyi to Tamar Kone for easy access to the transportation of crops and other necessary things. Similarly, the silt existing along the canals should also be cleaned for better drainage. Farmers are very happy to know that the project will be supporting for increased of irrigated area and crop productions in the target area with ADB loan in near future. Farmers are not so worried about the potential negative impacts of the project activities during the construction and after the project as they think the proposed activities would not damage to their farmland and positively affect their socioeconomic status even if some mechanical works included in the project design such as removal of silt by

caterpillars tractor or excavators and/or any other machinery works. So, all proposed project activities of renovation and replacement of existing canals, distributor outlets, drops, gate, etc., and activities of improving agricultural crop production practices and value chain development have been warmly welcomed by the farmers.

(5) Kan Te (LMC)

Farmers requested the project to help in getting irrigated water for the user farmers at the tail of the canal and the DY3 canal is full of silt and drops are broken and the water courses WCs at DY3 are also not in level so it could not reach the irrigated water to the farms and all of these are necessary to renovate for proper attainment of irrigated water for the farmers. In addition, farmers requested the project to renovate the bridge connecting from Dai Chaung Kan Te to Tamar Kone village as it is broken. If possible, it is better to establish the bridge at the tail of DY3 because farmers can use this more comfortably than the old one. Similarly, farmers also requested the project to help in renovation of transportation roads from the farms to the villages so they can use these roads in all seasons. In addition, the farmers also requested the project to support in getting quality seeds in a timely manner so farmers can grow them timely and ensuring maximum survival rate of grown seedlings. Furthermore, farmers also requested the project to help in establishment of effective water allocation system and strengthening of existing water user group members by providing appropriate hands on training or whatever suited to the needs of farmer for efficient water usage and management within the limited water availability.

Farmers are really pleased to hear that such kind of government executed project will be supporting for increased of irrigated area and crop productions in the target area with ADB loan in near future. Farmers are not so concerned about the potential negative impacts of the project activities during the construction and after the project as they do not think the proposed activities would damage to their farmland and they also think that the activities will surely positively affect their socioeconomic condition in the long term even if some mechanical works included in the project design such as removal of silt by caterpillars tractor or excavators and/or any other machinery works. So, all proposed project activities of renovation and replacement of existing canals, distributor outlets, drops, gate, etc., and activities of improving crop production practices and valued chain development have been warmly welcomed by the farmers.

(6) Tamar Kone (LMC)

During the discussions, farmers requested the project to help in renovation of DY3, DY4 and DY 5 as all of these canals are broken and silted for a long time. All water courses WCs and drops at the DY5 are also not functioning well and badly in need of renovation. Silt removal is also necessary in all of these canals. In addition, farmers requested the project to help in getting proper paddy variety suited to the actual availability of irrigated water from the canals for example if they get less water, they just need shorter lifespan of paddy variety and vice versa. For example, they like Manaw Thu Kha, long lived paddy variety and Shwe Thwe Yin, shorter lifespan paddy variety. Farmers are really happy to know that this kind of government executed project will be supporting for increased of irrigated area and crop productions in the target area with ADB loan in near future. Farmers are not worried about the potential negative impacts of the project activities during the construction and after the project as they think the proposed activities would not seriously damage to their farmland and even positively affect their socioeconomic condition for the long term for example increasing production and annual income from their farms even if some mechanical works included in the project design such as removal of silt by caterpillars tractor or excavators and/or any other machinery works. So, all proposed project activities of renovation and replacement of existing canals, distributor outlets, drops, gate, etc., and activities of improving agricultural crop production practices and value chain development have been accepted by the farmers.

(7) Chaung Kan Gyi (RMC)
Farmers from Chaung Kan Gyi during the FGD requested the project to help in renovation of DY2 as it is not functioning and the drop is broken and all water courses WCs are not level and so it is necessary to make them level for getting released water from the dam. 3 drops at the DY2 are broken and necessary to renovate. In addition, the bridges at the right main canal RMC and at the DY2 are also necessary to renovate as these two bridges are very important for transportation of farmers' crops and all other things in the area. Furthermore, farmers requested the project to help in getting sufficient inputs for their crop production with affordable prices as the overall cost for production of a specific crop is not so effective compared to the return.

But, farmers are really pleased to know that this kind of government executed project will be assisting for increasing irrigated area and crop productions in the target area with ADB loan in near future. Farmers are not worried about the potential negative impacts of the project activities during the construction and after the project as they think the proposed activities would not seriously damage to their farmland and even positively affect their socioeconomic condition in the long term for example increasing crop yield and annual income from their farms even if some mechanical works included in the project design such as removal of silt by caterpillars tractor or excavators and/or any other machinery works. So, all proposed project activities of renovation and replacement of existing canals, distributory outlets, drops, gate, etc., and activities of improving agricultural crop production practices and value chain development have been welcomed by the farmers.

(8) Nyaung Pin Te (RMC)
During the FGD with farmers, farmers requested the project to help in renovation of DY1 as only 3 WCs out of 6 WCs at the DY1 are getting water for their farms. So the rest of 3 WCS are necessary to renovate and make them level for attainment of irrigated water. In addition, the drops at the DY1 are broken and necessary to renovate and silt removal is also necessary to clean the canals. Similarly water course WCs at DY3 are necessary to renovate and there is no gate. The level of all WCs at DY3 is also needed to adjust. In addition, a supportive WC should be established between Drop No.4 and Drop No.5 for ensuring better attainment of irrigated water at their farms. Moreover, the farmers also requested the project to help in getting quality seeds and ensuring secured market for the farmers if it is possible. They also requested the project to provide small harvesting and threshing machines if possible so they can complete these tasks within the sensitive weather condition. In addition, farmers also requested the project to help in establishing a bridge at the lower site of drop No. 2 at DY1 if it is possible.

Farmers are really pleased to know that this kind of government executed project will be assisting for increasing irrigated area and crop production in the target area with ADB loan in near future. Farmers are not worried about the potential negative impacts of the project activities during the construction and after the project as they think the proposed activities would not seriously damage to their farmland and even positively affect their socioeconomic condition in the long term for example increasing crop yield and annual income from their farms even if some mechanical works included in the project design such as removal of silt by caterpillars tractor or excavators and/or any other machinery works. So, all proposed project activities of renovation and replacement of existing canals, distributory outlets, drops, gate, etc., and activities of improving agricultural crop production practices and value chain development have been warmly welcomed by the farmers.

(9) Sar Taung (LMC)
Farmers from Sar Taung during the FGD requested the project to assist in renovation of DY 5

such as renovation of gate, removal of silts and reestablish the water course WC1. In addition, 3 drops at DY5 are also necessary to renovate and unnecessary WCs should also be removed. Similarly, the level of drop at DY 6 is also necessary to be adjusted and WCs at DY6 are also necessary to renovate. Again, spill way between WC1 and WC2 is broken and necessary to renovate. In addition, 3 drops and WC1, WC2 and WC3 at DY7 are necessary to renovate and the level of gate should be adjusted. Similarly, farmers requested the project to help in getting paddy seeds and cotton seeds, small harvesting and threshing machines and small tractors if it is possible. In addition, farmers also requested the project to help in addressing the issues of labor scarcity and very costly in crop production.

Anyhow, farmers are very pleased to know that this kind of government executed project will be supporting for increasing irrigated area and crop production in the target area with ADB loan in near future. Farmers are not worried about the potential negative impacts of the project activities during the construction and after the project as they think the proposed activities would not seriously damage to their farmland and even positively affect their socioeconomic condition in the long term for example increasing crop yield and annual income from their farms even if some mechanical works included in the project design such as removal of silt by caterpillars tractor or excavators and/or any other machinery works. So, all proposed project activities of renovation and replacement of existing canals, distributory outlets, drops, gate, etc., and activities of improving agricultural crop production practices and value chain development have been accepted by the farmers.

(10) Thee Kone (RMC)

Farmers from Thee Kone during the FGD requested the project to help in renovation of DY5 as it was full of silts and the gate is fixed permanently and it is necessary to renovate the gate. Farmers also requested the project to help in renovation of canal connecting from Kyini Yayhlwe Pese (Kyini weir) to field No. 384 for more attainment of irrigated water for the farmers. In addition, farmers also requested the project to help in getting underground water if the irrigated water is not available from the dam.

Anyway, farmers are very happy to know that this kind of government executed project will be supporting for increasing irrigated area and crop production in the target area with ADB loan in near future. Farmers are not worried about the potential negative impacts of the project activities during the construction and after the project as they think the proposed activities would not seriously damage to their farmland and even positively affect their socioeconomic condition in the long term for example increasing crop yield and annual income from their farms even if some mechanical works included in the project design such as removal of silt by caterpillars tractor or excavators and/or any other machinery works. So, all proposed project activities of renovation and replacement of existing canals, distributory outlets, drops, gate, etc., and activities of improving agricultural crop production practices and value chain development have been warmly welcomed by the farmers.

(11) Pin Tar (LMC)

Farmers from Pin Tar during the focus group discussion requested the project to help in renovation of DY1 Minor 1 and the whole part of minor 1 canal. In addition, all bridges across the canal are also necessary to renovate. Similarly drops and bridges at DY 2 are also necessary to renovate and silt should be removed from the canal of DY2. Similarly, all water courses WCs at DY2 should also be renovated as it is originally existed. The canal should be renovated with concrete structure for ensuring long lasting of the canal. Again, WC1 at DY1 should be extended at the lower site for getting more irrigated water for the farmers. In addition, all bridges across the minor 1 and minor 2 canals should also be renovated. Similarly farmers also requested the

project to help in getting better yield variety with shorter lifespan and they feel like growing pre-monsoon paddy and pre-monsoon cotton if the irrigated water is available. In addition, farmers also requested the project to help in establishment of 5 water collecting ponds through harvesting of flowing waters from Pin Tar stream for ensuring water for their crops if the availability of irrigated water from the dam is not so sure. Similarly, farmers also requested the project to help in upgrading the road –embankment of Left Main Canal LMC with stones.

Anyhow, farmers are very pleased to know that this kind of government executed project will be supporting for increasing irrigated area and crop production in the target area with ADB loan in near future. Farmers are not worried about the potential negative impacts of the project activities during the construction and after the project as they think the proposed activities would not seriously damage to their farmland and even positively affect their socioeconomic condition in the long term for example increasing crop yield and annual income from their farms even if some mechanical works included in the project design such as removal of silt by caterpillars tractor or excavators and/or any other machinery works. So, all proposed project activities of renovation and replacement of existing canals, distributory outlets, drops, gate, etc., including activities of improving agricultural crop production practices and value chain development have been accepted by the farmers.

List of participants at the public consultation meeting township level in Pyawbwe

Sr.	Name	Department	Sex	Position
1	U Min Ko	General Administration	M	Township officer
2	U Zaw Lin	Agriculture Department	M	Township officer
3	U Win Shwe	Agricultural Mechanization	M	Township officer
4	U San Yu Naing	Forest Department	M	Ranger
5	U Khin Maung Kyaw	Dryzone Greening Department	M	Township officer
6	U Aung Ko Min	Irrigation Department	M	Township officer
7	U San Tun	Township Development Supportive	M	Chairman (Advocate)
8	U Aung Chit	SLRD	M	Township officer
9	U Sein Htay	Township Development Supportive	M	Member
10	U Tin Win	Township Development Supportive	M	Member
11	U Naing Win	Rural Development	M	Township officer

List of participants at the FCDs in the villages of Pyawbwe Township

(1) Ywar Tan

Sr.	Name	Occupation	Sex	Village
1	U Win Shwe	Village Tract Administrator	M	Wetlet
2	Daw Pyay Khine	GAD clerk	F	Ywar Tan
3	U Aung Hmat	100 HH Head	M	Ywar Tan
4	U Maung Than	Village Honorable	M	Ywar Tan
5	U Nyunt Maung	Farmer	M	Ywar Tan
6	U Win Maung	Farmer	M	Ywar Tan
7	U Kyaw Myint (lay)	Farmer	M	Ywar Tan
8	U Myint Maung	Farmer	M	Ywar Tan
9	U Bo Gyi	Farmer	M	Ywar Tan
10	U Nyein Maung	Farmer	M	Ywar Tan
11	U Thaung Shwe	Farmer	M	Ywar Tan
12	U Kyaw Thin	Farmer	M	Ywar Tan
13	U Win Zaw Oo	Farmer	M	Ywar Tan
14	U Kyaw Zaw	Farmer	M	Ywar Tan
15	Daw Hla Gyi	Farmer	F	Ywar Tan
16	Daw Yi n San	Farmer	F	Ywar Tan
17	Daw Tin Oo	Farmer	F	Ywar Tan
18	Daw Nyunt Tin	Farmer	F	Ywar Tan
19	Daw Mar Aye	Farmer	F	Ywar Tan
20	Daw Tin Hla	Farmer	F	Ywar Tan
21	Daw Mya Than	Farmer	F	Ywar Tan
22	Daw Mya Shwe	Farmer	F	Ywar Tan
23	Daw Aye Hlaing	Farmer	F	Ywar Tan
24	Daw Nyunt Shwe	Farmer	F	Ywar Tan
25	U Maung	Farmer	M	Ywar Tan
26	U Kyaw Khaing	Farmer	M	Ywar Tan
27	U Hla Oo	Farmer	M	Ywar Tan
28	U Hla Nyein	Farmer	M	Ywar Tan
29	U Sein Win	Farmer	M	Ywar Tan
30	Daw Pyar	Farmer	F	Ywar Tan
31	Daw Kyi Myint	Farmer	F	Ywar Tan
32	U San Lwin	Farmer	M	Ywar Tan

(2) Kone Tha

Sr.	Name	Occupation	Sex	Village
1	U Tun Tin	Farmer	M	Kone Thar
2	U Tun Yin	Farmer	M	Kone Thar
3	U Maung ko	Farmer	M	Kone Thar
4	U Aye Maung (Mya)	Farmer	M	Kone Thar
5	U Ohn Nyunt	Farmer	M	Kone Thar
6	U Tin Ngwe	Farmer	M	Kone Thar
7	U Thaung Shwe	Farmer	M	Kone Thar
8	U Aye Maung (Yin)	Farmer	M	Kone Thar
9	U Than Zaw	Farmer	M	Kone Thar
10	U Thaung Ngwe	Farmer	M	Kone Thar
11	U Myo Win	Farmer	M	Kone Thar
12	U Nyunt Win	Farmer	M	Kone Thar
13	U Tint Htoo	Farmer	M	Kone Thar
14	U Khin Maung Kyi	Farmer	M	Kone Thar
15	U Hla Maung	Farmer	M	Kone Thar
16	Daw Khin Aye	Farmer	F	Kone Thar
17	U Nyunt Aung	Farmer	M	Kone Thar
18	U Kyi Hlaing	Farmer	M	Kone Thar
19	U San Lwin	Farmer	M	Kone Thar
20	U Kyaw San	Farmer	M	Kone Thar
21	U Htay Lwin	Farmer	M	Kone Thar
22	U Naing Oo	Farmer	M	Kone Thar
23	U Aung Nyein	Farmer	M	Kone Thar
24	Daw Ohn Kyi	Farmer	F	Kone Thar
25	U Kyi Saung	Farmer	M	Kone Thar
26	U Kyaw Ngwe	Farmer	M	Kone Thar
27	Daw Hlee	Farmer	F	Kone Thar
28	U Tun Shwe	Farmer	M	Kone Thar
29	Daw Ohn Myint	Farmer	F	Kone Thar
30	U Soe Myint	Farmer	M	Kone Thar
31	U Kyi Khaing	Farmer	M	Kone Thar
32	U Soe Naing (Nwet)	Farmer	M	Kone Thar
33	U Ye Min	Farmer	M	Kone Thar
34	U Thar Cho	Farmer	M	Kone Thar
35	U Pauk Sa	Farmer	M	Kone Thar
36	U Ohn Mya	Farmer	M	Kone Thar

(3) Chaung Ma Gyi

Sr.	Name	Occupation	Sex	Village
1	U Myint Thein	Village Administrator	M	Chaung Ma Gyi
2	U Tin Ngwe	Farmer	M	Chaung Ma Gyi
3	U Tin Thein	Farmer	M	Padauk Pin
4	U Tun Aye	Farmer	M	Padauk Pin
5	U Maung	Secretary – Village Support	M	Chaung Ma Gyi
6	U Kyaw San	Farmer	M	Chaung Magyi
7	U Tun Maung	Farmer	M	Chaung Magyi
8	U Kyaw Than	Farmer	M	Chaung Magyi
9	U Aye Lwin	Farmer	M	Chaung Magyi
10	U Bo Tun	Farmer	M	Chaung Magyi
11	U San Lin	Farmer	M	Chaung Magyi
12	U Ngwe San	Farmer	M	Chaung Magyi
13	U Than Ngwe	Farmer	M	Padauk Pin
14	Daw Nan Paw	Farmer	F	Padauk Pin

Sr.	Name	Occupation	Sex	Village
15	U Kyaw Win	Farmer	M	Padauk Pin
16	U Myint Oo	Farmer	M	Padauk Pin
17	U Maung Pu	Farmer	M	Padauk Pin
18	Daw Htay	Farmer	F	Padauk Pin
19	U Than Maung	Farmer	M	Padauk Pin
20	Daw Khin Sein	Farmer	F	Padauk Pin
21	U Kyaw Nyein	Farmer	M	Padauk Pin
22	U Thaung Shein	Farmer	M	Chaung Magyi
23	Daw Khin Hla	Farmer	F	Chaung Magyi
24	U Tin Myint	Farmer	M	Padauk Pin
25	U Sein Win	Farmer	M	Padauk Pin
26	U Khin Maung Swe	Farmer	M	Padauk Pin
27	U Pho Aye	Farmer	M	Padauk Pin
28	U Maung Than	Farmer	M	Padauk Pin

(4) Thit Seik Pin

Sr.	Name	Occupation	Sex	Village
1	U Aung Khin	Farmer	M	Thit Seik Pin
2	U Se Pyar	Farmer	M	Thit Seik Pin
3	U Than Htike	Farmer	M	Thit Seik Pin
4	Daw Than Shein	Farmer	F	Thit Seik Pin
5	U Win Tint	Farmer	M	Thit Seik Pin
6	U Hla Nyein	Farmer	M	Thit Seik Pin
7	U Than Chaung	Farmer	M	Thit Seik Pin
8	U Aye Lwin	Farmer	M	Thit Seik Pin
9	U Soe Khaing	Farmer	M	Thit Seik Pin
10	U Kyaw Win	Farmer	M	Thit Seik Pin
11	Daw Saw Tin	Farmer	F	Thit Seik Pin
12	Daw Khin Soe	Farmer	F	Thit Seik Pin
13	U Phoe Toke	Farmer	M	Thit Seik Pin
14	U Tun Kyaw Khaing	Farmer	M	Thit Seik Pin
15	U Zaw Khin	Farmer	M	Thit Seik Pin
16	Daw Mya Aye	Farmer	F	Thit Seik Pin
17	Daw Tin Sein	Farmer	F	Thit Seik Pin
18	Daw Hla Myint	Farmer	F	Thit Seik Pin
19	U Gin Maung	Farmer	M	Thit Seik Pin
20	U Nat Tin	Farmer	M	Thit Seik Pin
21	U Thein Zaw Ni	Farmer	M	Thit Seik Pin
22	U Than Lin	Farmer	M	Thit Seik Pin
23	U Tun	Farmer	M	Thit Seik Pin
24	U Aung Min	Farmer	M	Thit Seik Pin
25	Daw Khin Nu	Farmer	F	Thit Seik Pin
26	Daw Sein	Farmer	F	Thit Seik Pin
27	U Thein Shwe	Farmer	M	Thit Seik Pin
28	Daw Amar Tin	Farmer	F	Thit Seik Pin
29	U Kyaw	Farmer	M	Thit Seik Pin
30	U Tin Aung	Farmer	M	Thit Seik Pin
31	U Thaung Htein	Farmer	M	Thit Seik Pin
32	U Mya Thein	Farmer	M	Thit Seik Pin
33	U Myo Nyein	Farmer	M	Thit Seik Pin
34	U Myo Chit	Farmer	M	Thit Seik Pin
35	U Min Zaw	Farmer	M	Thit Seik Pin
36	U Myint Aung	Farmer	M	Thit Seik Pin

Sr.	Name	Occupation	Sex	Village
37	U Thein Aung	Farmer	M	Thit Seik Pin
38	U Tin Aye	Farmer	M	Thit Seik Pin
39	U Myo	Farmer	M	Thit Seik Pin
40	U Ye Win	Farmer	M	Thit Seik Pin
41	U Kyaw Sein	Farmer	M	Thit Seik Pin
42	U Kyaw Nyunt	Farmer	M	Thit Seik Pin
43	U Myint Swe	Farmer	M	Thit Seik Pin
44	Daw Tin Ohn	Farmer	F	Thit Seik Pin
45	Daw Tin Nu	Farmer	F	Thit Seik Pin
46	Daw Khin Kyi	Farmer	F	Thit Seik Pin
47	U Phone Zaw	Farmer	M	Thit Seik Pin
48	U Win Moe	Farmer	M	Thit Seik Pin
49	U Aung Ko Min	Farmer	M	Thit Seik Pin
50	U Tin Win	Farmer	M	Thit Seik Pin
51	U Aye Lwin	Farmer	M	Thit Seik Pin
52	Daw Shan Ma	Farmer	F	Thit Seik Pin
53	U Tin Shwe	Farmer	M	Thit Seik Pin
54	U Kyaw Than	Farmer	M	Thit Seik Pin
55	U Kyaw Min	Farmer	M	Thit Seik Pin
56	U Win Kyaing	Farmer	M	Thit Seik Pin
57	U Nyo	Farmer	M	Thit Seik Pin
58	U Kalar	Farmer	M	Thit Seik Pin

(5) Kan Te

Sr.	Name	Occupation	Sex	Village
1	U Min Khin	Village Administrator	M	Tamar Kone
2	U Maung	GAD clerk (1)	M	Tamar Kone
3	U Pyuu Maung	100 HH Head	M	Kan Te
4	U Aung Tun	Farmer	M	Kan Te
5	U Hla Win	Farmer	M	Kan Te
6	U Kan Hla	Farmer	M	Kan Te
7	U San Win	Farmer	M	Kan Te
8	U Aung Lwin	Farmer	M	Kan Te
9	Daw Yin Mya	Farmer	F	Kan Te
10	U San Pu	Farmer	M	Kan Te
11	Daw Myint Khin	Farmer	F	Kan Te
12	Daw Nyan	Farmer	F	Kan Te
13	Daw Mya Mon	Farmer	F	Kan Te
14	U Minn Oo	Farmer	M	Kan Te
15	U Tin Soe	Farmer	M	Kan Te
16	U Thaung Shwe	Farmer	M	Kan Te
17	U Soe Win	Farmer	M	Kan Te
18	U Myint Shwe	Farmer	M	Kan Te
19	Daw San Win	Farmer	F	Kan Te
20	Daw Nyunt Yi	Farmer	F	Kan Te
21	U Win Naing	Farmer	M	Kan Te
22	U Myint Shwe	Farmer	M	Kan Te
23	Daw Nyunt Yi	Farmer	F	Kan Te
24	Daw Zin Mar Win	Farmer	F	Kan Te
25	U Min Oo	Farmer	M	Kan Te
26	Daw Khin Kyi	Farmer	F	Kan Te
27	U Than Lwin	Farmer	M	Kan Te
28	U Tun Tin	Farmer	M	Kan Te

Sr.	Name	Occupation	Sex	Village
29	Daw Myint	Farmer	F	Kan Te
30	U Win Nyunt	Farmer	M	Kan Te

(6) Tamar Kone

Sr.	Name	Occupation	Sex	Village
1	U Aung Min	Farmer	M	Tamar Kone
2	U Tin Myint	Farmer	M	Tamar Kone
3	U Maung Oo	Farmer	M	Tamar Kone
4	U Ohn Lwin	Farmer	M	Tamar Kone
5	U Aung Thu	Farmer	M	Tamar Kone
6	Daw khin Aye	Farmer	F	Tamar Kone
7	Daw Tin Myint	Farmer	F	Tamar Kone
8	Daw Htay Kyi	Farmer	F	Tamar Kone
9	U Kyaw Myint	Farmer	M	Tamar Kone
10	Daw Khin Pyone	Farmer	F	Tamar Kone
11	Daw Khin San Lwin	Farmer	F	Tamar Kone
12	U Kyi Shein	Farmer	M	Tamar Kone
13	U Sein Tun	Farmer	M	Tamar Kone
14	U Kyi Sein	Farmer	M	Tamar Kone
15	U Tint Swe	Farmer	M	Tamar Kone
16	U Maung Htoo	Farmer	M	Tamar Kone
17	U Tin Swe	Farmer	M	Tamar Kone
18	U Thaung Swe	Farmer	M	Tamar Kone
19	U Than Maung	Farmer	M	Tamar Kone
20	U Myint Ngwe	Farmer	M	Tamar Kone
21	U Kyaw Zaw	Farmer	M	Tamar Kone
22	U Kyaw Oo	Farmer	M	Tamar Kone

(7) Chaung Kan Gyi

Sr.	Name	Occupation	Sex	Village
1	U Pan Hmwe	Village Tract Administrator	M	Chaung Kan Gyi
2	U Tha Aung	Farmer	M	Chaung Kan Gyi
3	U Po Kar	Village administrator	M	Chaung Kan Gyi
4	U San Oo	Village Tract Clerk	M	Chaung Kan Gyi
5	U Kyaw Hlaing	Village honorable	M	Chaung Kan Gyi
6	U Soe Thein	100 HH Head	M	Chaung Kan Gyi
7	U Thar Htay	10 HH Head	M	Chaung Kan Gyi
8	U Myint Maung	10 HH Head	M	Chaung Kan Gyi
9	U Khin Maung	10 HH Head	M	Chaung Kan Gyi
10	U Maung Than	Farmer	M	Chaung Kan Gyi
11	U Thar Yin	Farmer	M	Chaung Kan Gyi
12	U Bo Kyaw	Farmer	M	Chaung Kan Gyi
13	U Maung Zaw	Farmer	M	Chaung Kan Gyi
14	U Than Kyaw	Farmer	M	Chaung Kan Gyi
15	U Mya Thein	Farmer	M	Chaung Kan Gyi
16	U Tin Aung	Farmer	M	Chaung Kan Gyi
17	U Kyi Maung	Farmer	M	Chaung Kan Gyi
18	U Shwe Myaing	Farmer	M	Chaung Kan Gyi
19	U Aung Hlaing	Farmer	M	Chaung Kan Gyi
20	U Thein Tun	Farmer	M	Chaung Kan Gyi
21	Daw Khway	Farmer	F	Chaung Kan Gyi
22	U Kyi Nyunt	Farmer	M	Chaung Kan Gyi
23	Daw Mar Lwin	Farmer	F	Chaung Kan Gyi

Sr.	Name	Occupation	Sex	Village
24	U Mya Nyein	Farmer	M	Chaung Kan Gyi
25	U Tin Oo	Farmer	M	Chaung Kan Gyi
26	U Thein Tun Kywe	Farmer	M	Chaung Kan Gyi
27	U Tin Ngwe	Farmer	M	Chaung Kan Gyi
28	U Soe Win	Farmer	M	Chaung Kan Gyi
29	U Sein Aung	Farmer	M	Chaung Kan Gyi
30	U Aung Htoo	Farmer	M	Chaung Kan Gyi
31	U Maung Aye	Farmer	M	Chaung Kan Gyi
32	U Ohn Myaing	Farmer	M	Chaung Kan Gyi
33	U Tin Myint	Farmer	M	Chaung Kan Gyi
34	U Kyi Aung	Farmer	M	Chaung Kan Gyi
35	U Tun Oo	Farmer	M	Chaung Kan Gyi
36	U Tin Aung	Farmer	M	Chaung Kan Gyi

(8) Nyaung Pin Te

Sr.	Name	Occupation	Sex	Village
1	U Zaw Min	Farmer	M	Nyaung pin Te
2	U Maung Htay	Farmer	M	Nyaung pin Te
3	U Hla Win	Farmer	M	Nyaung pin Te
4	U Nay Min Aung	Farmer	M	Nyaung pin Te
5	U Htay Win	Farmer	M	Nyaung pin Te
6	U Myint Aung	Farmer	M	Nyaung pin Te
7	Daw Mi Hmine	Farmer	F	Nyaung pin Te
8	Daw Hla San	Farmer	F	Nyaung pin Te
9	Daw Ngwe Yon	Farmer	F	Nyaung pin Te
10	U Myint Khine	Farmer	M	Nyaung pin Te
11	U Pway Kyaw	Farmer	M	Nyaung pin Te
12	Daw Tin Hla	Farmer	F	Nyaung pin Te
13	U Aye Lwin	Farmer	M	Nyaung pin Te
14	U Maung Win	Farmer	M	Nyaung pin Te
15	U Thit Swe Oo	Farmer	M	Nyaung pin Te
16	U Soe Thein	Farmer	M	Nyaung pin Te
17	U Khin Maung Swe	Farmer	M	Nyaung pin Te
18	U Maung Naing	Farmer	M	Nyaung pin Te
19	U Htay Maung	Farmer	M	Nyaung pin Te
20	U San Thein	Farmer	M	Nyaung pin Te
21	Daw San Aye	Farmer	F	Nyaung pin Te
22	Daw Mar Sein	Farmer	F	Nyaung pin Te

(9) Sar Taung

Sr.	Name	Occupation	Sex	Village
1	U Zaw Lin Oo	Village Honorable	M	Sar Taung (W)
2	U Win Oo	Farmer	M	Sar Taung (W)
3	U Than Naing	Farmer	M	Sar Taung (W)
4	U Thet Nwe Oo	Farmer	M	Sar Taung (W)
5	U Ye Lwin Oo	Farmer	M	Sar Taung (W)
6	U Hla Tun	Farmer	M	Sar Taung (W)
7	U Myo Aung	Village Administrator	M	Sar Taung (W)
8	U Tin Tun	Farmer	M	Sar Taung (W)
9	U Myint Thein	Farmer	M	Sar Taung (W)
10	U San Hlaing	Farmer	M	Sar Taung (W)
11	Daw Than Sein	Farmer	F	Sar Taung (W)
12	Daw Yati Sein	Farmer	F	Sar Taung (W)

Sr.	Name	Occupation	Sex	Village
13	Daw Nyo Lone	Farmer	F	Sar Taung (W)
14	U San Lwin	Farmer	M	Sar Taung (W)
15	Daw Cho Aye	Farmer	F	Sar Taung (E)
16	U Po Thar Aung	Farmer	M	Sar Taung (W)
17	Daw Cherry	Farmer	F	Sar Taung (W)
18	Dae San Shar Tin	Farmer	F	Sar Taung (W)
19	Daw Myint Htay	Farmer	F	Sar Taung (W)
20	U Tin Myint Win	Farmer	M	Sar Taung (E)
21	U San Nyein	Farmer	M	Sar Taung (E)
22	Daw Yi	Farmer	F	Sar Taung (E)
23	Daw Pyone	Farmer	F	Sar Taung (E)
24	Daw Me Nyo	Farmer	F	Sar Taung (W)
25	Daw Thin	Farmer	F	Sar Taung (W)

(10) Thee Kone

Sr.	Name	Occupation	Sex	Village
1	U Than	Village Tract Administrator	M	Thee Kone
2	U Soe Myint	Farmer	M	Thee Kone
3	U Maung San	Farmer	M	Thee Kone
4	U Maung Myint	Farmer	M	Thee Kone
5	U Bo Aung	Farmer	M	Thee Kone
6	U Moe	Farmer	M	Thee Kone
7	U Maung Than	Farmer	M	Thee Kone
8	Daw Wai San Aye	Farmer	F	Thee Kone
9	Daw Khin Win	Farmer	F	Thee Kone
10	U Kyi Khine	Farmer	M	Thee Kone
11	U Myint Zaw	Farmer	M	Thee Kone
12	Daw Win San Aye	Farmer	F	Thee Kone
13	Daw Nu	Farmer	F	Thee Kone
14	Daw Than Khin	Farmer	F	Thee Kone
15	U Nu	Farmer	M	Thee Kone
16	U Nyo	Farmer	M	Thee Kone
17	U Myo Swe	Farmer	M	Thee Kone

(11) Pin Tar

Sr.	Name	Occupation	Sex	Village
1	U Marlik	Village Administrator	M	Pin Tar
2	U Soe Myint	Village Honorable	M	Pin Tar
3	U Tin Myint	Village Security	M	Pin Tar
4	U Hershin	Farmer	M	Pin Tar
5	U Maung Nu	Farmer	M	Pin Tar
6	U Win Bo	Farmer	M	Pin Tar
7	U Myint Zaw	Ex-headmaster of primary school	M	Pin Tar
8	U Soe Aung	Farmer	M	Pin Tar
9	U Htay Aung	Farmer	M	Pin Tar
10	U Soe Win	Farmer	M	Pin Tar
11	U Khin Maung Lwin	Farmer	M	Pin Tar
12	U Kyaw Myint	Farmer	M	Pin Tar
13	Daw Shally	Farmer	F	Pin Tar
14	Daw Apu	Farmer	F	Pin Tar
15	U Tin Shwe	Farmer	M	Pin Tar
16	U Phone Naing	Farmer	M	Pin Tar
17	U Tin Win	Farmer	M	Pin Tar

Sr.	Name	Occupation	Sex	Village
18	U Ko Thet	Farmer	M	Pin Tar
19	U Kyaw Moe	Farmer	M	Pin Tar
20	U Bo Kyi	Farmer	M	Pin Tar
21	U Tin Aung	Farmer	M	Pin Tar
22	U Tin Aye	Farmer	M	Pin Tar
23	U Aung Ko Latt	Farmer	M	Pin Tar
24	Daw Arsha	Farmer	F	Pin Tar
25	U Khin Maung Shwe	Farmer	M	Pin Tar
26	U Kamar	Farmer	M	Pin Tar
27	U Khin Maung Myint	ID staff	M	Pin Tar
28	U Myint Maung	Redcross	M	Pin Tar
29	U Zaw Win	Farmer	M	Pin Tar
30	Daw khin Shwe	Farmer	F	Pin Tar
31	U Tint Swe	Farmer	M	Pin Tar
32	U Saman In	Farmer	M	Pin Tar
33	U Myint Lwin	Farmer	M	Pin Tar
34	U Maung Myint	Farmer	M	Pin Tar
35	U Myint Naing Oo	Farmer	M	Pin Tar

PCM meeting in Pyawbwe GAD

FCD Meeting in Chaungagyi village in Pyawbwe

FGD in Chaungkangyi village of Pyawbwe Township

FCD in Pintar Village of Pyawbwe Township

In addition to the public consultation meeting, the IAIDP environmental team met with the Environmental Conservation Department (ECD) of MOECAF to get an update on their proposed EIA Guidelines and environmental standards. The following are meeting minutes:

IAIDP Meeting Minutes, Environmental Conservation Department, MOECAF
8 September 2015

Name and positions of ECD officials met:

(1) Dr. San Oo, Director, Natural Resources Conservation and EIA Division, ECD, Naypyitaw
(2) U Sein Aung Min, Assistant Director, Natural Resources Conservation and EIA Division, ECD, Naypyitaw
(3) Daw Nway Ei Aung, Deputy Township Officer, Natural Resources Conservation and EIA Division, ECD, Naypyitaw

Mott MacDonald Representatives

(1) Larry Quinn, IAIDP International Environmental Specialist
(2) Kyaw Oo, IAIDP Domestic Environmental Management Specialist

Meeting minutes with ECD officials

- The June 2015 Environmental Impact Assessment (EIA) procedure has been submitted to Union General Attorney Office (UGAO) for official approval. A soft copy of the June 2015 draft was provided to the team in English and Burmese.
- The draft National Environmental Quality (Emission) Guideline has also been submitted to the UGAO for approval. It is likely to release as an official guide within next two months. They continue to refer to IFC and World Bank Guidelines in the interim.
- The Environmental Conservation Department (ECD) has been receiving a series of capacity building trainings, workshops and hands on exercises on EIA and its related subjects more than 7-8 times through the support of the Norwegian Environment Agency (NEA) and Vermont Law School since 2014. There will be a 3 day hands on training of EIA in next week starting from 22 September to 24 September with the support of NEA.
- In addition, My Asia, an Indian company had also supported ECD for improving capacity of ECD staffs through provision of EIA reviews theory and practical tasks for conducting an EIA.
- Currently, Vermont Law School has been providing trainings on EIA to ECD and other relevant ministries and will be extending its activities to Taninthari Region, southern Myanmar soon.
- Ministry of Science and Technology has two environmental laboratories in Yangon and Pyin Oo Lwin township of Mandalay Region. In addition, there are a few environmental laboratories companies providing services in Yangon but they have not been registered yet. It may be difficult to find qualified environmental testing laboratory for the air and noise monitoring of IAIDP.

ANNEX 4 – RAPID ENVIRONMENTAL ASSESSMENT CHECKLISTS OF CORE SUBPROJECTS

Rapid Environmental Assessment (REA) Checklist

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by the Director, RSES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: MYA (8583): Irrigated Agriculture Inclusive Development Project

Sector Division: SEER

Screening Questions	Yes	No	Remarks
A. PROJECT SITING IS THE PROJECT AREA ADJACENT TO OR WITHIN ANY OF THE FOLLOWING ENVIRONMENTALLY SENSITIVE AREAS?			Nothing for either core subproject
▪ PROTECTED AREA		√	
▪ WETLAND		√	
▪ MANGROVE		√	
▪ ESTUARINE		√	
▪ BUFFER ZONE OF PROTECTED AREA		√	
▪ SPECIAL AREA FOR PROTECTING BIODIVERSITY		√	
B. POTENTIAL ENVIRONMENTAL IMPACTS WILL THE PROJECT CAUSE…			
▪ loss of precious ecological values (e.g. result of encroachment into forests/swamplands or historical/cultural buildings/areas, disruption of hydrology of natural waterways, regional flooding, and drainage hazards)?		√	All operation activities are allowed to be Implemented only in the identified restricted project sites and those are not allowed to intrude into any other area. Little ecological value in either core subproject area.

Screening Questions	Yes	No	Remarks
▪ conflicts in water supply rights and related social conflicts?		√	Farmers will develop rights and responsibilities for ensuring equity in usage of irrigated water by formation of formal WUGs through the capacity building programme in Outputs 1 and 2 of the project
▪ Impediments to movements of people and animals?	√		Some inconveniency for movement of people and animals might happen during construction phase. Appropriate works scheduling and temporary access arrangements will be discussed and consensus on it with the project affected people must be reached during design and construction phase.
▪ potential ecological problems due to increased soil erosion and siltation, leading to decreased stream capacity?		√	Properly designed structures and regular maintenance of the canals would not affect stream capacity
▪ Insufficient drainage leading to salinity intrusion?	√		Properly designed drainage structures will reduce intrusion of salinity so 'No' after implementation.
▪ over pumping of groundwater, leading to salinization and ground subsidence?		√	No pumping of groundwater and it is just irrigated water from the dams. Project to include equitable systems of water delivery based on water demand.
▪ impairment of downstream water quality and therefore, impairment of downstream beneficial uses of water?		√	There will be no new constructions in the streams and it will not impair the downstream beneficial uses of water. Farmers will be instructed on proper use of fertilizer and pesticides.
▪ dislocation or involuntary resettlement of people?		√	Renovation and establishment of canal structures will be in the place of existing established structures of the canals administered by the Irrigation Department and so no need to do any dislocation or involuntary resettlement of the people
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		√	Project affected people will not suffer from this disproportionate impacts and all of them agreed with the proposed interventions during public consultations
▪ potential social conflicts arising from land tenure and land use issues?		√	Village land and farm administration committees will solve with existing farmland law even if these arise
▪ soil erosion before compaction and lining of canals?	√		No significant impact on soil. Mitigation measures include: (i) diversion drains and bunds, and temporary silt traps/ponds; and (ii) stockpiling of soil in flat areas and far from drainage routes
▪ Noise from construction equipment?	√		Noise may occur during construction phase. Discussions will be done with the project affected people to get consensus on schedules and duration of noisy construction activities. All construction vehicles and equipment must be well maintained. Contractors must follow the code of conducts regarding environmental protection mentioned in the EMP and TOR of the contractor.

Screening Questions	Yes	No	Remarks
▪ Dust during construction?	√		Dust may be increased during construction phase but will be reduced by suitable management measures, such as (a) frequent watering of exposed areas; (b) covering all vehicles transporting dispersible materials to and from the site; (c) and consensus with the project affected people on the schedule and duration of construction works.
▪ Water logging and soil salinization due to inadequate drainage and farm management?	√		Appropriate drainage structure and farm management system will reduce water logging and soil salinization so 'No' after implementation.
▪ leaching of soil nutrients and changes in soil characteristics due to excessive application of irrigation water?		√	Proper allocation, usage and management system of irrigated water will be set up by the Irrigation Department ID and Water User Groups WUGs member concerned
▪ reduction of downstream water supply during peak seasons?		√	through proper management and distribution of irrigated water by the ID and WUGs members concerned , so it will not affect downstream water supply
▪ soil pollution, polluted farm runoff and groundwater, and public health risks due to excessive application of fertilizers and pesticides?		√	Fertilizers and pesticides will be properly used through sustainable agricultural practices supported by the project
▪ soil erosion (furrow, surface)?		√	Farmers will use good land management & climate smart agriculture practices
▪ scouring of canals?		√	Reinforcement provided where appropriate in canals
▪ clogging of canals by sediments?		√	Removal of sediments and rubbish will be done regularly by ID and WUGs members concerned and renovated structures will be designed to reduce these sediments.
▪ clogging of canals by weeds?		√	Regular weeding operation will be done by the ID and WUG members concerned after setting up their own rights and responsibilities in usage of irrigated water.
▪ seawater intrusion into downstream freshwater systems?		√	Not applicable
▪ introduction of increase in incidence of waterborne or water related diseases?		√	No current issues in project areas and not anticipated
▪ dangers to a safe and healthy working environment due to physical, chemical and biological hazards during project construction and operation?		√	At the construction sites health and safety issues will not be serious during construction period. These will be addressed by the formulation of EMP and environmental code of conduct prescribed for contractors under the supervision of LIEC concerned
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		√	Local labor will be hired and they have their own access to water supply and sanitation

Screening Questions	Yes	No	Remarks
▪ social conflicts if workers from other regions or countries are hired?		√	Local people are flexible in dealing with any others in nature.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		√	Since the project activities are mainly in renovation works and these would reduce such kind of risks by following code of conducts mentioned in the EMP and TOR of contractors.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., irrigation dams) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		√	Since the project activities are mainly in renovation works and these would reduce such kind of risks by following code of conducts mentioned in the EMP and TOR of contractors.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: Myanmar: Irrigated Agriculture Inclusive Development Project
Sector : Agriculture, natural resources and rural development
Subsector: Water-based natural resources management
Division/Department: SEER/SERD

Screening Questions		Score	Remarks[5]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	Affected sections of the canals will be strengthened to withstand anticipated floods and landslides. For droughts irrigation scheduling will be done based cropwater requirements
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	Hydrological analysis will be done to forecast the river flows , water availability and extreme floods/droughts
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	Irrigation infrastructure improvements based on technical best practices and not affected. Material selection will suit current climate variability
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	0	Floods may affect the infrastructure but detailed design will take account of flood risks.
Performance of project outputs	Would weather/climate conditions and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their	1	Not applicable to power but irrigable areas could be affected

[5] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

	design life time?		

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

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

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

Other Comments:____Engineering best practices will mitigate these low to medium climate change risks.

_____

Prepared by: _____Larry Quinn_____

ANNEX 5 – DRAFT ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES

[Extracted table of contents from latest draft of June 2015. Full document in EARF}

ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURE

The Government of the Republic of the Union of Myanmar

Ministry of Environmental Conservation and Forestry

Notification No._____/ 2015

Nay Pyi Taw, the_____Day of_____, 1374 M.E. (____,

2015)

CHAPTER I. Title and Definitions

CHAPTER II. Establishment of the Environmental Impact Assessment Process
- Requirements concerning third party organizations or persons undertaking EIA

CHAPTER III. Screening

CHAPTER IV. Initial Environmental Examination
- IEE Report Requirements
- Submission of IEE Report
- Review and Approval Process for IEEs

CHAPTER V. Environmental Impact Assessment
- EIA Investigation
- EIA Report Requirements
- Submission of EIA Report
- Review and Approval Process for EIA Report

CHAPTER VI. Appeal Process

CHAPTER VII. Environmental Consideration in Project Approval
- Project Approval Requirements
- Environmental Compliance Certificate, Conditions and Revisions to Conditions
- Responsibility for all Adverse Impacts

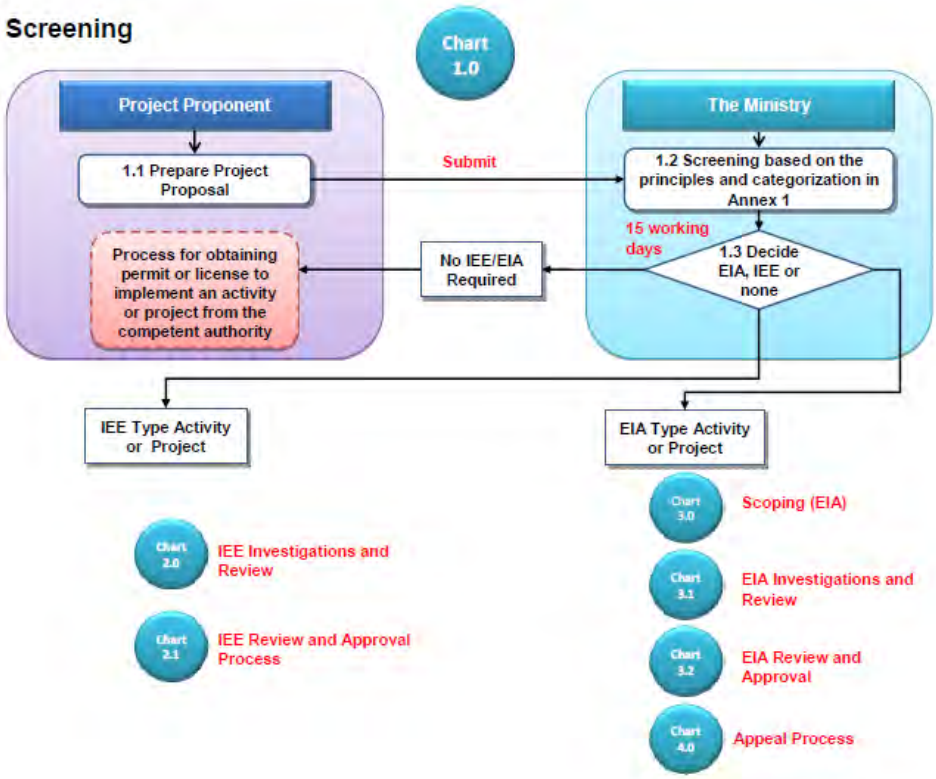
CHAPTER VIII. Monitoring
- Monitoring and Inspection of the Ministry

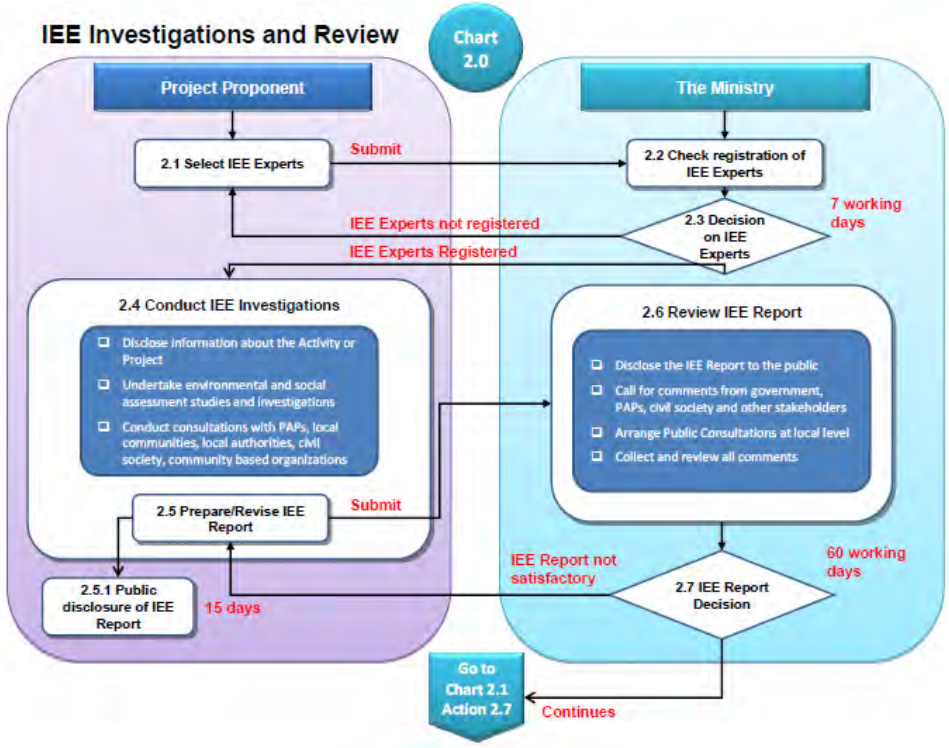
CHAPTER IX. Strategic Environmental Assessment

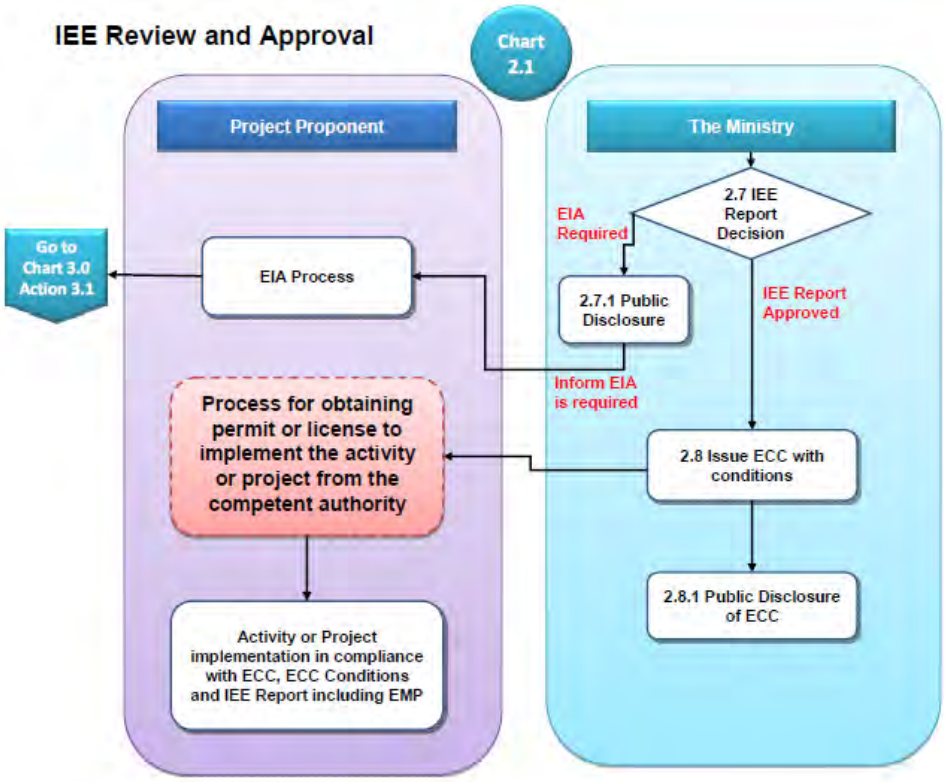
CHAPTER X. Administrative Punishment

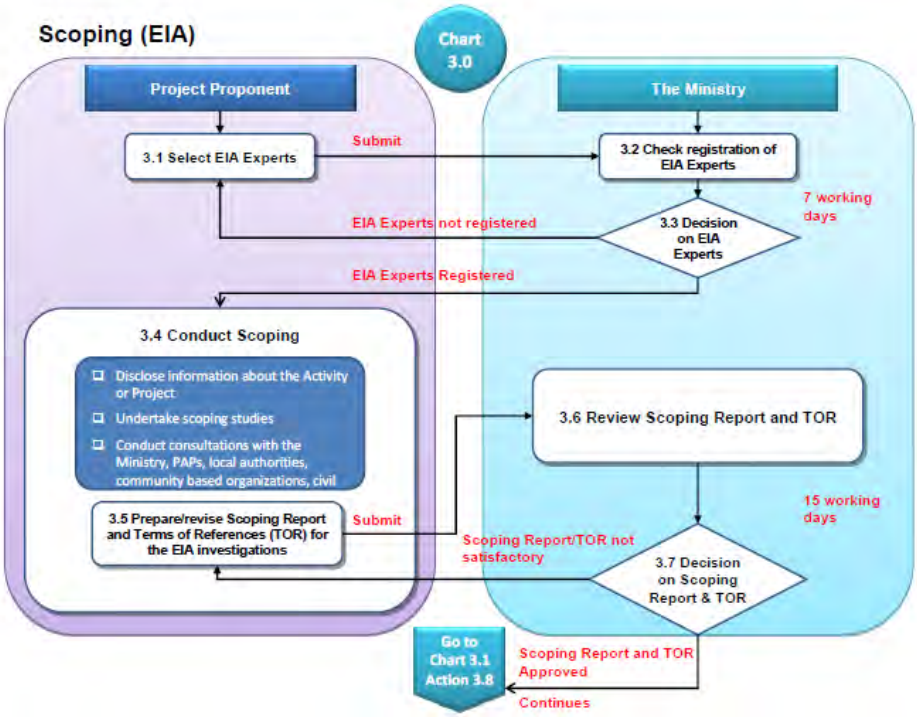
Annex 1:
- Tables outlining IEE versus EIA requirements for various types of sector projects.

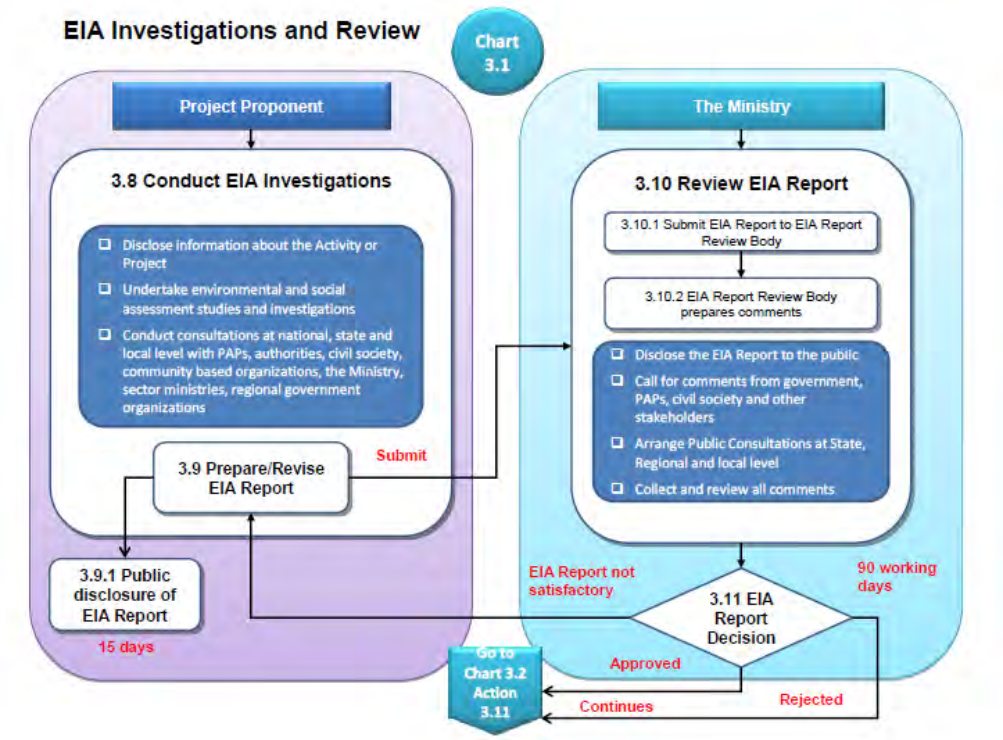
Annex 2 – Environmental Assessment Procedure Flowchart

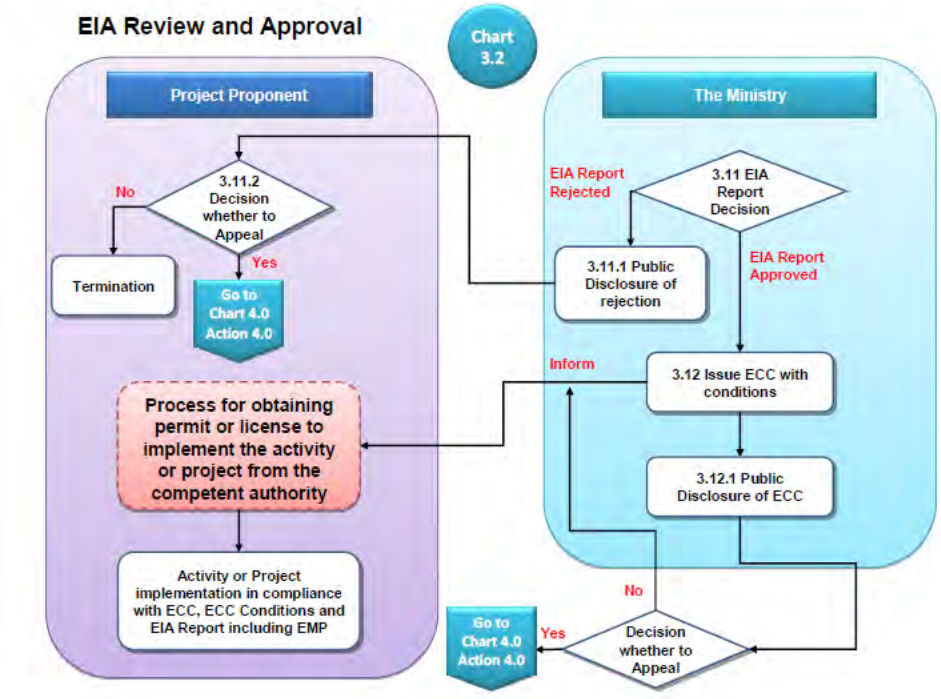


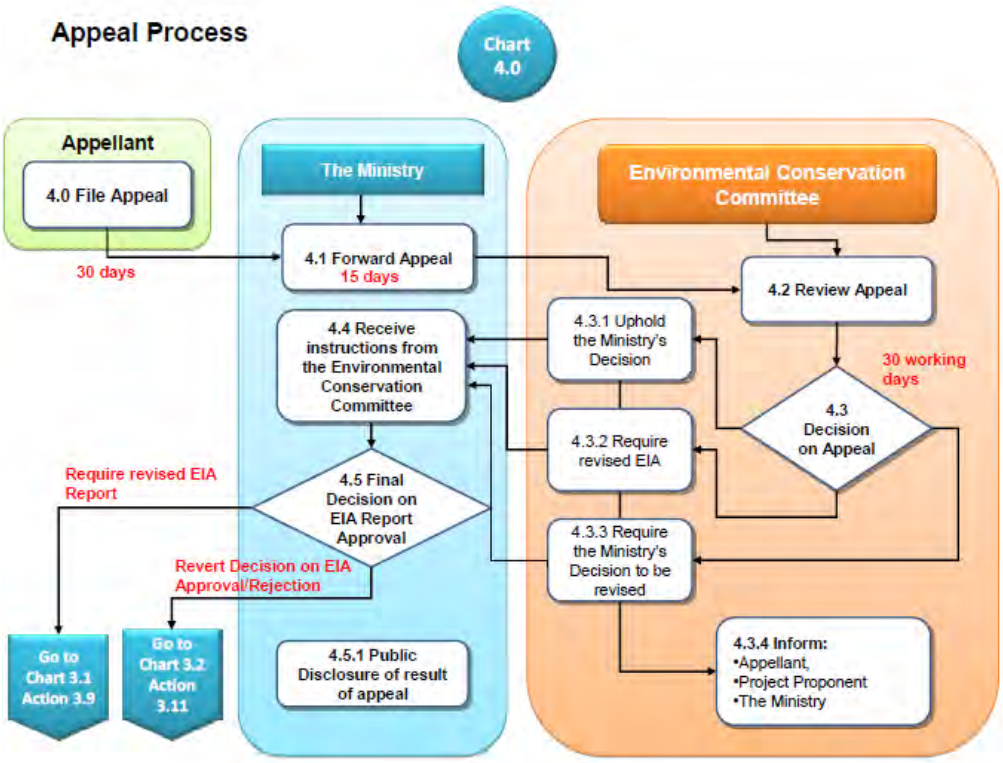



IEE Review and Approval
Chart 2.1
Project Proponent
The Ministry
2.7 IEE Report Decision
EIA Required
IEE Report Approved
Go to Chart 3.0 Action 3.1
EIA Process
2.7.1 Public Disclosure
Inform EIA is required
Process for obtaining permit or license to implement the activity or project from the competent authority
2.8 Issue ECC with conditions
2.8.1 Public Disclosure of ECC
Activity or Project implementation in compliance with ECC, ECC Conditions and IEE Report including EMP


Scoping (EIA)
Chart 3.0
Project Proponent
The Ministry
3.1 Select EIA Experts
Submit
3.2 Check registration of EIA Experts
7 working days
EIA Experts not registered
3.3 Decision on EIA Experts
EIA Experts Registered
3.4 Conduct Scoping
Disclose information about the Activity or Project
Undertake scoping studies
Conduct consultations with the Ministry, PAPs, local authorities, community based organizations, civil
3.6 Review Scoping Report and TOR
15 working days
3.5 Prepare/revise Scoping Report and Terms of References (TOR) for the EIA investigations
Submit
Scoping Report/TOR not satisfactory
3.7 Decision on Scoping Report & TOR
Go to Chart 3.1 Action 3.8
Scoping Report and TOR Approved
Continues

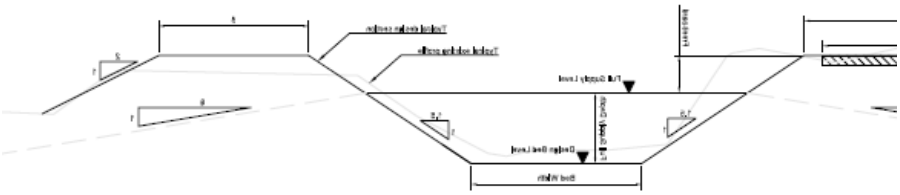
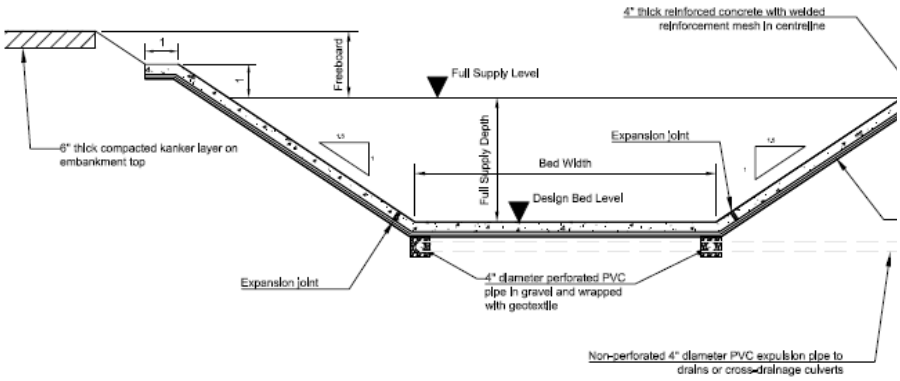

EIA Investigations and Review
Chart 3.1
Project Proponent
3.8 Conduct EIA Investigations
Disclose information about the Activity or Project
Undertake environmental and social assessment studies and investigations
Conduct consultations at national, state and local level with PAPs, authorities, civil society, community based organizations, the Ministry, sector ministries, regional government organizations
3.9 Prepare/Revise EIA Report
Submit
3.9.1 Public disclosure of EIA Report
15 days
The Ministry
3.10 Review EIA Report
3.10.1 Submit EIA Report to EIA Report Review Body
3.10.2 EIA Report Review Body prepares comments
Disclose the EIA Report to the public
Call for comments from government, PAPs, civil society and other stakeholders
Arrange Public Consultations at State, Regional and local level
Collect and review all comments
EIA Report not satisfactory
90 working days
3.11 EIA Report Decision
Approved
Rejected
Continues
Go to Chart 3.2 Action 3.11


EIA Review and Approval
Chart 3.2
Project Proponent
3.11.2 Decision whether to Appeal
No
Yes
Termination
Go to Chart 4.0 Action 4.0
Process for obtaining permit or license to implement the activity or project from the competent authority
Activity or Project implementation in compliance with ECC, ECC Conditions and EIA Report including EMP
The Ministry
EIA Report Rejected
3.11 EIA Report Decision
EIA Report Approved
3.11.1 Public Disclosure of rejection
Inform
3.12 Issue ECC with conditions
3.12.1 Public Disclosure of ECC
No
Yes
Decision whether to Appeal
Go to Chart 4.0 Action 4.0



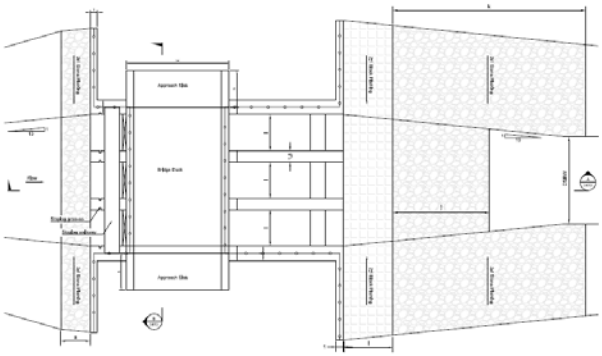
Annex 3 – Prescribed Penalties

ANNEX 6 – PHOTOGRAPHS AND EXAMPLES OF PROPOSED REHABILITATIONS

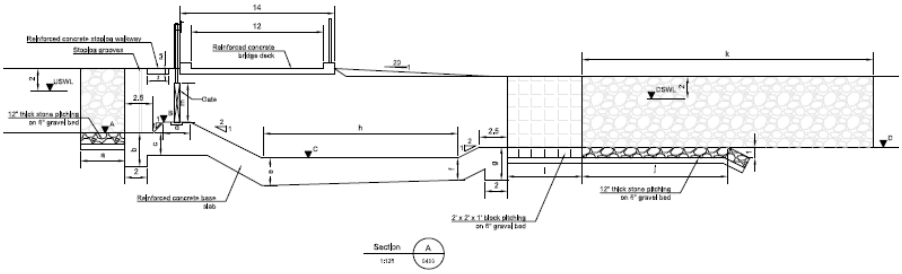
Photograph of existing rehabilitation need	Standard detail drawing of rehabilitation measure
Sedimentation in NM RMC(RD 23450') 	MMD-346056-IDD-DR-NM-01-0230 Main and DY Canals Unlined Canal Typical Cross-Section 
Very Steep and Sandy Unlined Canal in NM RMC(RD 24000-26000') 	MMD-346056-IDD-DR-NM-01-0240 Main and DY Canals lined Canal Typical Cross-Section 

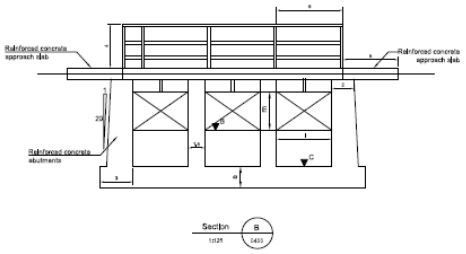
NM RMC Check-Drop (RD 9224')

MMD-346056-IDD-DR-NM-01-0400 (Plan)
Main Canal
MMD-346056-IDD-DR-NM-01-0410 (Section
Main Canal



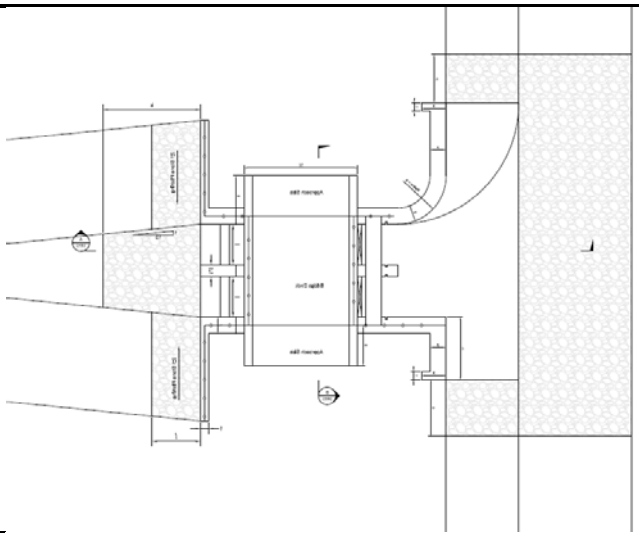
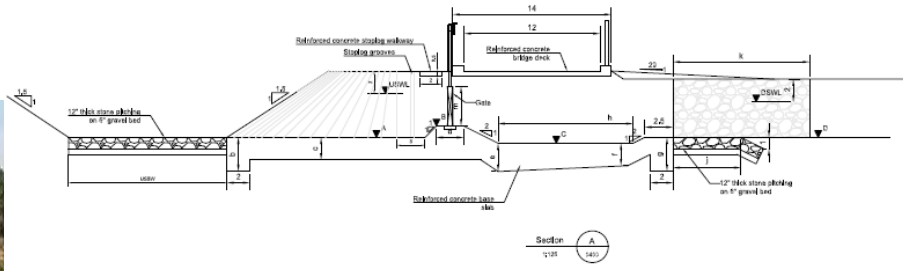
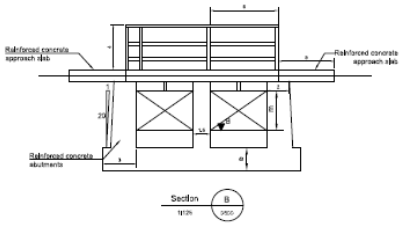
CMG LMC Check-Drop

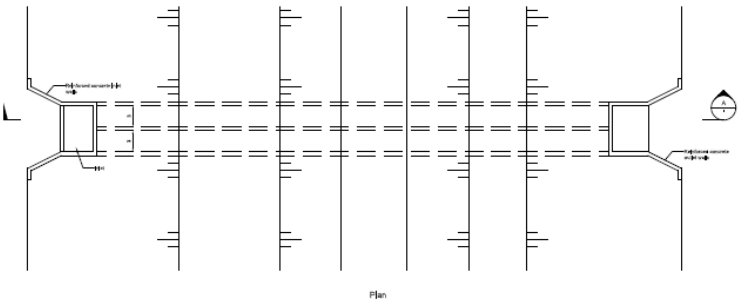


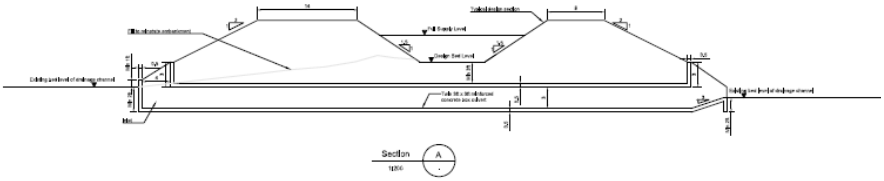


NM RMC HR (RD44796' DY2 HR)

MMD-346056-IDD-DR-NM-01-0500 (Plan)
MMD-346056-IDD-DR-NM-01-0510 (Sections)
DY and Minor Head Regulators

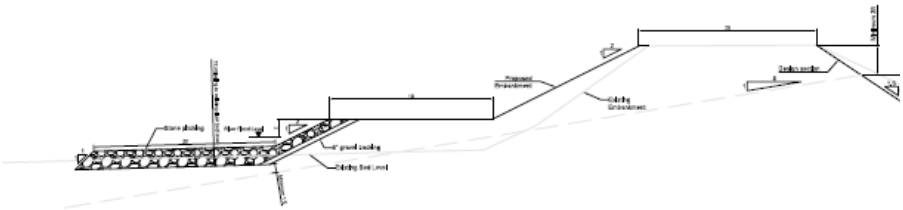
	
CMG LMC HR 	 
Cross Drainage damage to Natmauk RMC (RD 6000')	MMD-346056-IDD-DR-NM-01-0600 Main and DY Canals Cross-Drainage Culvert Typical Plan and Section





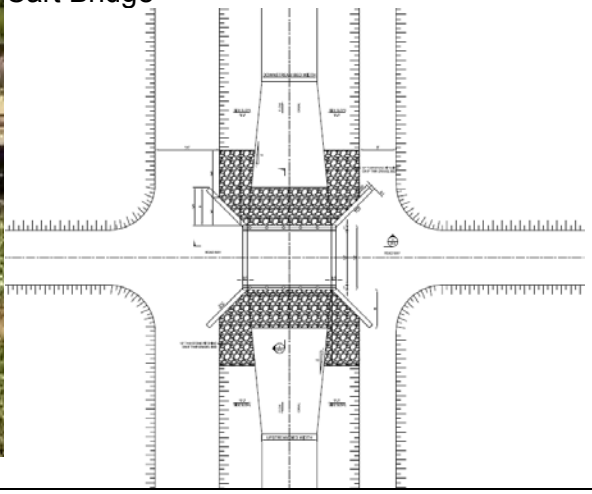
Natmauk RMC River Yin Protection

MMD-346056-IDD-DR-NM-01-0250
Right Main Canal
Protection to Left Embankment



NM Bridge (RD 11467')

MMD-346056-IDD-DR-NM-01-0800 (Plan)
MMD-346056-IDD-DR-NM-01-0810 (Section)
Main and DY Canals
Cart Bridge



CM Bridge (RD 7373')