Appendix 5

Soft Component Plan

APPENDIX 5 SOFT COMPONENT PLAN

Union of Myanmar

Ministry of Progress of Border Areas and National Races and Development Affairs

THE PREPARATORY SURVEY ON THE PROVISION OF EQUIPMENT FOR RURAL WATER SUPPLY PROJECT IN THE CENTRAL DRY ZONE IN THE UNION OF MYANMAR

SOFT COMPONENT PLAN

March 2011

Japan International Cooperation Agency

(JICA)

Kokusai Kogyo Co., Ltd.

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5-1 Background of the Soft Component

5-1-1 Natural and Social Conditions for Water Supply

The central dry zone in the Union of Myanmar (hereinafter referred to as "Myanmar") lies across three (3) administrative areas: Mandalay, Magway and Sagaing Regions. This consists of 93 townships and 16,324 villages. The population is around 19.7 million and it accounts for 33.7 % of the total population of Myanmar. The population density there is approximately three (3) times as many as the average in the country.

The annual precipitation in the central dry zone is around 400-880 mm and it is mostly observed in the period from May to October. The villagers depend on reservoirs sourced from rainwater and shallow wells for their domestic water needs, which consequently sometimes dry out in the dry season. In this case, the villagers need to use water resources located several kilometers away, which obviously is quite hard work. According to the survey result implemented in year 2000-2001, only 7,760 (47 %) of all 16,324 villages have their own water resource.

5-1-2 Policy and Current Situation to Water Supply Condition

Based on the water supply condition above, the Government of Myanmar made the improvement of current condition in the villages in the central dry zone a top priority development subject. Department of Development Affairs, Ministry of Progress of Border Areas and National Races and Development Affairs (hereinafter referred to as "DDA") formulated a "Ten Year Project for rural Water supply (2000-2001, 2009-2010)" (hereinafter referred to as "Ten-year project"). The Ten-year project aims at "developing at least one water resource in every village". The Ten-year project improved the supply situation in the central dry zone to some extent, but there are still many villages in which one water resource is used by many households and neither water quality nor quantity is sufficient as a potable water source. Based on this perspective, DDA recognizes the necessity of sustainable water resources development in the central dry zone. Therefore, DDA selected villages that suffer from water shortages and formulated a "Five Year Project for Rural Water Supply (from 2011-2012 to 2015-2016)" (hereinafter referred to as "Five-year project") to complement the Ten-year project. DDA has set the objectives in the Five-year project to construct 826 deep wells, and specified 110 villages in which the improvement of water supply situation is to be given top priority and immediate attention due to water shortage, poverty and so forth.

5-1-3 Addressing the Shortage of Quality Water

While developing more water resources to address the water shortage, DDA began dealing with the issue of safe water supply, that is, the shortage of quality water. In the central dry zone, Mandalay City Development Committee (hereinafter referred to as "MCDC") is in charge of the water quality analysis in urban areas of Mandalay Region, and DDA is responsible for analyzing in the other urban areas and rural areas in the central dry zone. Therefore, the laboratory of DDA plays a very important role for health control of the central dry zone.

The groundwater quality in the central dry zone is strongly affected by the geological environment from Pegu layer of marine stratum and so the groundwater in many areas indicates significantly high salt concentration. Also, the blackish brown sedimentation frequently occurs since iron and manganese dissolved into the groundwater are aerated and then oxidized. Arsenic, which causes problems in many Asian countries, is not found in the central dry zone. However, high concentrations of fluorine and nitric acid have been reported in the southern area.

Because a tiny amount of fluorine and nitric acid were detected by technical assistance project in the central dry zone, changes need to be monitored.

The related government ministries and agencies to be connected drinking water established Proposed National Drinking Water Quality Standards（hereinafter referred to as "WQS"）in 2006 as the base drinkable water. This is composed of 28 analysis items covering bacteriology, physics and chemistry.

5-1-4 Analysis Capability for Water Quality of DDA

(1) Actual Condition of Analysis Capability

The items and capability for water quality by DDA are organized in the following table. These analysis items and standard value were made independently based on WHO Guidelines for Drinking Water Quality and considering water conditions in Myanmar. As a result, several items are set below WHO Guidelines, however, there are no epidemiological problems.

Table 1: Analysis Capacity of DDA Laboratory for WQS

Classification	No.	Parameter	DDA Standards	WHO Guideline*	Unit	Testability of DDA **		
Microbial water quality	1	Fecal coliforms	0	0	No. 100 mL^{-1}		B	
	2	Total coliforms	10	0	No. 100 mL^{-1}		B	
Chemical water quality (health item)	3	Arsenic	0.05	0.01	mg L^{-1}	A		
	4	Cadmium	0.005	0.003	mg L^{-1}			C
	5	Chromium	0.05	0.05	mg L^{-1}		B	
	6	Copper	2.0	2	mg L^{-1}		B	
	7	Cyanide	0.07	0.07	mg L^{-1}			C
	8	Fluoride	1.5	1.5	mg L^{-1}	A		
	9	Lead	0.01	0.01	mg L^{-1}			C
	10	Mercury	0.001	0.001	mg L^{-1}			C
	11	Nitrate	50	50	mg L^{-1}	A		
	12	Selenium	0.01	0.01	mg L^{-1}			C
	13	Manganese	0.3	0.4	mg L^{-1}		B	
Chemical water quality (desirable item)	14	Aluminum	0.1	—	mg L^{-1}		B	
	15	Chloride	250	—	mg L^{-1}	A		
	16	Hardness	500	—	mg L^{-1}	A		
	17	Iron	1	—	mg L^{-1}	A		
	18	pH	6.5-8.5	—	—	A		
	19	Sodium	200	—	mg L^{-1}			C
	20	Sulfate	400	—	mg L^{-1}		B	
	21	Zinc	10	—	mg L^{-1}		B	
	22	Calcium	200	—	mg L^{-1}		B	
	23	Magnesium	150	—	mg L^{-1}		B	
	24	Electric conductiviy	150	—	mS m^{-1}	A		
	25	Total dissolved solids	1000	—	mg L^{-1}	A		
Others	26	Color	20	—	degree			C
	27	Taste and Odor	Not abnormal	—	—		B	
	28	Turbidity	5	—	NTU	A		

Remarks: * Based on Guidelines for drinking-water quality, Volume 1, 3rd edition (2004)
** A: Analytical items which are conducted at all times currentry (10 items)
B: Analytical items which have difficulties due to lack of personal skills and laboratory consumables (11 items)
C: Analytical items which cannot be conducted due to lack of equipments, infrastructures and personal skills (7 items)

DDA always analyzes only ten (10) of 28 items given WQS (“A” on the Table 1). About last of 18 items, 11 items (“B” on the Table 1) cannot be analyzed for reasons of lack of consumables or personnel skill shortage, and 10 items (“C” on the Table 1) cannot be analyzed for reasons of lack of equipment, improvement of infrastructure and experience. However, 10 items leave much to be improved for their analysis accuracy.

According to UNICEF, DDA members attended a lecture giving instructions on operating testing equipment when they received them. And DDA has operating manuals in the local language for testing equipment (see Photo 1).

However, currently, administrators do not understand the manner of operation because they did not receive instructions from their predecessors. Furthermore, they cannot understand the method of real sample examination that has a variety of water quality conditions, because the manuals only explain how to operate the equipment.

Photo 1: Equipment operation manual prepared by UNICEF

Therefore, administrators have done checks and report instrumentally-determined values that measure murky and brownish-red groundwater in the central dry zone that have not had pre-analysis treatment (see Photo 2). That is, there is a lack of basic knowledge, water quality analysis techniques, and directions on equipment use.

Photo 2: Water quality test. turbid water sample was measured without any pretreatments

It is clear there is a lack of credibility for value accuracy of ten (10) items that DDA check up currently. It is difficult to contribute to the aim of ensuring a safe water supply if this situation whereby DDA can not get hold of real test results is permitted. It is a task of pressing urgency for DDA to acquire basic water quality testing techniques.

DDA has a system to convey obtained well water at new well drilling points or repaired wells, and to conduct water quality analysis. In the event of a problem, DDA will devise measures regarding the well water, for example a ban on using the well. As such, DDA's analysis data has authority and responsibility, so it is a serious commitment for DDA to obtain exact data.

(2) Actual Condition of Materials for Water Quality Analysis

All materials for water examination DDA is using are provided from WHO or UNICEF. Details of materials and lab equipment possessed by DDA are shown in Table 2.

Table 2: Materials and Equipment Condition of DDA Laboratory

Classification	Donor	Equipment name	Specification	Using state
Equipment for water quality test	WHO	pH meter	Bench use only. High accuracy and repeatability. Calibration method is relatively complicated.	Rarely use
		EC meter		Rarely use
		Spectrophotometer	Available for various orgainic and inorganic items	Rarely use
		Portable coliform test kit	Currently in use in the Township	Unconfirmed
	UNICEF	Multi-meter for water quality	Not so high accuracy. Available also for on-site measurements for pH, EC, TDS and salinity.	Current use
		Spectrophotometer	Compact type. Available only for presetted analytical items into equipment memory. Not so high repeatability.	Current use
		Portable arsenic test kit	Available also for on-site measurement. Low accuracy.	Occasional use
Laboratory instrumentation	WHO	Refrigerator freezer	Use for safekeeping for sample water	Current use
		Chemical balance	Weighing range: 0.1 g - 3 kg (approx.)	Rarely use
		Hot stirrer	Diversion to cultivation of coliforms currently	Unconfirmed
		Drying oven	Temperature range: 5 - 200 degree centigrade	Rarely use

In the early 2000s WHO provided materials, after that UNICEF provided further equipment (see Figure 2). But the situation of their use in the past is unclear because DAD doesn't have a system to record. Now ADA only uses materials provided from UNICEF. Because it is more convenient provided from UNICEF than WHO. To use sophisticated equipment from WHO, DAD needs high-level of knowledge and techniques. Equipment from UNICEF needs few reagents for preparation, so now a spectral photometer from UNICEF assumes ADA's chemical water examination.

Though field observations show this spectral photometer lacks stability of illuminant and poorly-reproducible final value. Presumably, this arises from handling misses and maintenance of administrators. It needs building up method of operation and maintenance. The usable lifespan of the equipment was taken up by mastering applicable operating instructions and doing basic maintenance.

(3) Actual Condition Operational and Maintenance in Laboratory

There are two (2) people doing water examination in DDA laboratories. One is a manager, whose position is "Sub Staff Officer", which has a three (3) year service period. Although he is an intellectual with a chemical technology postgraduate degree from Mandalay University, they had no lectures on chemical analysis.

The other is an assistant, with a five (5) year service period. He graduated from a chemical course at Mandalay University, he also has received no lectures on analysis.

The actual achievement of water examination is 268 for DDA in 2009. Annually, the most busy period starts in June and continues until September (see Figure 1). Other time in this busy period, water examination is undertaken by only the manager. There is no plan to increase the staff.

As already mentioned, DDA has a system of conducting water examinations in the laboratory, but they don't draw up an inventory control of test reagents and management of water examination without having an operation manual.

Especially, test reagent is ordered from UNICEF every year with considering actual achievement previous year by DDA. There is some doubt; in spite of DDA lacking an administration system, how

they got this information about test reagents.

It is necessary to make more improvements and buildup administrative control to correspond to the planned increased water examination in future.

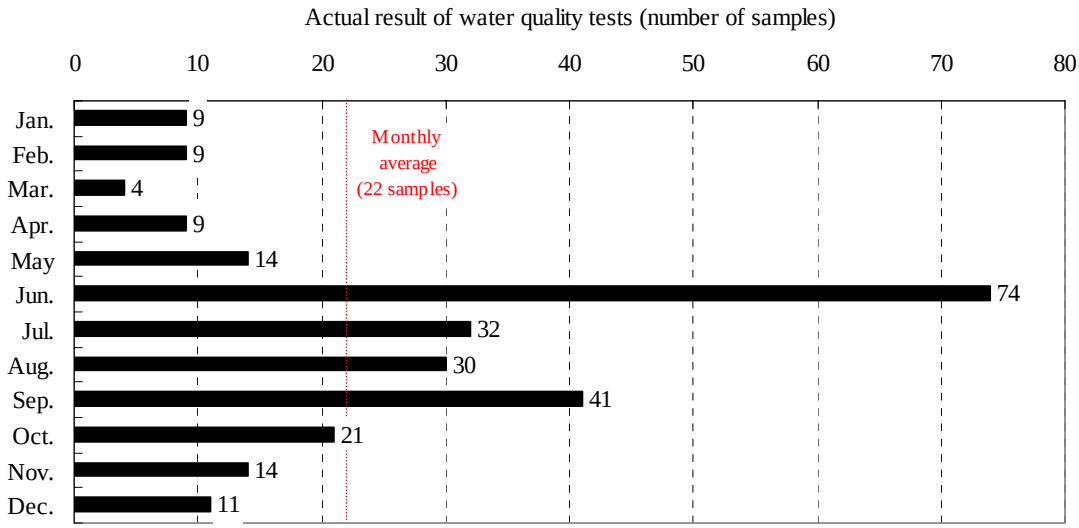


Figure 1 Actual Achievement of Water Examination at DDA Laboratory in 2009

(4) Necessity of Soft Component

Thanks to the technical assistant project on the rural water supply in the central dry zone, new construction and the management capability of DDA was elevated. So, planning of increased water supply is a marked achievement. On the other hand, already mentioned, it is apprehensive about operation and maintenance system and water quality analysis method for the DDA's laboratory which assumes the role of securing water from new wells. In this Project new construction of water source and water examination is inextricably linked. The Project will not contribute to the achievement of DDA's upper goal: "to supply water through the entire year and elevate the living environment in the central dry zone" without strengthening the water examination system. And, about equipment maintenance and administration, care will need to be taken not to have similar problems to WHO and UNICEF, without considering about actual condition and adjusting system for management lab.

Consequently, there is a strong necessity for technical guidance on water examination by soft component to make sure that the project progresses smoothly and it has a lasting impact.

5-2 The Aim of Soft Component

The sphere of the soft component activities at DDA's water examination laboratory were considered - in light with the current condition of the laboratories and according to the general steps outlined in Figure 2 - to achieve the fundamental phase and accuracy level.

Realization of enlargement and reconstruction of laboratory, installation of special analytical equipment is vital for achievement of acquirement of analyses techniques for 10 items and implementation of various water quality tests, which are part of the application phase. Therefore, a long-term commitment is need from the Government of Myanmar, because all of these components need to be tackled independently by DDA. Moreover, as mentioned above, each component of the fundamental phase has room for improvement.

Consequently, the target of the soft component is to support strengthening the structure and improving accuracy of water quality analysis.

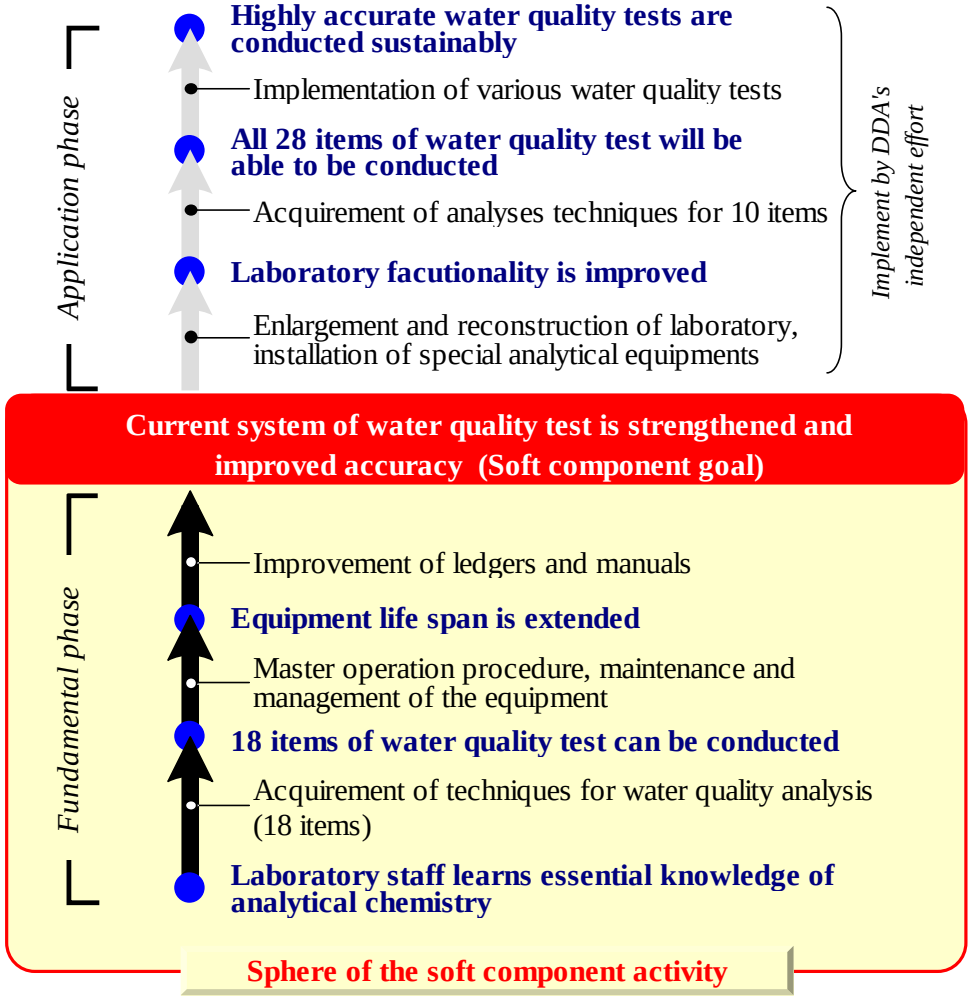


Figure 2: Aim and necessary matters for soft component

5-3 The Result of Soft Component

In accordance with the above objects, the results to be expected by implementation of soft component are shown below. This soft component will be implemented to two (2) DDA laboratory staff and responsible person. These laboratory staff is working full-time on water quality analysis, therefore, there is no possibilities of a change in personnel. In addition, the contents of activities in order to achieve each result are mentioned in detail in Chapter 5.

5-3-1 Result 1: Acquirement of Techniques for Water Quality Analysis (18 Items)

DDA staff may have mastered the basic techniques of water quality analysis with accuracy on this result. The items for technical transfer are ten (10) to be analyzed every time ("A" in the table), and eleven (11) not to be analyzed because of lack of techniques and equipment (reagents) ("B" in the table) in Table 2, Chapter 1.4.4. However, "Fecal coliforms" and "Total coliforms" in the microbial water quality are excluded, because the target of water quality analysis is mostly groundwater. And "Taste and odor" in the other is also excluded, because equipment is not necessary for analysis. Therefore, the items to be conducted in the technical transfer for water quality analysis are eighteen (18). These eighteen (18) items are enough for groundwater development (groundwater source).

1) To understand the analysis basis for equipment
2) To understand methods of coordination and treatment of reagent
3) To understand suitable methods of pretreatment of reagent
4) To be able to analyze eighteen (18) water quality items
5) To consider characteristic features of water samples

In addition, after mastering the above 3), laboratory staff may be able to suggest how to take and transport water samples to a third party (mainly drilling team). After mastering 5) above, they may be able to recommend and instruct the correspondence to the villagers when samples are found with highly contaminated water that may pose a health risk.

5-3-2 Result 2: Master Operation Procedure, Maintenance and Management of the Equipment

DDA staff may have mastered the method of equipment operation and maintenance in order to implement sustainable water quality analysis with accuracy on this result.

1) To understand the relationship between maintenance of equipment and accuracy of analysis
2) To master methods of equipment operation
3) To master methods of maintaining equipment

5-3-3 Result 3: Improvement of Ledgers and Manuals

The ledgers and manuals may be improved in order to consolidate the operation and maintenance structure of laboratory on this result.

1) To maintain the data for water quality analysis
1) To maintain the ledgers of equipment and utilization
2) To maintain the reagent inventory
3) To compile the manual for water quality analysis
4) To compile the maintenance manual for equipment

5-4 Confirmation Method of Achievement of the Result

The result item, confirmation issue and method in order to confirm the achievement for each activity is shown in Table 3. In addition, the result will be confirmed upon completion of local dispatch by the Japanese consultant.

Table 3: Objectively Verifiable Indicator and Means of Verification

Result item	Objectively verifiable Indicator	Means of verification
Result 1: Acquirement of techniques for water quality analysis (18 items)	1) Understanding of measuring principles of analytical equipment 2) Preparing test reagents properly 3) Acquirement of pretreatment methods for water samples 4) Understanding of quality management methods for analytical results	• Training record • Paper/practice examination record
Result 2: Master operation procedure, maintenance and management of the equipment	Conducting operation and maintenance of equipment based on principle and specification	• Training record • Paper/practice examination record
Result 3: Improvement of ledgers and manuals	1) Managing water quality data properly 2) Managing equipment properly 3) Managing reagents properly 4) Conducting appropriate water quality examination sustainably	• Data record of water quality test • Equipment logbook, operation record • Stock book and usage record of reagents • water quality test manual • Equipment maintenance manual

5-5 Activity of Soft Component (Input Plan)

Technical transfer on this soft component set four (4) terms in order to sustain consolidation of activity. In addition, local personnel are not utilized on this soft component with consideration for technical level of water quality analysis, because a Japanese consultant who has necessary techniques for the activities of each term will implement it directly, as mentioned in the next table. Number of times for dispatch by Japanese consultant is once (1), and the period is calculated as 1.13 months. The Japanese consultant will report progress and point of occasion to DDA arbitrarily and adjust the contents of soft component in order to transfer technique surely.

Table 4: Activity Plan of Soft Component

Term	Activities	Counterpart	Activity place	Human resource	Days required
1st term	・Meeting to explain activities of the soft compornent to DDA	Responsible person and laboratory staff	DDA Nay Pyi Taw	Japanese consultant, 1 person (expert in charge of water quality analysis)	1
Result 1: Acquirement of techniques for water quality analysis (18 items)					
1st term	・Lecture on analytical chemistry including general guidance of water quality analysis and equipment	Laboratory staff	DDA laboratory	Japanese consultant, 1 person (expert in charge of water quality analysis)	1
	・Lecture and practice about handling and preparation of chemicals	Laboratory staff	DDA laboratory		1
	・Practice in suitable pretreatment for water samples	Laboratory staff	DDA laboratory		2
2nd term	・Practical training of water quality test using by real samples ・Lecture and practice about data analysis of water quality analysis and quality management	Laboratory staff	DDA laboratory		5
Result 2: Master operation procedure, maintenance and management of the equipment					
3rd term	・Lecture on equipment maintenance of water quality test	Laboratory staff	DDA laboratory	Japanese consultant, 1 person (expert in charge of water quality analysis)	1
	・Lecture and practice about spectrophotometer maintenance ・Lecture and practice about water distiller machine maintenance	Laboratory staff	DDA laboratory		4
Result 3: Improvement of ledgers and manuals					
4th term	・Preparation of logbooks and operation manuals for equipment of water quality analysis ・Preparation of inventory of chemicals and reagnts	Laboratory staff	DDA laboratory	Japanese consultant, 1 person (expert in charge of water quality analysis)	2
	・Preparation of water quality test manual ・Preparation of maintenance manual for water quality analysis	Laboratory staff	DDA laboratory		2
	・Meeting to explain results and outputs of the soft compornent to DDA ・Discussion and proposal regarding subjects which should be conducted by DDA continuously	Responsible person and laboratory staff	DDA Nay Pyi Taw		1

5-6 Procurement Method of Implementation Resource

As mentioned above, this soft component is implemented by one (1) Japanese consultant directly, therefore local resource is not utilized. The reasons are shown below.

1) Technical level of local personnel is not enough, therefore, conclusive technical transfer is not expected in case local personnel are utilized.
2) Person in charge of water quality analysis in DDA is only two (2), therefore local personnel except translator is not utilized.
3) Implementation by one (1) Japanese consultant is more effective, because the number of equipment for water quality analysis is small.
4) Item of water quality analysis to be trained is small, therefore, multi training structure is not utilized.
5) Priority issue for training is the basic of analytical chemistry, knowledge and experience from local personnel is not utilized.

5-7 Implementation Plan

Implementation plan of Soft Component is shown as Table 4 (next page).

5-8 Output

The following reports will be submitted arbitrarily to JICA (in Japanese) and DDA (in English), the implementing organization in Myanmar.

1) Activity plan (JICA Myanmar office: upon arrival in Myanmar, DDA: upon arrival in Nay Pyi Taw)
2) Activity report (weekly, DDA: on completion of each term)
3) Manual for water quality analysis (English, JICA Myanmar office: on completion of the 4th term, DDA: on completion of the 4th term)
4) Manual for maintenance of the equipment for water quality analysis (English, JICA Myanmar office: before leaving, DDA: on completion of the 4th term)
5) Completion report (JICA head office: after arrival in Japan)

5-9 Responsibility of Myanmar Side

In order to implement high accuracy water quality analysis continuously, aggressive participation and execution of responsibility by Myanmar side are very important. The responsibility of Myanmar side is as below.

5-9-1 Responsibility during Implementation of Soft Component

1) Permission of inland transportation for Japanese consultant
2) Work space for implementation of the Project
3) Assignment of needed staff for the Project

5-9-2 Responsibility after Implementation of Soft Component

1) Continuous assignment of staff for water quality analysis and maintenance for equipment
2) Continuous budget for water quality analysis and maintenance for equipment
3) Continuous implementation of water quality analysis and maintenance for equipment by utilizing output of soft component
4) Periodical monitoring for activity of water quality analysis

Table 6: Implementation Plan

1. Work in Japan

Avtivities	1 Mon	2 Tue	3 Wed	4 Thu	5 Fri
Information collection / Material preparation	■	■	■	■	■
Expert in charge of water quality analysis					
5.0 days(required)/20.0 days(monthly)=0.25 (M/M)	■	■	■	■	■

1. Work in Myanmar

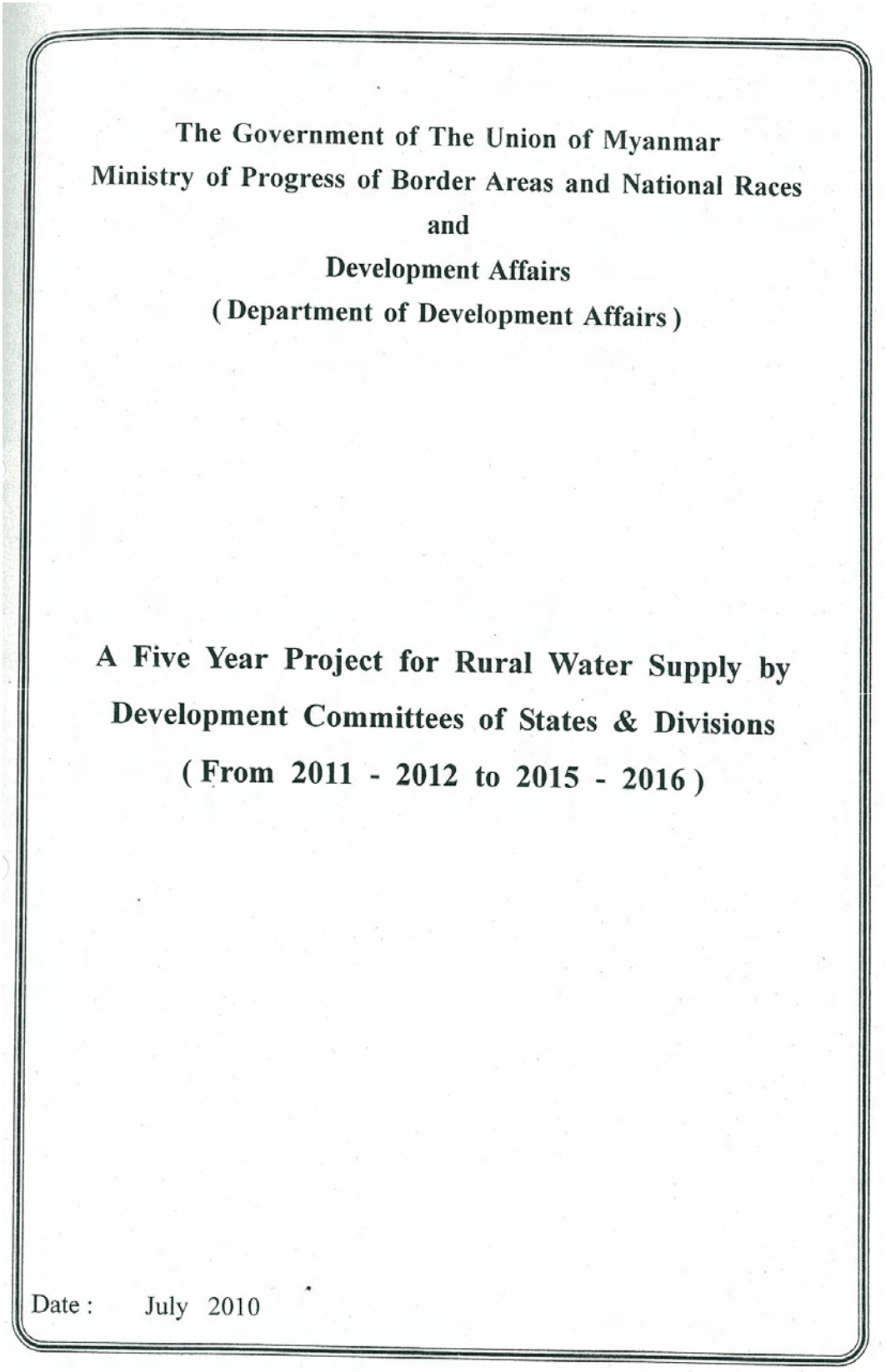
Avtivities	Pre	1 Thu	2 Fri	3 Sat	4 Sun	5 Mon	6 Tue	7 Wed	8 Thu	9 Fri	10 Sat	11 Sun	12 Mon	13 Tue	14 Wed	15 Thu	16 Fri	17 Sat	18 Sun	19 Mon	20 Tue	21 Wed	22 Thu	23 Fri	24 Sat	25 Sun	26 Mon	27 Tue	28 Wed	29 Thu	30 Fri	31 Sat	32 Sun	33 Mon	34 Tue	Japan
· Inspection of spectrophotometer (C-1)	★																																			
· Inspection of water distiller machine (C-2)	★																																			
· Flight (NRT-BKK-YGN-NPT- YGN-BKK-NRT)		→YGN			→NPT																									→YGN		→BKK	→NRT		
· Discussion with JICA Myanmar office			★JICA			★DDA																							★DDA			★JICA			
· Visit on donors (WHO, UNICEF)			■																																
· Information and Data arrangement, reporting etc.				■							■	■						■	■						■	■						■				
						← 1st term →							← 2nd term →							← 3rd term →							← 4th term →										
Result 1: Acquirement of techniques for water quality inspection (18 items)																																				
1-1) Lecture on equipment principle							■	■																												
1-2) Lecture on reagent preparation							■	■																												
1-3) Lecture/practice regarding sample pretreatment									■	■																										
1-4) Practice in testing of real water samples													■	■	■	■	■																			
1-5) Practice at data analysys													■	■	■	■	■																			
Result 2: Master operation procedure, maintenance and management of the equipment																																				
2-1) Lecture on equipment maintenance and measurement accuracy																				■																
2-2) Practice at maintenance for spectrophotometer																					■	■	■	■												
2-3) Practice at maintenance for water distiller machine																					■	■	■	■												
Result 3: Improvement of ledgers and manuals																																				
3-1) Preparation of logbooks and operation manuals for equipments																											■	■								
3-2) Preparation of inventory of chemicals and reagents																											■	■								
3-3) Preparation of water quality test manual																													■	■						
3-4) maintenance manual for water quality test																													■	■						
Submission schedule of reports (★) and outputs (▲)		★Work plan (JICA)				★Work plan (DDA)					★Weekly report							★Weekly report							★Weekly report		Water quality test manual▲					★Weekly report			Final report★
																					Equipment maintenance manual for water quality test▲														
Expert in charge of water quality analysis																																				
35.0 days(required)/30.0 days(monthly)=1.13 (M/M)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	

Appendix 6

Other Relevant Data

APPENDIX 6 OTHER RELEVANT DATA

(1) A Five Year Project for Rural Water Supply



The Government of The Union of Myanmar
Ministry of Progress of Border Areas and National Races
and
Development Affairs
(Department of Development Affairs)

A Five Year Project for Rural Water Supply by
Development Committees of States & Divisions
(From 2011 - 2012 to 2015 - 2016)

Date : July 2010

A Five Year Project for Rural Water Supply by Development Committees of States & Divisions

(From 2011 - 2012 to 2015 - 2016)

CONTENTS

A Five Year Project for Rural Water Supply by Development Committees of States & Divisions

(From 2011 - 2012 to 2015 - 2016)

Chapter 1

Project Objective and Project period

Project Objective

1. In accordance with the guidance of the Head of the State, in Myanmar, the Development committees in States and Divisions are working for effective promotion of economic, social, educational, health, road and communications works in the villages of respective townships. To raise the living status of the people, year by year, a project is to be drawn for supply of safe potable water to the villages in the whole country to become water - secure areas. Regarding rural water supply, the Department of the Development Affairs was, since 2000-2001 fiscal year, formulated and implemented 10 - year rural water supply plan for Central Dry Zone and the remaining States and Divisions.Nowadays increasing of populations and households, a five year plan from 2011-2012 to 2015-2016 is to be implemented to secure adequate water in the rural areas.

Project Period

2. The project is to be implemented in the period from 2011-2012 Fiscal Year to 2015-2016 Fiscal Year giving priority to the villages which are getting insufficient amount of water.

Chapter 2

Constitution of Divisions

Area and Climate

3. The area and climate of States and Divisions are mentioned in Annex 1.

Formation of village tracts and population

4. The population of township, villages tract, village in States and Divisions are shown in Annex 2.

Present water supply situation of the villages

5. Upon completion of 10 years implementation,(8042) villages, (12970) water supply system were inatalled in Sagaing,Magway and Mandalay Divisions, (15183) villages, (21888) water supply system were installed in the remaining States and Divions. Totally (23225) villages and (34858) water supply system were

installed in the rural areas. Although 10 years plan is completed ,New Action Plan for Rural Water Supply is required due to increasing of populations and households.

Chapter 3

Provisional income and Estimate

6. The provisional income of the States and Divisions from 2011-2012 to 2015-2016 is Kyats (224087.85) million and estimated expenditure to be spent for rural water supply is Kyats (25755) million. The per centage on the income to be spent for rural water supply is estimated at 15&10 Provisional income and estimated expenditure for each fiscal year are shown in Annex 3. States & Divisionwise provisional income, works to be done, estimated expenditures are shown in Annex 3-B.

Proposed Works

7. Proposed works for obtaining water and estimated expenditure to be carried out and spent in each State and Division during the period from 2011-2012 to 2015-2016 fiscal year by year are shown in Annex 4. The consolidated account of expenditure required for Five Year Rural Water Supply Project by States and Divisions is shown in Annex 5.

Appraisal

8. The Township Development Committees are self - supporting local bodies who are carrying out regional development. As mention in Chapter 3, the volume of money for the whole project is difficult for small towns having poor income and big volume of works to implement that project.

9. In order to achieve the set objectives of above mentioned water supply plans, efforts have been made by collaboration and operation with UN agencies, donors, NGOs and INGOs.

10. Over 500 feet deep tube wells are to be drilled in central dry zone. The works will be completed in time only if the department can assist by supplying machines and materials.

11. In carrying out rural water supply works, government contributions and donations by private donors are required for some development committees who have less income.

Conclusion

12. On completion of 5 Year Rural Water Project, present population will enjoy the adequate supply of clean potable water. For the success of the Rural Water Supply Project almost endeavours will be made by applying the best methods and securing assistance.

Department of Development Affairs

Annex 1

Areas and Weather of States and Divisions

Sr.	States / Divisions	AREA		WEATHER		Remark
		Square Miles	Acres	AVG. Rain Fall (Inches)	Temperature (F)	
1	Sagaing	30250.95	18534721.88	43	80-109	
2	Magway	17213.05	11016351.00	34	41-114	
3	Mandalay	14651.00	9376640.00	31	76-110	
4	Kachine	34196.062	11673489.12	78	58	
5	Kayah	4529.56	2898918.40	40	95	
6	Kayin	11730.86	750780.90	136	88	
7	Chin	10780.20	6899220.80	73	55	
8	Tanintharyi	16738.64	10712730.00	175	96	
9	Bago	9759.31	6063368.20	87	96	
10	Bago (West)	5757.9	3673024.50	48	101	
11	Mon	47530.77	3038921.00	185	98	
12	Rakhine	15068.91	9644102.00	170	93	
13	Yangon	3631.22	2323978.00	93	89	
14	Shan (South)	20414.28	13065139.00	40	83	
15	Shan (North)	17726.04	11344665.00	56	86	
16	Shan (East)	13082.24	7759685.00	53	94	
17	Ayeyarwaddy	14675.11	9392071.00	108	101	

Annex (2)

Administrative Makeup of States and Divisions in Myanmar

Sr.	States / Divisions	No of Township	No of Village Track	No of Village	Village Household	Population of Villages (2011-2012)	Population of Villages (2015-2016)
1	Sagaing	34	1582	5460	716384	4678262	
2	Magway	25	1547	4792	557119	3558748	
3	Mandalay	26	1618	5550	789069	4666227	
4	Kachine	11	317	1121	118786	941062	
5	Kayah	7	64	418	21956	162810	
6	Kayin	7	377	2079	204546	1544680	
7	Chin	8	378	987	49179	352616	
8	Tanintharyi	10	265	1255	132800	962292	
9	Bago	14	693	2528	338627	3008343	
10	Bago (West)	14	672	3559	299559	1862961	
11	Mon	10	374	1127	193666	1402093	
12	Rakhine	18	1159	4172	395152	2663369	
13	Yangon	12	594	1752	240373	1475623	
14	Shan (South)	21	423	3373	193304	1659298	
15	Shan (North)	17	679	1565	133230	1047231	
16	Shan (East)	9	176	2438	62163	373905	
17	Ayeyarwaddy	26	1908	11347	908725	5802992	
Total		**184**	**8079**	**37721**	**3292066**	**23259275**	

Annex (3)

A Five Year Project For Rural Water Supply by Development Committees of States & Divisions

(From 2011 - 2012 to 2015 - 2016)

(Kyats in Million)

Sr.	State / Division	Township	Village	2011-12		2012-13		2013-14		2014-15		2015-16		Total		Remark
				System	Alloted	System	Alloted	System	Alloted	System	Alloted	System	Alloted	System	Alloted	
1	Sagaing	30	339	71	806.00	68	802.00	67	801.00	64	842.00	69	947.00	339	4198.00	15%
2	Magway	24	334	69	839.00	69	817.00	63	752.00	70	780.00	63	587.00	334	3775.00	Alloted
3	Mandalay	20	404	84	1167.00	78	1095.00	79	1121.00	82	1177.00	81	1214.00	404	5774.00	
	Total	**74**	**1077**	**224**	**2812.00**	**215**	**2714.00**	**209**	**2674.00**	**216**	**2799.00**	**213**	**2748.00**	**1077**	**13747.00**	
1	Kachine	9	98	20	69.50	18	51.50	19	54.50	20	55.50	21	43.50	98	274.50	10%
2	Kayah	7	56	12	120.00	12	120.00	11	119.00	11	119.00	10	118.00	56	596.00	Alloted
3	Kayin	6	22	6	5.00	6	5.00	6	5.00	2	10.00	2	1.00	22	26.00	
4	Chin	8	65	12	165.00	12	191.00	13	208.00	14	225.00	14	212.00	65	1001.00	
5	Tanintharyi	10	182	36	98.00	34	87.50	33	83.50	38	80.00	41	110.50	182	459.50	
6	Bago	7	129	27	97.50	27	97.50	26	93.50	27	94.50	22	76.00	129	459.00	
7	Bago (West)	14	322	67	107.50	59	101.50	62	107.00	65	222.50	69	119.00	322	657.50	
8	Mon	9	118	22	60.50	23	77.50	24	80.00	25	91.00	24	62.00	118	371.00	
9	Rakhine	14	152	31	137.00	30	136.00	30	136.00	30	145.00	31	111.00	152	665.00	
10	Yangon	11	511	100	184.00	99	183.00	101	187.50	105	453.00	106	198.50	511	1206.00	
11	Shan (South)	19	205	44	257.00	45	378.00	41	362.00	37	348.50	38	358.00	205	1703.50	
12	Shan (North)	14	191	40	371.50	36	347.50	35	347.00	39	428.00	41	460.50	191	1954.50	
13	Shan (East)	9	73	18	248.00	18	264.00	14	225.00	12	191.00	11	174.00	73	1102.00	
14	Ayeyarwaddy	33	532	107	284.50	105	281.00	108	281.50	105	425.50	107	260.00	532	1532.50	
	Total	**170**	**2656**	**542**	**2205.00**	**524**	**2321.00**	**523**	**2289.50**	**530**	**2888.50**	**537**	**2304.00**	**2656**	**12008.00**	
	Grand Total	**244**	**3733**	**766**	**5017.00**	**739**	**5035.00**	**732**	**4963.50**	**746**	**5687.50**	**750**	**5052.00**	**3733**	**25755.00**	

Annex (3-B)

A Five Year Project For Rural Water Supply by Development Committees of States & Divisions

(From 2011 - 2012 to 2015 - 2016)

Sr.	State / Division	Township	Village	System to be Adopted						In Come (Kyats Million)	15% Alloted For Water Supply	Estimated Expenditures	Remark
				S.T	D.T	Dug Well	Pond	Streem	Total				
1	Sagaing	30	339		256	66	1	16	339	23066.52	3459.98	4198.00	
2	Magway	24	334		233	12	89		334	28600.67	4290.10	3775.00	
3	Mandalay	20	404		337	18	12	37	404	42578.26	6386.74	5774.00	
	Total	**74**	**1077**		**826**	**96**	**102**	**53**	**1077**	**94245.45**	**14136.82**	**13747.00**	
1	Kachine	9	98	2	65	26		5	98	9006.20	900.62	274.50	10%
2	Kayah	7	56			6	20	30	56	2275.40	227.54	596.00	Alloted
3	Kayin	6	22	19	3				22	6465.59	646.56	26.00	
4	Chin	8	65				8	57	65	1502.74	150.27	1001.00	
5	Tanintharyi	10	182	6	2	148	11	15	182	7185.10	718.51	459.50	
6	Bago	7	129		14	12	103		129	5633.48	563.35	459.00	
7	Bago (West)	14	322	127	174	11	10		322	21679.69	2167.97	657.50	
8	Mon	9	118	7	31	26	51	3	118	9026.95	902.70	371.00	
9	Rakhine	14	152	21		16	103	12	152	8850.13	885.01	665.00	
10	Yangon	11	511	278	71	5	157		511	11306.61	1130.66	1206.00	
11	Shan (South)	19	205	17	8	40	58	82	205	13435.92	1343.59	1703.50	
12	Shan (North)	14	191	3	38	27	20	103	191	16842.29	1684.23	1954.50	
13	Shan (East)	9	73			3	7	63	73	5411.60	541.16	1102.00	
14	Ayeyarwaddy	33	532	168	100	8	256		532	11220.70	1122.07	1532.50	
	Total	**170**	**2656**	**648**	**506**	**328**	**804**	**370**	**2656**	**129842.40**	**12984.24**	**12008.00**	
	Grand Total	**244**	**3733**	**648**	**1332**	**424**	**906**	**423**	**3733**	**224087.85**	**27121.06**	**25755.00**	

Annex (4)

Rulal Water Supply for Year 2011-2012 by Development Committees of States & Divisions

Sr.	State / Division	Township	Village	System to be Adopted						In Come (Kyats Million)	15% Alloted For Water Supply	Estimated Expenditures	Remark
				S.T	D.T	Dug Well	Pond	Streem	Total				
1	Sagaing	30	71		50	18	1	2	71	5177.00	776.55	806.00	
2	Magway	24	69		52	3	14		69	5929.00	889.35	839.00	
3	Mandalay	20	84		66	4	5	9	84	7956.20	1193.43	1167.00	
	Total	**74**	**224**		**168**	**25**	**20**	**11**	**224**	**19062.20**	**2859.33**	**2812.00**	
1	Kachine	9	20	1	12	5		2	20	4218.00	421.80	69.50	10%
2	Kayah	7	12			2	4	6	12	562.10	56.21	120.00	Alloted
3	Kayin	6	6	5	1				6	1289.20	128.92	5.00	
4	Chin	8	12				3	9	12	252.34	25.23	165.00	
5	Tanintharyi	10	36	2	2	25	4	3	36	2369.20	236.92	98.00	
6	Bago	7	27		3	2	22		27	2394.48	239.45	97.50	
7	Bago (West)	14	67	30	31	3	3		67	3536.39	353.64	107.50	
8	Mon	9	22	1	6	5	10		22	3688.85	368.89	60.50	
9	Rakhine	14	31	4		4	20	3	31	3075.93	307.59	137.00	
10	Yangon	11	100	54	16	1	29		100	2500.41	250.04	184.00	
11	Shan (South)	19	44	7	3	11	12	11	44	2897.62	289.76	257.00	
12	Shan (North)	14	40	2	9	5	5	19	40	3881.79	388.18	371.50	
13	Shan (East)	9	18			2	2	14	18	1696.00	169.60	248.00	
14	Ayeyarwaddy	33	107	29	24	2	52		107	5550.00	555.00	284.50	
	Total	**170**	**542**	**135**	**107**	**67**	**166**	**67**	**542**	**37912.31**	**3791.23**	**2205.00**	
	Grand Total	**244**	**766**	**135**	**275**	**92**	**186**	**78**	**766**	**56974.51**	**6650.56**	**5017.00**	

Annex (4-a)

Rulal Water Supply for Year 2012-2013 by Development Committees of States & Divisions

Sr.	State / Division	Township	Village	System to be Adopted						In Come (Kyats Million)	15% Alloted For Water Supply	Estimated Expenditures	Remark
				S.T	D.T	Dug Well	Pond	Streem	Total				
1	Sagaing	26	68		49	16		3	68	5121.06	768.16	802.00	
2	Magway	24	69		50	3	16		69	6526.67	979.00	817.00	
3	Mandalay	18	78		64	4	3	7	78	8463.53	1269.53	1095.00	
	Total	**68**	**215**		**163**	**23**	**19**	**10**	**215**	**20111.26**	**3016.69**	**2714.00**	
1	Kachine	5	18	1	12	4		1	18	1570.00	157.00	51.50	10%
2	Kayah	6	12			2	4	6	12	616.60	61.66	120.00	Alloted
3	Kayin	6	6	5	1				6	1418.12	141.81	5.00	
4	Chin	8	12				1	11	12	277.50	27.75	191.00	
5	Tanintharyi	9	34	1		28	2	3	34	1966.20	196.62	87.50	
6	Bago	5	27		3	2	22		27	918.30	91.83	97.50	
7	Bago (West)	12	59	23	32	2	2		59	3732.00	373.20	101.50	
8	Mon	6	23	1	6	5	10	1	23	1894.70	189.47	77.50	
9	Rakhine	10	30	4		3	20	3	30	3601.40	360.14	136.00	
10	Yangon	10	99	54	14	1	30		99	2230.00	223.00	183.00	
11	Shan (South)	19	45	3	1	8	15	18	45	3187.30	318.73	378.00	
12	Shan (North)	13	36	1	8	5	4	18	36	3573.80	357.38	347.50	
13	Shan (East)	9	18			1	2	15	18	1865.60	186.56	264.00	
14	Ayeyarwaddy	20	105	29	23	1	52		105	2950.00	295.00	281.00	
	Total	**138**	**524**	**122**	**100**	**62**	**164**	**76**	**524**	**29801.52**	**2980.15**	**2321.00**	
	Grand Total	**206**	**739**	**122**	**263**	**85**	**183**	**86**	**739**	**49912.78**	**5996.84**	**5035.00**	

Annex (4-5)

Rulal Water Supply for Year 2013-2014 by Development Committees of States & Divisions

Sr.	State / Division	Township	Village	System to be Adopted						In Come (Kyats Million)	15% Alloted For Water Supply	Estimated Expenditures	Remark
				S.T	D.T	Dug Well	Pond	Streem	Total				
1	Sagaing	24	67		49	15		3	67	4333.30	650.00	801.00	
2	Magway	20	63		46	2	15		63	5372.67	805.90	752.00	
3	Mandalay	17	79		66	4	2	7	79	8805.33	1320.80	1121.00	
	Total	**61**	**209**		**161**	**21**	**17**	**10**	**209**	**18511.30**	**2776.70**	**2674.00**	
1	Kachine	2	19		13	5		1	19	1031.50	103.15	54.50	10%
2	Kayah	5	11			1	4	6	11	677.30	67.73	119.00	Alloted
3	Kayin	6	6	5	1				6	1559.93	155.99	5.00	
4	Chin	8	13				1	12	13	305.30	30.53	208.00	
5	Tanintharyi	8	33	1		28	1	3	33	1651.00	165.1	83.50	
6	Bago	4	26		3	2	21		26	731.70	73.17	93.50	
7	Bago (West)	12	62	24	34	2	2		62	4105.20	410.52	107.00	
8	Mon	5	24	1	7	5	10	1	24	1856.60	185.66	80.00	
9	Rakhine	5	30	4		3	20	3	30	1058.30	105.83	136.00	
10	Yangon	9	101	55	14	1	31		101	2102.10	210.21	187.50	
11	Shan (South)	18	41	3	1	8	11	18	41	3300.00	330	362.00	
12	Shan (North)	12	35		8	5	4	18	35	3805.10	380.51	347.00	
13	Shan (East)	8	14				1	13	14	1047.80	104.78	225.00	
14	Ayeyarwaddy	13	108	34	19	1	54		108	1786.30	178.63	281.50	
	Total	**115**	**523**	**127**	**100**	**61**	**160**	**75**	**523**	**25018.13**	**2501.81**	**2289.50**	
	Grand Total	**176**	**732**	**127**	**261**	**82**	**177**	**85**	**732**	**43529.43**	**5278.51**	**4963.50**	

Annex (4-c)

Rulal Water Supply for Year 2014-2015 by Development Committees of States & Divisions

Sr.	State / Division	Township	Village	System to be Adopted						In Come (Kyats Million)	15% Alloted For Water Supply	Estimated Expenditures	Remark
				S.T	D.T	Dug Well	Pond	Streem	Total				
1	Sagaing	23	64		51	9		4	64	4433.30	665.00	842.00	
2	Magway	19	70		46	2	22		70	5819.00	872.85	780.00	
3	Mandalay	15	82		70	4	1	7	82	8644.67	1296.70	1177.00	
	Total	**57**	**216**		**167**	**15**	**23**	**11**	**216**	**18896.97**	**2834.55**	**2799.00**	
1	Kachine	2	20		13	6		1	20	1134.60	113.46	55.50	10%
2	Kayah	4	11			1	4	6	11	200.00	20.00	119.00	Alloted
3	Kayin	6	2	2					2	1046.83	104.68	10.00	
4	Chin	8	14				1	13	14	335.80	33.58	225.00	
5	Tanintharyi	5	38	1		33	2	2	38	570.80	57.08	80.00	
6	Bago	4	27		3	3	21		27	804.90	80.49	94.50	
7	Bago (West)	12	65	24	37	2	2		65	4515.70	451.57	222.50	
8	Mon	2	25	2	6	5	11	1	25	849.30	84.93	91.00	
9	Rakhine	2	30	5		2	21	2	30	530.70	53.07	145.00	
10	Yangon	7	105	57	14	1	33		105	2130.50	213.05	453.00	
11	Shan (South)	17	37	2	1	7	10	17	37	2088.30	208.83	348.50	
12	Shan (North)	10	39		6	6	4	23	39	2657.90	265.79	428.00	
13	Shan (East)	5	12				1	11	12	420.50	42.05	191.00	
14	Ayeyarwaddy	8	105	37	17	2	49		105	580.70	58.07	425.50	
	Total	**·92**	**530**	**130**	**97**	**68**	**159**	**76**	**530**	**17866.53**	**1786.65**	**2888.50**	
	Grand Total	**149**	**746**	**130**	**264**	**83**	**182**	**87**	**746**	**36763.50**	**4621.20**	**5687.50**	

Annex (4-d)

Rulal Water Supply for Year 2015-2016 by Development Committees of States & Divisions

Sr.	State / Division	Township	Village	System to be Adopted						In Come (Kyats Million)	15% Alloted For Water Supply	Estimated Expenditures	Remark
				S.T	D.T	Dug Well	Pond	Streem	Total				
1	Sagaing	21	69		57	8		4	69	4001.86	600.28	947.00	
2	Magway	17	63		39	2	22		63	4953.33	743.00	587.00	
3	Mandalay	14	81		71	2	1	7	81	8708.53	1306.28	1214.00	
	Total	**52**	**213**		**167**	**12**	**23**	**11**	**213**	**17663.72**	**2649.56**	**2748.00**	
1	Kachine	1	21		15	6			21	1052.10	105.21	43.50	10%
2	Kayah	3	10				4	6	10	219.40	21.94	118.00	Alloted
3	Kayin	6	2	2					2	1151.51	115.15	1.00	
4	Chin	7	14				2	12	14	331.80	33.18	212.00	
5	Tanintharyi	5	41	1		34	2	4	41	627.90	62.79	110.50	
6	Bago	3	22		2	3	17		22	784.10	78.41	76.00	
7	Bago (West)	11	69	26	40	2	1		69	5790.40	579.04	119.00	
8	Mon	1	24	2	6	6	10		24	737.50	73.75	62.00	
9	Rakhine	2	31	4		4	22	1	31	583.80	58.38	111.00	
10	Yangon	7	106	58	13	1	34		106	2343.60	234.36	198.50	
11	Shan (South)	14	38	2	2	6	10	18	38	1962.70	196.27	358.00	
12	Shan (North)	10	41		7	6	3	25	41	2923.70	292.37	460.50	
13	Shan (East)	3	11				1	10	11	381.70	38.17	174.00	
14	Ayeyarwaddy	5	107	39	17	2	49		107	353.70	35.37	260.00	
	Total	**78**	**537**	**134**	**102**	**70**	**155**	**76**	**537**	**19243.91**	**1924.39**	**2304.00**	
	Grand Total	**130**	**750**	**134**	**269**	**82**	**178**	**87**	**750**	**36907.63**	**4573.95**	**5052.00**	

Annex (5)

Yearly Programme of Water Supply for Sagaing Division Rural Areas

Sr.	Fiscal Year	Township	Village	System to be Adopted						Income (Kyats in Million)	15% Alloted For Water Supply	Estimated Expenditures	Remark
				S.T	D.T	Dug Well	Pond	Stream	total				
1	2011-2012	30	71		50	18	1	2	71	5177.00	776.55	806.00	
2	2012-2013	26	68		49	16		3	68	5121.06	768.16	802.00	
3	2013-2014	24	67		49	15		3	67	4333.30	650.00	801.00	
4	2014-2015	23	64		51	9		4	64	4433.30	665.00	842.00	
5	2015-2016	21	69		57	8		4	69	4001.86	600.28	947.00	
	Total	**30**	**339**	**0**	**256**	**66**	**1**	**16**	**339**	**23066.52**	**3459.98**	**4198.00**	

Yearly Programme of Water Supply for Magway Division Rural Areas

Sr.	Fiscal Year	Township	Village	System to be Adopted						Income (Kyats in Million)	15% Alloted For Water Supply	Estimated Expenditures	Remark
				S.T	D.T	Dug Well	Pond	Stream	total				
1	2011-2012	24	69		52	3	14		69	5929.00	889.35	839.00	
2	2012-2013	24	69		50	3	16		69	6526.67	979.00	817.00	
3	2013-2014	20	63		46	2	15		63	5372.67	805.90	752.00	
4	2014-2015	19	70		46	2	22		70	5819.00	872.85	780.00	
5	2015-2016	17	63		39	2	22		63	4953.33	743.00	587.00	
	Total	**24**	**334**	**0**	**233**	**12**	**89**	**0**	**334**	**28600.67**	**4290.10**	**3775.00**	