The Study on Groundwater Development in Central Cambodia
Final Report

Main Report

LOCATION MAP
EXCHANGE RATE AND LIST OF ABBREVIATION
EXECUTIVE SUMMARY

CONTENTS

CHAPTER 8

WATER SUPPL Y PL AN

CHAPTER 8 WATER SUPPLY PLAN

8.1 Water Supply Plan Policy

(1) Based on the results of the studies on the actual conditions of existing water resources, a water supply plan targeting 2005 is prepared for the target villages. In the target villages, new water source is urgently needed and people are showing clear willingness to independently organize the VWC and WPC and carry out operation and maintenance (O&M). The water supply system is composed of tube well and hand pump. O&M will be carried out by the villagers themselves (VLOM: Village Level Operation and Maintenance).

(2) Of the areas covered by the study, Kg Chhnang province is located on the gentle slope contiguous to western mountain and on the alluvial lowland along the Tonle Sap River. The number of the requested village is 203. Among these villages, 112 villages are targeted because more than 50% of the residents depend on the hand dug wells. However, groundwater potential of the Quaternary aquifer in this province is low. Groundwater is generally high in iron. Arsenic is locally higher than the WHO guideline value. One the other hand, fissure and weathered zone of the basement rocks form an aquifer. However, the yield changes place to place and the borehole often meets no gorundwater. In order to develop groundwater in this province, it is necessary to conduct detailed topographical, geological and geophysical surveys at each village. In addition, access to the village is bad. Considering difficulties mentioned above, this water supply plan excludes the target villages in Kg. Chhnang. In the future, MRD should conduct detailed groundwater investigation upon request form the village and implements an individual groundwater development program.

(3) In the alluvial lowland along the Tonle Sap River and the Mekong River of western Kg. Cham Province, groundwater development is not feasible because of its low potential and inferior water quality. Therefore, the target villages located on the alluvial lowland are excluded from the plan. In the future, MRD should promote development of alternative water sources, such as river, rainwater, shallow well with protection and iron removal device etc. On the other hand, groundwater potential of Plio-Pleistocene sediments and basalt is high in the right bank of the Mekong River, the western Kg. Cham Province. However, many tube wells have already been drilled by several international organizations, such as PRASAC, China and NGOs, in this area. In addition, number of the target village is few. Therefore, the plan excludes this area.

(4) The plan will be implemented in the eastern part of Kg. Cham, which is located on the left bank of the Mekong River. Plio-Pleistocene sediments and basalt aquifers in this area have high potential and good quality of groundwater. There are many hand dug wells in this area. Most of them have no well cover, concrete seal and curb. The hand dug wells are contaminated by colon bacillus without exception. Therefore, it is urgent to secure safe and clean drinking water in this area. In addition, a bridge over the Mekong River was build on December 2001. With opening of the bridge and rehabilitation of the national road No.7, the area will economically be developed rapidly. The water supply plan is well-timed in this regard.

(5) For the sustainable use of the village water supply facilities, the residents should first establish the VDC, then organize the VWC and WPC themselves, and independently carry out O&M of the facility. The soft component of the water supply plan will, therefore, include guidance in the formation of VWC/WPC and its operation, and in line with the construction of the facilities, assistance in O&M to be carried out by the residents. MRD and relevant departments should conduct a sanitation campaign in collaboration with the sanitary improvement project currently implemented by UNICEF and NGOs.

8.2 Project Area and Village Selection

8.2.1 Target Project Area

The entire region of Kampong Chhnang Province, for reasons stated in section 8.1 (1), and five districts in Kampong Cham Province (Kaoh Soutin, Steung Trang, Krouch Chhmar, Chamkar Leu, Cheung Prey), for reasons stated in 8.1 (2), have been omitted from the Target Project Area.

Therefore, the Target Project Area consists of the following five districts of the Kampong Cham Province.

① Memot
② Ponhea Kraek
③ Dambae
④ Tboung Khmum
⑤ Ou Reang Ov

8.2.2 Classification of 303 Villages

A Flow of Classification was established as shown in Figure 8.1 in order to decide the target villages for project implementation.

The criteria to decide the order of the villages for project implementation are as follows:

(1) Groundwater development potential based on quantity
(2) Groundwater development potential based on quality
(3) Access to site
(4) Flood conditions
(5) Number of existing hand pumps（set a standard of 1 pump/210 people、refer to Chapter 8.3）
(6) The presence of existing hand pumps
(7) The presence of VDC（Village Development Committee）

8.2.3 Target Village Selection

The result of the classification, which is based on Project policy and results of village surveys, are shown in Table 8.1 and 8.2. The 131 villages ranked A, B, C, and D, where groundwater development potential and the need for well construction are great, are planned as the Target Village.

Table 8.1 Village Ranking for Project Implementation

Rank	Number of Target Villages		
	Kampong Chhnang	Kampong Cham	Total
A	0	28	28
B	0	55	55
C	0	20	20
D	0	28	28
Total	0	131	131
E	0	11	11
F	0	13	13
G	0	6	6
H	0	2	2
I	0	28	28
J	112	0	112
Total	112	191	303

8.2.4 Alternative Water Source

The use of alternative water sources in the 172 villages (out of 303), that were omitted from the target villages for project implementation, needs to be examined. The potential use and problems of the major alternative water sources are stated below.

(1) Dug Well

The number of water sources with potential for use are shown in Figure 8.2. There are an average of 29.5 usable dug wells per village in dry season and they are the most widely used water source among the villagers. Furthermore, as dug wells exist in all but 4 of the 303 villages, it is considered that developing dug wells is possible in whole villages.
The main problem with dug wells is that the water becomes contaminated with fecal coliform due to inflow and water seepage. In such a situation, the problem can be dealt with by educating the residents on the importance of drinking boiled water.
Another problem is that analysis of water samples taken from existing dug wells revealed contaminants, other than fecal coliform, with levels exceeding the WHO guideline and water treatment at the village level would be difficult.

(2) Rainwater

According to the results of village survey, using rainwater as a water source is a traditional practice and it is used in 87% of the villages. The quality of rainwater is good and if public education on sanitary practices were provided, it would be an effective alternative water source. The problem is that it is difficult to secure a sufficient supply in terms of quantity in the dry season.

(3) River

As there are only a few small/medium-sized rivers in the vicinity around the villages and they tend to dry up in the dry season, rivers are difficult to use as an effective alternative resource. However, the great Mekong River flows in the Kampong Cham Province and Tonle Sap River in the Kampong Chhnang Province and although their water level drops, the two rivers can be used throughout the year as a water source. In an area where the quality of dug well water is unsafe and alternative water sources are difficult to secure in the dry season, an effective measure is to construct a pipeline water supply system using the two rivers as a water source. As construction costs of such a project would be high, a Feasibility Study would be required.

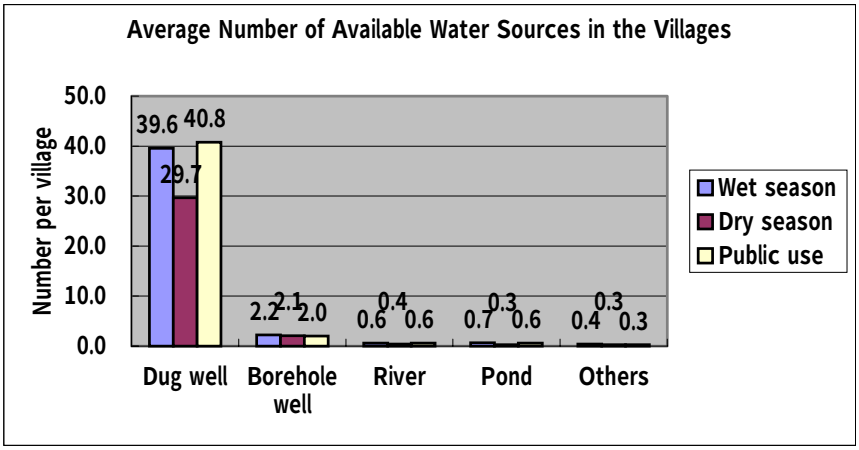


Figure 8.2 Average Number of Available Water Source in the Village

8.3 Design Standards

8.3.1 Standard Amount for Water Consumption

The results of the village survey showed that average water consumption in the target villages is 152 liters per household (see Table 8.4).

The MRD has not established a standard amount for water consumption for rural water supply, adopting about 20 liters/capita/day based on the WHO standards shown in Table 8.5. This figure, however, widely differs from reality even in consideration of the accuracy of the village survey. This Project will, therefore, adopt WHO's upper limit of 40 liters/capita/day for rural water supply.

Table 8.4 Water Use Amount (Unit: litter/person/day)

Purpose	Wet Season	Dry Season	Average
Drinking	2.2	3.1	2.6
Cooking	8.7	9.0	8.8
Bathing	60.0	75.2	67.6
Washing	26.4	26.9	26.6
Gardening	6.3	36.8	21.6
Livestock	9.3	35.5	22.4
Others	2.4	2.4	2.4
Total	115.4	188.8	152.1

Table 8.5 WHO Standard of "Distance to Water Source"

Water Source	Distance	Standard Amount of Water Consumption
Distance to water resource	>1,000 m	5~10 liters/capita/day
	500~1,000 m	10~15 liters/capita/day
Distance to village well	>250 m	15~25 liters/capita/day
	<250 m	20~40 liters/capita/day
Public faucets		50 liters/capita/day

8.3.2 Water Demand Projection

According to the result of village survey, annual growth rate of the 303 villages is 0.9% while annual growth rate of the villages without households moved in/out is 2.23% (see Table 5.2.3.2). In consideration of the reality of the actual population growth, 2.23% shall be adopted. Based on the Study area population projected for 2005 (2.23 % growth rate), the population of the 131 target villages will increase to a total of 118,320. The water demand estimated as a result of this increase is as shown in Table 8.6.

Table 8.6 Population and Water Demand Forecast of 131 Target Villages

Province	Village Number	Population 2001	Population 2005	Water Demand (m^3/day; 40 l/c/d)
Kampong Chhnang	0	0	0	0
Kampong Cham	131	108,332	118,320	4,733
Total	131	108,332	118,320	4,733

8.3.3 Hand Pump Selection

According to the results of comparison of hand pump mentioned in Clause 6.2, experience of water supply facility in the study and the Study of Groundwater Development in Southern Cambodia, Afridev hand pump is the best hand pump in Cambodia and shall be adopted for implementation project.

8.3.4 Required Hand Pumps

(1) Pumping Capacity of Afridev

The results of the continuous pumping test conducted in the 20 test wells in Kampong Cham province showed that the maximum pumping discharge was 1,296 m^3/day (900 liters/min) and the lowest was 24.5 m^3/day (17 liters/min). The groundwater level fluctuates seasonally.

The maximum total dynamic head is estimated to be less than 35 m. Within this head range, the pumping discharge of Afridev is estimated at 15 to 20 liters/min in average.

Accordingly, the daily pumping capacity Qc is calculated as follows:

Time of pumping operation = 8 hours

Qc = (15 to 20) liters × 60 min × 8 hours = 7.2 to 9.6 m^3/day (average 8.4 m^3/day)

(2) Water supply population per Afridev hand pump

As mentioned above, the average pumping capacity of Afridev is 8.4 m^3/day. The population served by a single Afridev hand pump at a design water consumption of 40 lpcd is calculated as follows:

8,400 liters/day ÷ 40 lpcd = 210 persons

8.3.5 Number of Hand Pumps Required

The pumping capacity of the Afridev hand pump varies according to aquifer permeability coefficient and groundwater level. Nonetheless, surveys at the site show an actual pumping volume of roughly 15 to 20 liters/min. This Project, therefore, plans an average pumping volume of 17.5 liters/minute for a period of 8 hours. With an Afridev hand pump, the target pumping volume per hand pump, standard water consumption amount, and water supply population per hand pump would be 8.4 m^3/day, 40 liters/capita/day, and 210 people, respectively.

While, the number of hand pump is designed as 20 – 25 households per hand pump on the "Seth Koma Program" (UNICEF, 2001-2005), according to the monitoring progress report of the Study on Groundwater Development in Southern Cambodia, the number of user is 4-136 households (20-680 people) per hand pump (see Table 8.7).

In order to minimize the project cost, less number of hand pump is preferable and it is important to be registered as users by much resident through the O&M education.

Therefore, 210 people per hand pump is adopted as the standard to calculate the number of required hand pump for the implementation.

Table 8.7 Number of Users Registered in the Pilot Villages in Southern Cambodia

No.	Province	Village	Number of users				
			May, 1999	June, 2000		June, 2001	
				No.	Fluctuation	No.	Fluctuation
1	Peri-urban	Khvet	56	57	+1	60	+3
2	Peri-urban	Mean Chey	55	30	-25	50	+20
3	Svay Rieng	Koy Tra Bek	*	10	-	10[*3]	±0
4	Svay Rieng	Trapaing Thmor	*	50	-	4	-46
5	Svay Rieng	Dok Por	19	21	+2	21	±0
6	Svay Rieng	Cham Kar Leiv	*	23	-	24	+1
7	Svay Rieng	Toul Khpos	*	42	-	42	±0
8	Takeo	Prech	54	110	+56	136	+26
9	Takeo	Prey Maok	35	43	+8	43	±0
10	Takeo	Trapaing Thmor	30	29	-1	31	+2
11	Takeo	Ta Pen	13	16	+3	16	±0
12	Kandal	Svay Kraom	37	38	+1	38	±0
13	Kandal	Krang Svay	41	40	-1	43	+3
14	Kandal	Angkor Chey	27	27	±0	29	+2
15	Prey Veng	Ka Kou	113	14	-99	14	±0
16	Prey Veng	Russei Tvear	127	32	-95	24	-8
17	Prey Veng	Kok Trom Kha	*	20	-	3	-17
18	Prey Veng	Prey Phdau	24	17	-7	17	±0
19	Kompong Speu	Sre Kak	72	45	-27	45	±0
20	Kompong Speu	Kiri Raksmey	94	30	-64	39	+9
	Total		797	694*[1]	-	689*[2]	-

Source: Monitoring Progress Report (II), the Study on Groundwater Development in Southern Cambodia, December 2001, JICA

Required number of hand pump is shown in Table 8.8. The number is already made deduction of the number of existing hand pump and the hand pumps installed in the study.
Detail of number of hand pump for target villages is shown in Table 8.9.

Table 8.8 Required Number of Hand Pump

Rank	Number of Village	2005	
		Population	Required Number of Hand Pumps
A	28	22,684	121
B	55	44,777	236
C	20	22,931	69
D	28	27,928	100

Total	131	118,320	526

8.4 Water Supply Facility

The water supply system will be made up of a tube well (deep well) with hand pumps (Afridev), a platform and an iron removal device (see Figures 6.2.1, 6.2.2 and 6.2.3). According to the Chapter 6.2 Water Supply Facility and the result of the study, design of water supply facility for implementation is as follows,

(1) Deep Well

According to the Chapter 7.3, target depth of the deep well for implementation is 50 m. In consideration with water and earth pressure at 50 m deep, PVC pipe is available, economical and anticorrosive. The design of well structure is shown in Figure 8.3. Both of mud circulation method and down the hole (DTH) method are adopted for drilling work. Due to the pumping capacity of Afridev, pumping rate of the well shall be planned more than 20 litter/min. As there is no water quality standard in Cambodia, WHO guideline value shall be adopted as water quality standard. Design of well structure is shown in Figure 8.3.

Size of casing pipe and screen pipe is same as pilot well as follows,

- Diameter: 4 inches
- Screen Length: 16 m
- Opening Ratio: 5 %

(2) Hand Pump

According to the comparison of hand pump for the pilot study mentioned in Chapter 6.2, Afridev pump shall be adopted for implementation in respect of the advantage of easier maintenance, economy and MRD recommendation. In consideration with the corrosion in the future, materials of riser pipes and pump rods shall be anticorrosive as follows,

- Riser Pipes: PVC
- Pump Rods: Stainless Steel

(3) Platform

The design of platform is shown in Figure 8.4. The specification of the platform design is planned as follows,

- Embankment: Minimum 35 cm higher than ground level
- Structure: Reinforced Concrete
- Inner Dimension: Width 2.5 m × Length 3.8 m
- Section Dimension: Slab Thickness 15 cm, Wall Thickness 15 cm
- Concrete Compressive Strength: 21 N/mm^2 (Cylinder Test Piece)
- Reinforcing Steel: Round Bar dia. 9 mm @ 15 cm × 15 cm

In order to avoid the affection of flood in the future, height of embankment shall be determined hearing past flood water level to the residents on site. And it is preferable that embankment shall be done by residents.

(4) Drain

The design of drain is shown in Figure 8.4. The specification of the design is planned as follows,

- Structure: Reinforced Concrete
- Inner Dimension: Width 35 cm × Depth 20 cm × Length 5.0 m
- Section Dimension: Slab Thickness 15 cm, Wall Thickness 15 cm
- Specification of Concrete and Reinforcing Steel shall be same as platform.

Education for hygiene and O&M shall be needed to make villagers understand to prevent congestion of drain water and sediment of rubbish and excavate ditch to drain water.

(5) Iron Removal Device (IRD)

Due to the following reasons, it is necessary to educate users about effect of IRD, how to install and maintain IRD, etc., so as to install IRD by them at their own expense.

- As mentioned in Chapter 8.1, the area where good groundwater quality is not expected is excluded in the target area of implementation. The number of well where iron concentration is high is expected less.

- According to the Monitoring Progress Report (II), the Study on Groundwater Development in Southern Cambodia (December 2001, JICA), if there is an alternative water source with water of better quality that of the well water after using an IRD, the device will be of no use to the residents even an IRD has good effect of reducing iron. Therefore, an IRD shall be installed based on the demand of the users after completion of

hand pump well.

- Iron removal devices were installed during the Study. The model is about 1,000 US$ as it is made of stainless steel. However, it is possible to reduce costs by constructing the same model with concrete. If a design that is cheap and easy to construct is used, the users can build the devices themselves.

8.5 Project Cost

8.5.1 Condition of Estimate

The Project cost were calculated in accordance with the following terms,

- Time of Estimate: February 2002
- Exchange Rate: US$ 1.00 = 3,910 Riel = 133 Yen
- Implementation Period: 72 months
- Contractor: Cambodian Consultant and Contractor
- Subcontractor of drilling works: Third Country
- Dry Hole Ratio: 20%

Actual dry hole ratio of test drilling in the study was 17% in Kampong Cham province.

The contents of the Project Cost are as follows,

(1) Construction of Water Supply Facility

a) Deep Well Construction: 526 sets

(2) Procurement Equipment for Operation & Maintenance

a)	Afridev Spare Parts:	530 sets
b)	Afridev Maintenance Tools:	53 sets
c)	Hand Pump Assembly Set:	53 sets
d)	Pickup Truck:	2 units
e)	Air Compressor:	1 unit
f)	Truck with Crane:	1 unit

(3) Design Supervision

a) Detailed Design and Tender
b) Construction Supervision
c) Organization/Hygiene/O&M Program Supervision
d) Monitoring Supervision

The Project cost are broken down in the Table 8.10.

Table 8.10 Project Cost

(Unit: US$1,000)

Item	Amount
Total Amount	11,913
1. Civil Construction	10,375
1-1Construction Cost	9,432
a. Direct Cost	8,424
b. Indirect Cost	257
c. Direct Expense	751
1-2 General Overhead	943
2. Procurement Equipment	205
2-1 Equipment Cost	177
2-2 Transportation Cost	21
2-3 General Overhead	6
3. Design and Supervision	1,333
3-1 Design	293
a. Direct Expense	138
b. Personnel Expense	64
c. Indirect Expense	90
3-2 Supervision	402
a. Direct Expense	196
b. Personnel Expense	86
c. In-direct Expense	120
3-3 Education and Monitoring	638
a. Direct Expense	250
b. Personnel Expense	162
c. In-direct Expense	227

The Project cost by phase were also calculated and shown in the Table 8.11.

Table 8.11 Project Cost by Phase

(Unit: US$ 1,000)

Phase	I	II	III	Total
Year	2003~2005	2004~2007	2006~2008	
Target Village	A	B	C+D	
Number of Villages	28	55	48	131
Number of deep wells and hand pumps	121	236	169	526
Construction costs	2,426	4,674	3,275	10,375
Equipment & material procurement	174	25	6	205
Design supervision cost	393	548	392	1,333
Total	2,993	5,247	3,673	11,913

8.6 Project Implementation

8.6.1 Implementing Body

The agencies in charge of the implementation of the project are the DRWS of the MRD, and the Provincial Department of Rural Development (PDRD) in Kampong Cham province involved. For smooth and effective implementation of the Project, a Project Management Unit (PMU) will be established at DRWS headquarters. With the cooperation of the consultant, PMU will manage the Project. Along with the detailed design, the consultant will also extend guidance in the establishment of a WPC in the target villages and in facility O&M, and conduct a sanitation campaign and O&M training after installation of hand pump. The consultant also conducts monitoring with PDRD about O&M for water supply facilities for 1 year after completion of construction. The contractor will construct the water supply facilities and O&M facilities, and procure the necessary equipment and materials under the supervision of the consultant.

8.6.2 Implementation Schedule

The implementation schedule of the water supply plan was made in line with the basic planning policies, and is as shown in Figure 8.5.

8.7 Operation & Maintenance and Monitoring Program

8.7.1 Policy

Operation and maintenance is one of indispensable factors in water supply program, in particular, in community water supply program. Sustainability and accountability of the program mostly depend on pervasion of this concept to community.

Decentralization policy promoted by the Cambodia government is also extended to rural water supply program. National Standard Roles and Responsibilities of Community in the Water Well Drilling Program have been discussed in VSC Meeting. In response to consecutive discussions, VLOM becomes mainstream of operation and maintenance program as national policy. In this policy, user groups to be elected by village people will be a core and self-help organization. The ultimate aim of VLOM concept is that user groups manage and finance the upkeep of their hand pumps by themselves.

Hand pump is considered the most feasible and appropriate for VLOM in the light of cost effectiveness and repair capabilities of village community. Most of the common repair and maintenance task will be executed by the trained local hand pump caretakers selected from the user groups.

VLOM program facilitates community participation to a maximum extent. Community based approach is the process to empower community and facilitate change of their attitude. Empowerment is to stimulate community awareness and ownership of village community, and to strengthen O&M executing capacity at village level. Village community's capability will be enhanced through compiled experiences.

National and provincial level supporting structure will be a minimum range by putting user groups in the center of O&M frameworks. What is the most significant is to optimize systematic communication network among village, province and national to meet necessity of technical support and procurement of spare parts.

8.7.2 Organization

(1) Water Point Committee (WPC)

According to the proposed national guidelines for VLOM, WPC, which is defined as so-called user group among some working agencies, is preferably promoted to be organized. VLOM

policy has originated from empirical concept compiled in community water supply program among concerning agencies. In VLOM policy, user-based organization such a WPC is regarded as a core organization to operate practical O&M activities as the smallest and the most pragmatic unit. Advantage of WPC is to consist of only users so as to be able to mobilize village people easily.

In order to achieve the goals of VLOM, the most significant component is community based approach. The attitude to be emphasized in the approach is to facilitate community participation as a catalyst. Expected users will be mobilized and facilitated to organize WPC for O&M. Regarding detail WPC framework, which will be input to village community, are as following:

1) Responsibilities of WPC

Suggested responsibilities by national policy and tested in the study are as followings:

a) General

- Site selection for water well drilling in consultation with expected users
- Community (users) mobilization
- Water point fund mobilization and management
- Hand pump operation and maintenance management
- Follow up the water use and hygiene education activities
- To discuss resolution (of the water point users)

b) Before Well Construction

- Participate in the users meetings and agree for formal request of the water point construction
- Participate in the election process to set up committees for O&M
- Site selection according to the agreed criteria
- Cash contribution for the Maintenance Funds
- Agreement to participate in the well construction activities
- Preparation of site and access path
- Provide land for water point construction (if private land is selected, the owner should sign on the agreement for public use.)

c) During Well Construction

- To assist the technical team for well drilling
- To contribute labor and local construction material for well construction

- To provide the accommodation for working teams as requested
- To take care of the security of equipment and working teams
- To fence the well and hand pump

Village community will arrange all of the suggested roles, referring to their preference.

2) Recommended Members and Member's Work

WPC members shall be selected by village community in a democratic way. Recommended members consist of chairperson, secretary, accountant, two (2) caretakers and two (2) pump maintenance respectively. Caretakers will be trained on repair and inspection skills. Pump maintenance will be trained on how to keep environment around hand pump clean.

a) Chairperson

- To convene members and community and preside over the meeting
- To take responsibility for management of the committee

b) Secretary

- To record minutes of meeting
- To assist chairperson

c) Accountant

- To take in charge with management of water fund

d) 2 caretakers (1 man and 1 woman)

Two (2) caretakers should be neighbors of hand pump so that daily inspection will be conducted easily. Caretakers will be in charge with technical aspect.

Table 8.12 Proposed Caretakers' Work

Works	Detail Work
1. Daily Inspection	■ To confirm hand pump conditions at sight. ■ To check platform and drainage conditions. ■ Lubrication and greasing fixtures
2. Regular Inspection (every six months)	■ To inspect items specified in monitoring sheet. ■ To take quick action in case any damages in handpump are detected.
3. Emergency Inspection	■ To conduct minor repairs, such as those required for platform and drainage canals, tightening of bolts and replacement of bolts, rings, seals and O-shaped rings, etc., ■ Major repairs also require bigger tools. Hence, caretakers will get in touch with PDRD so that PDRD dispatch local handpump mechanics for repair (e.g. damage or breakdown in the foundation of handpump, replacement of spare parts etc.)
4. Minor Repairs	■ To repair damage or breakdown in platform and drainage canals ■ To tighten and replace bolts and nuts ■ To replace washers ■ To replace O-shaped rings

e) 2 pump maintenance (1 man and 1 woman)

- To clean hand pump environment
- To promote hygiene education to users

(2) Support Structure

1) Village Level

a) Village Development Committee (VDC)

Guideline for VDC seems not to be defined clearly among concerning working groups. Establishment of VDC depends on support agencies' programs. Some agencies supported to establish sectional committees directly if there is no VDC.

In villages where VDC was established, VDC has a responsibility to take care of village development program in all sectors. Specific sectors such as Water Supply, Health and Education are belong to VDC as sub-committee. One of VDC members will be a chairperson of sub-committee. VDC takes initiative to organize sectional sub committee and coordinate issues arising from the committee. Furthermore, VDC will be a main channel to coordinate with external support agencies.

In recent discussion on new guideline for VLOM among some working groups and the Department of Community Department in MRD, to strengthen VDC function as a core organization of village development activities was widely accepted. Under this policy establishment of VDC is promoted prior to establishment of specific sectional committees. Structures and roles of VDC will be consolidated through further program in new guideline.

Regarding VDC structure, support agencies recommend 5 to 9 members to be elected by village people in meeting. Half of the members should be women. Chairperson, secretary and accountant are commonly recommended by support agencies. However, other recommended members are slightly different in each province. Members who are in charge with specific sector such as health and education, water and environment, food, and so on are suggested in some provinces. Arrangement of detail structure depends on village community.

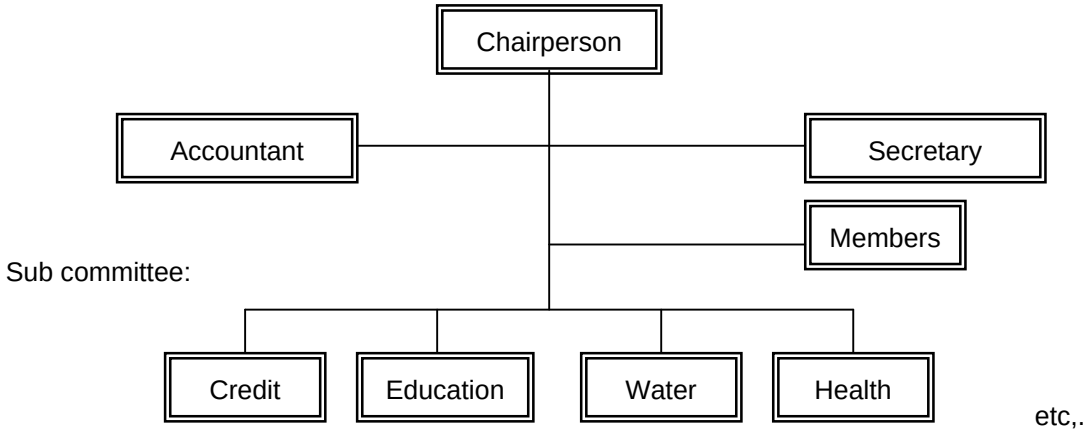


Figure 8.6 VDC Organization Structure

b) Responsibilities of water sector of VDC

- To assess and identify water needs and problems
- To facilitate group selection for water well drilling
- To plan water supply program and coordinate with VWC
- To communicate with WPC and VWC
- To follow up and monitor the water well/hand pump conditions
- To discuss resolution related with water supply activities
- To communicate with focal agencies for water supply program

2) Province Level

Rural Water Supply Bureau and Community Development Bureau of PDRD are most closely

related department for community water supply program. Regarding technical support, repair team of Rural Water Supply Bureau will take care of hand pump in response to request arising from WPC. Community participation will be promoted and facilitated by Community Development Bureau.

3) National Level

DRWS and Department of Community Development (DCD) are main concerning departments. DRWS will support concerning hand pump care, training caretakers on minor repair and daily inspection and supporting procurement of spare parts. Moreover, DRWS consult and support PDRD in any case. DCD is in charge with community participation program. This department will coordinate policy-makers on community-based approach and guideline for community organization.

8.7.3 Notification system and maintenance record

(1) Notification system

The notification system in O&M support network between concerning parties such as WPC, VWC, PDRD and DRWS will be in accordance with the support system of national policy. In case of any abnormalities in the hand pump, countermeasures will be immediately taken in accordance with the system as explained in Figure 8.7. If hand pump were damaged seriously, which were beyond village community capabilities, province or national level support will be necessary. Moreover, almost all of official organization at commune and district levels seemed not to be functioned actually.

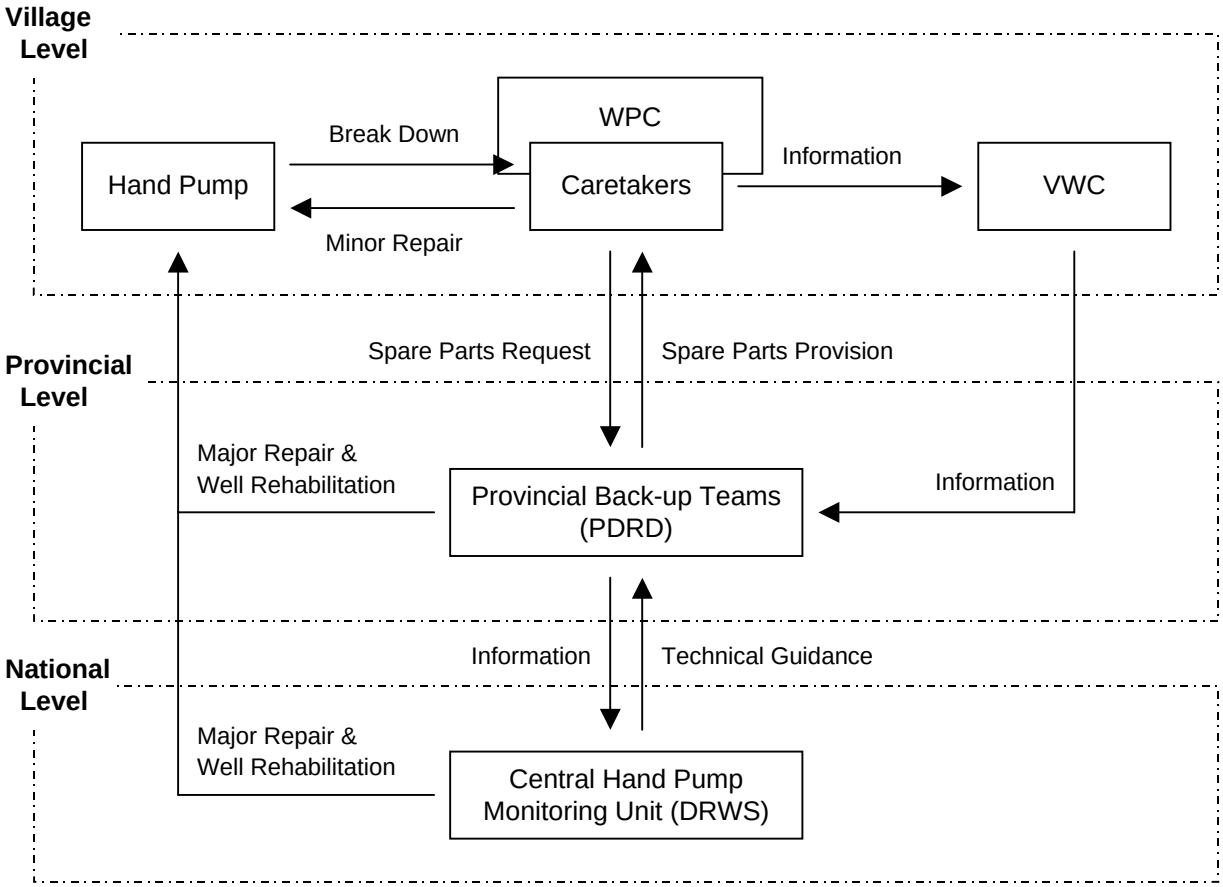


Figure 8.7 Notification System for O&M

The followings are described on in which notification system will be necessary and work out:

a) Receipt of primary spare parts and maintenance tools for WPC

After operation and maintenance education program is completed, the primary stocks of spare parts and maintenance tools will be provided to WPC. The spare parts and tools shall be stored properly to avoid misuse and loss. A receipt will be required for the provision of spare parts and tools as shown in Table 8.13.

b) Method of requesting spare parts

In case additional spare parts are required, WPC shall submit the request to PDRD through VWC, using the form of spare parts request as shown in Table 8.14. However, the cost of the spare parts shall be paid by water fund charging to all the users of the well.

c) Method of requesting repair and maintenance

In case facilities are judged by the caretakers to be repaired immediately, a request shall be sent to PDRD, using the form of repair/maintenance request as shown in Table 8.15. The

spare parts for this kind of repair will be provided with PDRD. The cost for the repair and spare parts shall be paid by water fund pooled by WPC by collecting water charges from the users.

(2) Maintenance Record

Recording skill is one of important factors to communicate outsiders and review their activities. In case the handpump undergoes several breakdowns or needs spare parts replacement, the date to be broke down, the date to be repaired, repair fee, cause of breakdown, and the person handling the repair will be recorded in the form as shown in Table 8.16. Maintenance record will be helpful for repair expert to identify main causes.

8.7.4 Troubles to Happen

The following is a list of assumable trouble with pilot water well with hand pump. Necessary measures, persons in charge and tool & equipment to each trouble are suggested accordingly.

Table 8.17 List of Assumable Troubles with Hand Pump Well

	Troubles	Necessary Measures	Person in Charge	Tool & Equipment
1	Exhausted Materials	Replacement of spare parts	Village Caretakers	■ Fishing tool ■ Socket spanner ■
2	Unidentified trouble	Inspection and repair	PDRD	■ Fishing tool ■ Socket spanner ■ Pick up
3	Broken major items	Repair or replacement of parts	PDRD	■ Fishing tool ■ Socket spanner ■ Pick up
4	Sand sedimentation in borehole	Well development	PDRD	■ Air Compressor ■ Truck with crane

8.7.5 Spare Part s and Maintenance Tools

According to VLOM structure, primary stock of spare parts and maintenance tools shall be provided to WPC and secondary stock of spare parts and maintenance tools shall be provided to PDRD so that whenever spare parts may be consumed and maintenance tools may be lost in WPC, PDRD can sell spare parts and maintenance tools to WPC. PDRD will procure more spare parts and maintenance tools with money collected from WPC.

In the water supply program Afridev is recommended hand pump. The followings spare parts and maintenance tools are for Afridev hand pump.

Cost of following items is shown in the Table 8.10 Project Cost as Procurement Equipment except Afridev spare part set and maintenance tools for WPC which is included into Construction Cost.

(1) Necessary O&M materials for WPC

a) Afridev Spare Part Set: 530 sets (1 set each/WPC)

No.	Description	Quantity
1	Rubber Rod Centralisers SKAT FIG 505	10 pieces
2	Bush Bcaring Sets SKAT 100&101	4 sets
3	Valve Bobbing as per SKAT FIG 555	2 sets
4	U-Seals per SKAT 556	2 pieces
5	O-Ring for Foot Valve per SKAT 558	2 pieces

b) Afridev Maintenance Tools: 530 sets (1 set each/WPC)

No.	Description	Quantity
1	Fishing tool	1 piece
2	Socket spanner	1 piece

(2) Necessary O&M materials for PDRD

In consideration with troubles to be happened in hand pump, the following spare parts are considered necessary to be provided.

a) Afridev Spare Part Set: 530 sets (same number of total wells)

No.	Description	Quantity
1	Rubber Rod Centralisers SKAT FIG 505	10 pieces
2	Bush Bcaring Sets SKAT 100&101	4 sets
3	Valve Bobbing as per SKAT FIG 555	2 sets
4	U-Seals per SKAT 556	2 pieces
5	O-Ring for Foot Valve per SKAT 558	2 pieces

b) Afridev Maintenance Tools: 53 sets (10 % of total wells)

No.	Description	Quantity
1	Fishing tool	1 piece
2	Socket spanner	1 piece

c) Hand Pump Assembly Set: 53 sets (10% of total wells)

No.	Description	Quantity
1	Pump Head Assembly	53 sets
2	Cylinder Assembly	53 sets
3	Pump Rod Assembly	53 sets

d) Riser Pipes: 530 pieces (10% of total wells)

e) Pick Up Truck for Transportation: 2 units

8.7.6 Operation and Maintenance Cost

Annual operation and maintenance cost at village level is estimated considering spare parts cost, periodical PDRD inspection to be done once a year, fuel and allowance for PDRD mechanics to be dispatched for one (1) day-repair. Moreover, in order to replace hand pump set in ten (10) years, new hand pump set price of US$ 160 is put into annual O&M cost. Furthermore, well development is considered as necessary works for O&M to be done once three (3) years. The annual cost of well development is estimated at US$ 48.

Total amount of O&M cost is estimated at US$ 132 annually. These necessary costs will be raised from users annually. According to Chapter 8.3, estimated beneficiaries per hand pump are 210 people. Thus estimated annual cost per family (estimated as one family has five members) is US$ 3 as shown in the table below:

Table 8.18 Annual O&M cost at village level

	Description	Unit cost (US$)	Quantity	Total (US$)	Remark
1	Renewal of spare parts	11.0	1 set	11.0	Every year
2	PDRD staff allowance	5.0	2 person	10.0	Annual Monitoring
3	Patrol car	25.0	1day	25.0	Ditto
4	Well development	160.0	0.3 times	48.0	Every 3 years
5	DRWS staff allowance	15.0	0.6 person	9.0	Ditto
6	Patrol car	25.0	0.3 day	7.5	Ditto
7	Renewal of Hand pump	160.0	0.1 set	16.0	Every 10 years
8	DRWS staff allowance	15.0	0.2 person	3.0	Ditto
9	Patrol car	25.0	0.1 day	2.5	Ditto
	Total			132.0	

Exchange rate: US$ 1.00 = 3,910 Riel =133 Yen

Of the 20 villages that were monitored on “The Study on Groundwater Development in Southern Cambodia”, the rate of water charge collection was only 35%. When asked why during interviews, the replies were “even if fees were collected, there is no safe bank or safety box to store it in” and “fees will be collected when repairs are needed”. A method for collection needs to be examined for each village based on their individual situations.

8.7.7 Monitoring Program

In order to realize sustainable use of the facilities, periodical inspections of the facilities and O&M practices need to be conducted and the problem the facilities need to be taken care of.

(1) Implementation of Monitoring

Monitoring activities should be conducted long-term and the Rural Water Supply Bureau and Community Development Bureau of PDRD, which has jurisdiction over the target area, should be the responsible body. However, as the staff of the PDRD has neither the experience nor the know-how, monitoring for the first year after construction of the facility should be included as part of the Project. During that time, the PDRD staff should be given technical training to prepare them with the necessary skills to continue monitoring effectively once the Project is complete.

Moreover, two 4WD pickup trucks should be procured for patrolling activities as part of the Project, as the Rural Development Section cannot afford to do so.

(2) Method of Monitoring

Two PDRD staff members (one in charge of water supply facilities and the other in charge of the community organization), together with the WPC and the VWC, should conduct the monitoring activities listed below. Monitoring should be conducted annually for each village.

① The water supply facilities should be inspected and if damaged parts are discovered, they should be repaired immediately. The cause and reason for delay of repairs should also be determined.

② It should be confirmed as to whether or not the facilities are being adequately maintained.

③ It should be confirmed as to whether or not the O&M system in running smoothly.

④ Based on the above results, the matters that need to be improved should be pointed out to WPC and VWC members and guidance should be given accordingly.

(3) Monitoring Costs

As the PDRD does not have the budget, the users, who are the beneficiaries, should cover the costs. The PDRD staff allowance and vehicle costs for patrol activities to be conducted once a year have been appropriated in the Maintenance Costs in Table 8.18.

8.8 Guidance in O&M & Sanitation Campaign

O&M and health education program is a key factor in water supply program. In order to achieve sustainability of the program, the consultant will form a team consisting of local consultant, DRWS and PDRD, to promote O&M and health education. Local consultant shall be employed for the implementing stage from the beginning until one (1) year after completion of construction.

Details of activity are as follows,

(1) From the Planning Stage

The consultant team will involve the village community through as WPC in terms of methodology to promote VLOM and health education. At the same time, provincial officials will be trained as closest counterparts to the village community in O&M and health sectors.

(2) In the Construction Stage

Village community participation in construction works will be promoted to a maximum extent, which lead their ownership to the community. Moreover, the village community will be trained in hand pump installation and repair, construction/installation of incidental facilities (e.g., iron removal equipment).

(3) After Completion of the Construction Works

The local consultant will keep monitoring village community and administrative officials at province and village level, and hold a meeting or workshop to consolidate what they were input for O&M, if necessary. Every time monitoring the village community, the local consultant will refer to indicators to measure their achievement and pursue improvement way.

(4) Hygiene and Health Education

Hygiene and health education will be conducted through overall stages. In particular hygiene concept will be disseminated to the community for disease-prevention.

Through the above-mentioned activities, our main concern is to stimulate village community's awareness and enhance their capacity for O&M. Support capacity of organizations such as PDRD and DRWS will be built at higher level simultaneously.

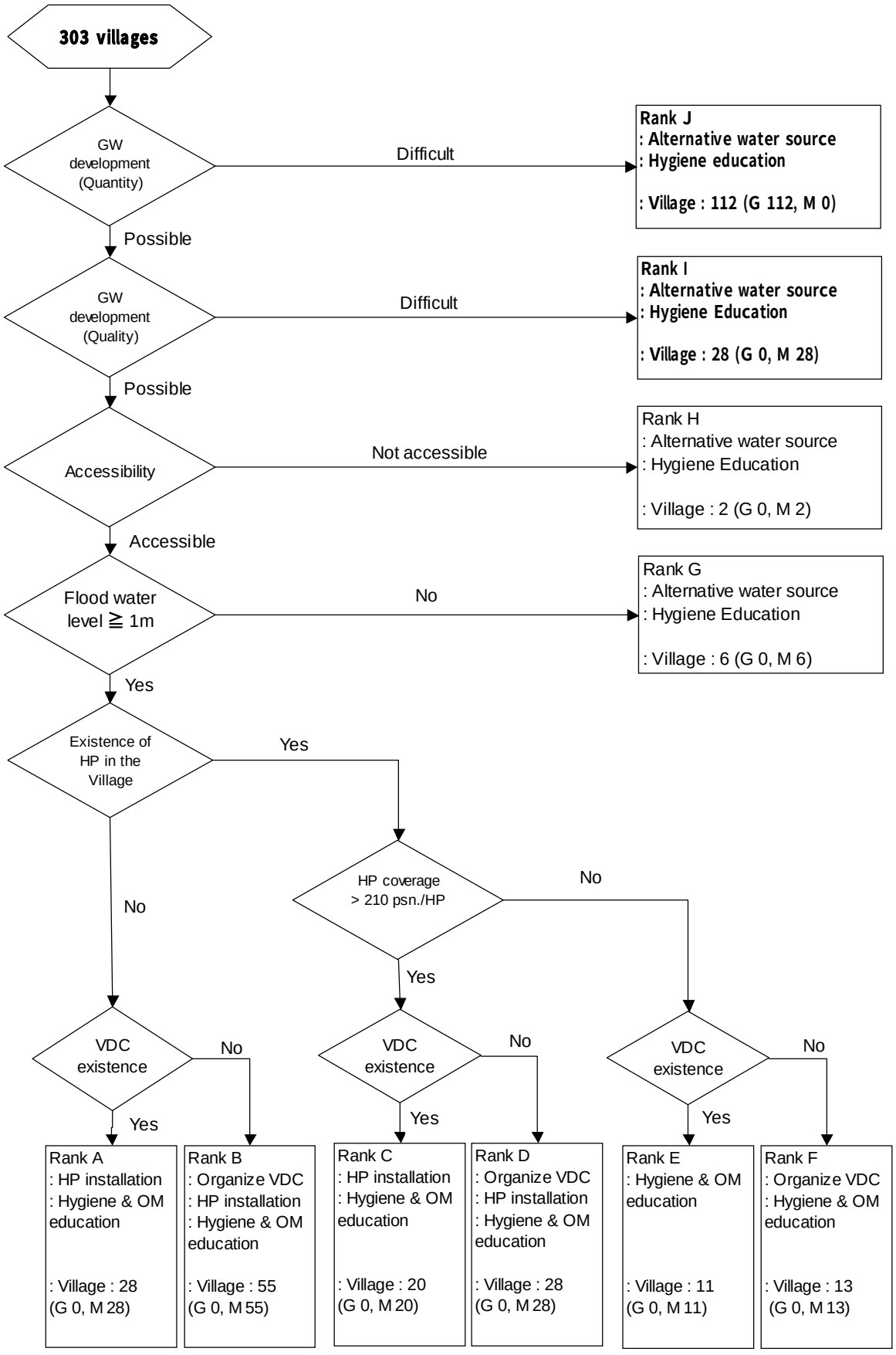


Figure 8.1 Flow Chart of Village Classification

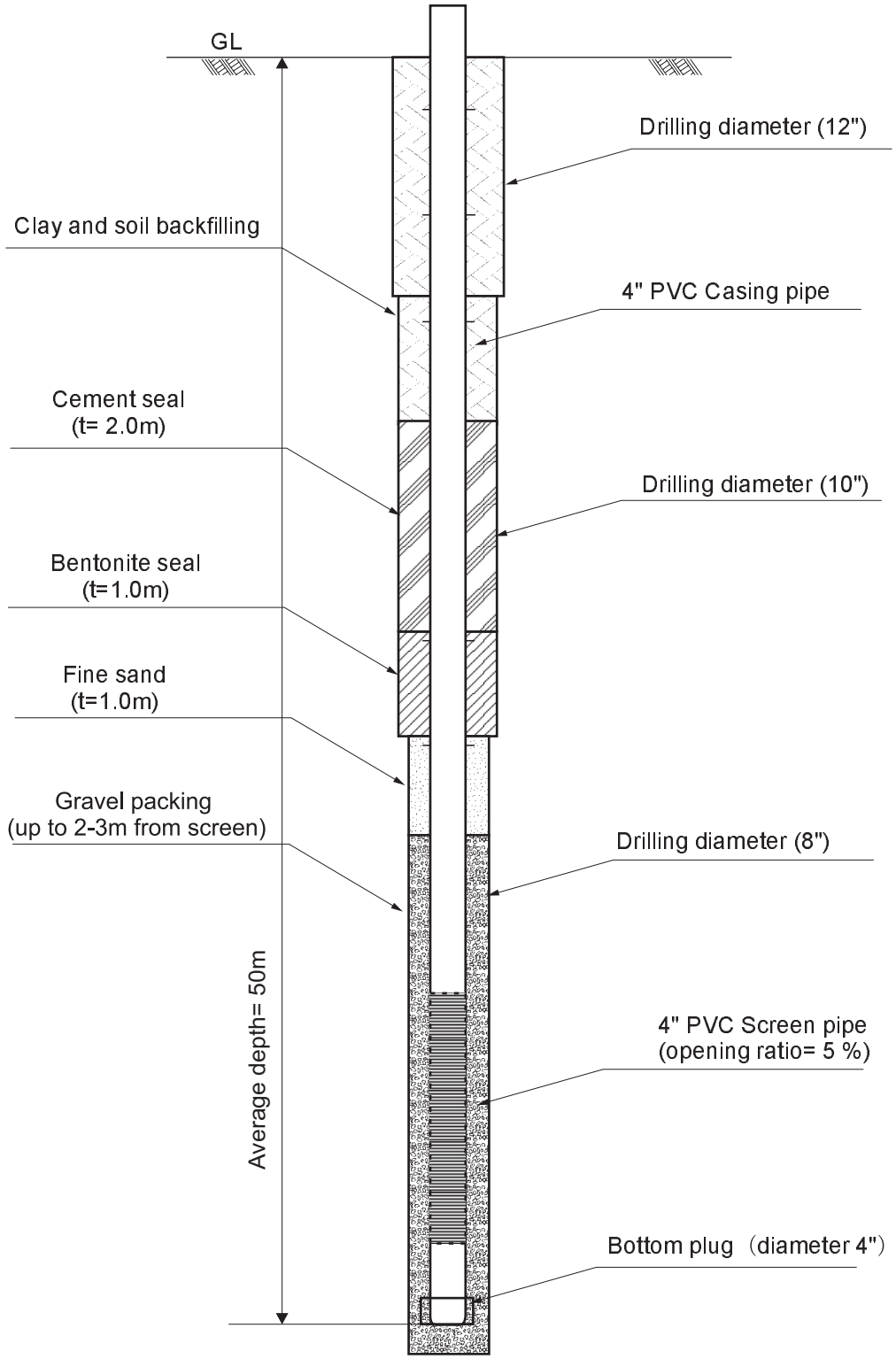
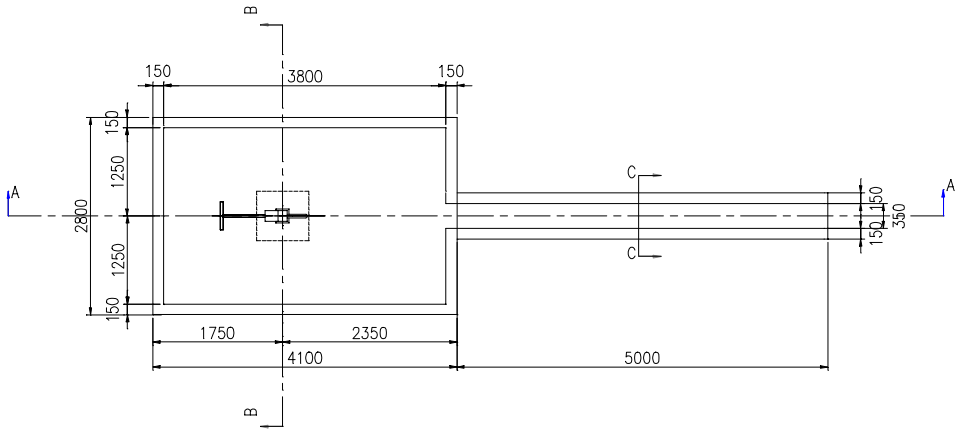
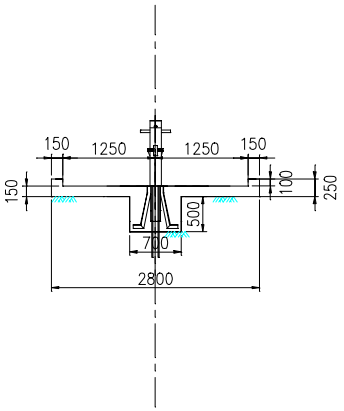


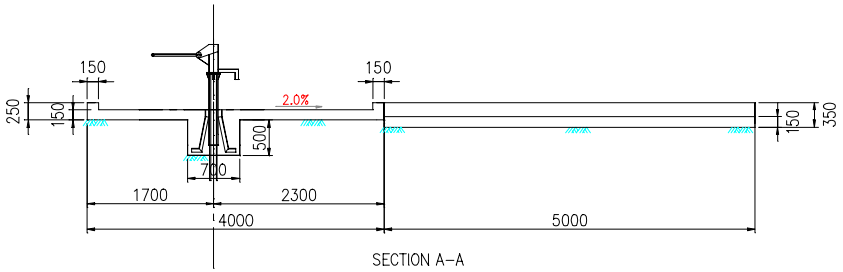
Figure 8.3	Design of Well Structure
THE STUDY ON THE GROUNDWATER DEVELOPMENT IN CENTRAL CAMBODIA	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	



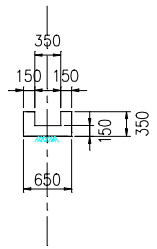
PLAN



SECTION B–B



SECTION A–A



SECTION C–C

Figure 8.4 Design of Platform and Drain

S=1/40

REMARK
Concrete Strength: 21 N/mm2
Reinforcing Steel Bar: ϕ9mm @ 150mmX150mm
Embankment shall be 35cm higher than ground level

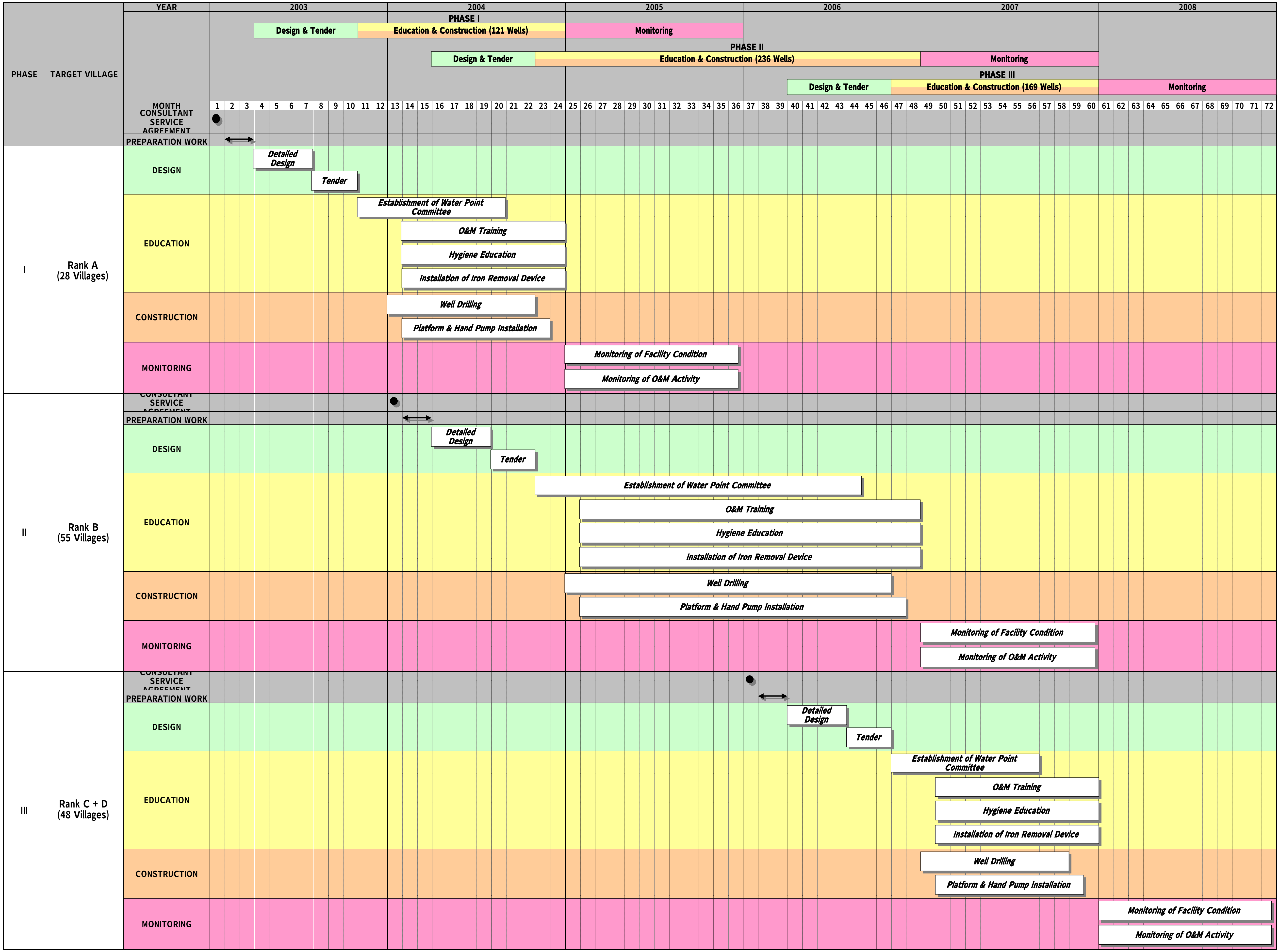


Figure 8.5 Implementation Schedule

Table 8.2 Results of 303 Villages Classification (1/6)

Province	District	Commune	Village No.	Village Name	Population in 2001	Population in 2005	Necessary Borehole Well (210 psn/well)	Existing Borehole Well	JICA Study Well	Required New Borehole Well	Accessibility	Flood damage (times/10 years)	Flood water level (m)	Existence of VDC	Rank
Kampong Chhnang	Kg. Leng	Tra Nget	4	Trabaek	793	868	5	0	0	5	D	1	1.0	Y	J
Kampong Chhnang	Kg. Leng	Tra Nget	5	Chres	429	469	3	0	0	3	D	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Tra Nget	6	Tumnob	830	907	5	0	0	5	D	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Tra Nget	7	Trapeang Mess	345	377	2	0	0	2	D	1	0.3	Y	J
Kampong Chhnang	Kg. Leng	Tra Nget	8	Andoung Ronuk	690	754	4	1	0	3	D	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Svay	10	Chambak Khpos	1,086	1,186	6	0	0	6	D	1	1.0	Y	J
Kampong Chhnang	Kg. Leng	Rumpear	12	Knong	1,078	1,177	6	1	0	5	D	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Rumpear	13	Lvea	1,254	1,370	7	0	0	7	D	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Rumpear	14	Ta Lat	966	1,055	6	0	0	6	C	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Dear	15	Dar	1,490	1,636	8	0	0	8	C	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Dear	16	Thnal	1,098	1,199	6	0	0	6	C	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Dear	17	Chrolong	839	916	5	0	0	5	C	1	0.5	Y	J
Kampong Chhnang	Kg. Leng	Dear	18	Prasat	946	1,033	5	0	0	5	C	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Dear	19	Kuy	542	592	3	2	0	1	C	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Chranouk	20	Kanglaeb	1,376	1,503	8	0	0	8	C	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Chranouk	21	Thlok	1,559	1,703	9	1	0	8	C	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Chranouk	22	Ae Lech	2,055	2,245	11	0	0	11	D	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Chranouk	23	Kandal	1,513	1,653	8	0	0	8	D	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Pou	24	Pou	878	959	5	0	0	5	D	0	0.0	N	J
Kampong Chhnang	Kg. Leng	Pou	25	Damnak Kakaoh	444	485	3	0	0	3	D	0	0.0	Y	J
Kampong Chhnang	Kg. Leng	Pou	28	Thnal	507	554	3	0	0	3	C	3	N/A	Y	J
Kampong Chhnang	Kg. Leng	Pou	29	Peam Tonlee	678	741	4	0	0	4	C	0	0.0	Y	J
Kampong Chhnang	Kg. Tralaach	Chhuk Sa	30	Andoung Tramung	901	984	5	3	0	2	B	0	0.0	N	J
Kampong Chhnang	Kg. Tralaach	Chhuk Sa	32	Prey Pear	560	612	3	3	0	0	B	0	0.0	Y	J
Kampong Chhnang	Kg. Tralaach	Chhuk Sa	34	Trapeang Chrov	358	391	2	0	0	2	B	0	0.0	Y	J
Kampong Chhnang	Kg. Tralaach	Chhuk Sa	35	Trapeang Khtum	773	844	5	0	1	4	C	N/A	N/A	N	J
Kampong Chhnang	Kg. Tralaach	Chrees	40	Serei Chhaom	484	529	3	0	0	3	C	0	0.0	Y	J
Kampong Chhnang	Kg. Tralaach	Chrees	41	Veal Lvieng	599	654	4	0	0	4	B	1	0.8	Y	J
Kampong Chhnang	Kg. Tralaach	Chrees	42	Ou	591	646	4	1	0	3	B	3	0.5	Y	J
Kampong Chhnang	Kg. Tralaach	Chrees	43	Samy Andaet	540	590	3	0	0	3	B	0	0.0	Y	J
Kampong Chhnang	Kg. Tralaach	Chrees	44	Kanhchroung	1,036	1,132	6	2	0	4	B	0	0.0	N	J
Kampong Chhnang	Kg. Tralaach	Chrees	45	Prey Pis	681	744	4	2	1	1	A	N/A	N/A	Y	J
Kampong Chhnang	Kg. Tralaach	Chrees	46	Prah Phcheah	796	869	5	1	0	4	B	0	0.0	N	J
Kampong Chhnang	Kg. Tralaach	Chrees	48	Chumteav	846	924	5	1	0	4	B	0	0.0	N	J
Kampong Chhnang	Kg. Tralaach	Tra Chees	50	La Peang	447	488	3	1	0	2	B	4	0.5	Y	J
Kampong Chhnang	Kg. Tralaach	Tra Chees	52	Samraong	865	945	5	9	0	0	A	2	0.5	Y	J
Kampong Chhnang	Kg. Tralaach	Tra Chees	53	Svay Krom	1,030	1,125	6	3	0	3	A	0	0.0	Y	J
Kampong Chhnang	Kg. Tralaach	Tra Chees	54	Souvong	587	641	4	3	0	1	A	0	0.0	Y	J
Kampong Chhnang	Kg. Tralaach	Tra Chees	55	Svay Bakav	1,770	1,933	10	1	0	9	B	0	0.0	Y	J
Kampong Chhnang	Kg. Tralaach	Tra Chees	57	Thlok Yol	480	524	3	1	0	2	B	0	0.0	Y	J
Kampong Chhnang	Kg. Tralaach	Tra Chees	58	Ta Kaoh	433	473	3	0	0	3	B	2	0.5	Y	J
Kampong Chhnang	Kg. Tralaach	Tra Chees	61	Sampoar	693	757	4	2	1	1	B	2	0.7	N	J
Kampong Chhnang	Rolea Bier	Bantaey	62	Phlov Kou	371	405	2	1	0	1	B	0	0.0	N	J
Kampong Chhnang	Rolea Bier	Preal	63	Toap Srov	500	546	3	0	0	3	C	0	0.0	N	J
Kampong Chhnang	Rolea Bier	Preal	65	Sdok Kabbas	508	555	3	0	0	3	B	0	0.0	N	J
Kampong Chhnang	Rolea Bier	Preal	66	Trapeang Phkoam	449	490	3	0	0	3	B	0	0.0	N	J
Kampong Chhnang	Rolea Bier	Krang Leav	72	Tuek L'ak	688	751	4	10	1	0	B	0	0.0	N	J
Kampong Chhnang	Rolea Bier	Krang Leav	76	Andoung Preng	819	895	5	4	0	1	B	0	0.0	Y	J
Kampong Chhnang	Rolea Bier	Prasneb	77	Prey Sampov	831	908	5	0	0	5	C	0	0.0	Y	J
Kampong Chhnang	Rolea Bier	Prasneb	78	Chonleav	416	454	3	0	0	3	C	0	0.0	Y	J
Kampong Chhnang	Rolea Bier	Prasneb	79	Sting	638	697	4	0	0	4	C	0	0.0	Y	J
Kampong Chhnang	Rolea Bier	Prasneb	81	Trapeang Ampil	909	993	5	9	0	0	B	0	0.0	N	J
Kampong Chhnang	Rolea Bier	Prasneb	82	Prasneb	843	921	5	0	1	4	B	N/A	N/A	N	J

Table 8.2 Results of 303 Villages Classification (2/6)

Province	District	Commune	Village No.	Village Name	Population in 2001	Population in 2005	Necessary Borehole Well (210 psn/well)	Existing Borehole Well	JICA Study Well	Required New Borehole Well	Accessibility	Flood damage (times/10 years)	Flood water level (m)	Existence of VDC	Rank
Kampong Chhnang	Rolea Bier	Prasneb	83	Chor	609	685	4	0	0	4	C	N/A	N/A	N	J
Kampong Chhnang	Rolea Bier	Srae Thnei	85	Chankar Ta Mau	639	698	4	11	1	0	B	0	0.0	N	J
Kampong Chhnang	Tuec Phos	Chieb	90	Tumnob Thmei	1,427	1,559	8	8	0	0	C	0	0.0	Y	J
Kampong Chhnang	Tuec Phos	Chieb	93	Kaoh Kandal	364	398	2	7	0	0	C	0	0.0	Y	J
Kampong Chhnang	Tuec Phos	Kbal Tuek	96	Kravang Doh Laeung	650	710	4	0	0	4	C	N/A	N/A	N	J
Kampong Chhnang	Tuec Phos	Tuol Khpos	105	Voat	256	280	2	3	0	0	D	0	0.0	N	J
Kampong Chhnang	Tuec Phos	Krang Skear	109	Krang Skear	821	897	5	4	0	1	C	0	0.0	Y	J
Kampong Chhnang	Tuec Phos	Krang Skear	110	Tuol Samraong	614	671	4	2	0	2	C	0	0.0	Y	J
Kampong Chhnang	Tuec Phos	Krang Skear	111	Phnum Ta Sam	1,192	1,302	7	6	0	1	D	0	0.0	Y	J
Kampong Chhnang	Tuec Phos	Krang Skear	112	Chan Trak	686	749	4	5	0	0	C	2	1.0	Y	J
Kampong Chhnang	Tuec Phos	Krang Skear	113	Trapeang Mlu	585	639	4	4	0	0	B	0	0.0	Y	J
Kampong Chhnang	Tuec Phos	Krang Skear	114	Kdol	490	535	3	0	0	3	C	N/A	N/A	Y	J
Kampong Chhnang	Tuec Phos	Krang Skear	115	Krang Skear Tboung	316	345	2	2	0	0	C	1	0.5	Y	J
Kampong Chhnang	Tuec Phos	Krang Skear	116	Chambak Prasat	962	1,051	6	5	0	1	C	0	0.0	Y	J
Kampong Chhnang	Tuec Phos	Akphivoath	119	Srae Khtum	442	483	3	4	0	0	C	3	0.8	Y	J
Kampong Chhnang	Tuec Phos	Akphivoath	120	Tuek Chum	516	564	3	4	0	0	C	3	0.6	Y	J
Kampong Chhnang	Tuec Phos	Akphivoath	121	Ropeak	344	376	2	6	0	0	C	0	0.0	Y	J
Kampong Chhnang	Tuec Phos	Akphivoath	123	Trapeang Pring	715	781	4	5	0	0	C	0	0.0	Y	J
Kampong Chhnang	Tuec Phos	Tang Krasang	130	Srae Uk	732	800	4	0	0	4	B	0	0.0	Y	J
Kampong Chhnang	Saamaki Mean Chey	Krang	145	Thnal	565	617	3	13	0	0	C	N/A	N/A	Y	J
Kampong Chhnang	Saamaki Mean Chey	Lvear	146	Krang Lvea	641	700	4	11	0	0	C	N/A	N/A	Y	J
Kampong Chhnang	Saamaki Mean Chey	Lvear	147	Ou Kakhob	625	683	4	4	0	0	C	0	0.0	Y	J
Kampong Chhnang	Saamaki Mean Chey	Lvear	148	Chres	658	719	4	6	0	0	C	N/A	N/A	Y	J
Kampong Chhnang	Saamaki Mean Chey	Lvear	149	KhnaTey Mouk	341	372	2	3	0	0	C	N/A	N/A	Y	J
Kampong Chhnang	Saamaki Mean Chey	Lvear	150	Ta Krong	492	537	3	5	0	0	B	N/A	N/A	Y	J
Kampong Chhnang	Saamaki Mean Chey	Lvear	154	Tang Kruos Kaeut	1,226	1,339	7	12	0	0	C	N/A	N/A	Y	J
Kampong Chhnang	Saamaki Mean Chey	Seedthei	156	Thlok Ruessei	694	758	4	2	0	2	C	N/A	N/A	Y	J
Kampong Chhnang	Saamaki Mean Chey	Seedthei	158	Khnach	433	473	3	1	0	2	C	0	0.0	Y	J
Kampong Chhnang	Saamaki Mean Chey	Seedthei	159	Krang Siem	430	470	3	2	0	1	C	0	0.0	Y	J
Kampong Chhnang	Saamaki Mean Chey	Seedthei	160	Angkrong	440	481	3	3	0	0	B	0	0.0	Y	J
Kampong Chhnang	Saamaki Mean Chey	Seedthei	161	Voat Sedthei	636	695	4	4	0	0	B	2	0.7	Y	J
Kampong Chhnang	Saamaki Mean Chey	Seedthei	162	Peareach	862	963	5	4	1	0	A	N/A	N/A	Y	J
Kampong Chhnang	Saamaki Mean Chey	Tbaeng	165	Neang Mealea	675	737	4	5	0	0	B	0	0.0	Y	J
Kampong Chhnang	Saamaki Mean Chey	Khpos	166	Veal Ta King	420	459	3	3	0	0	B	0	0.0	Y	J
Kampong Chhnang	Saamaki Mean Chey	Khpos	168	Tbaeng Khpos	619	676	4	2	1	1	B	0	0.0	N	J
Kampong Chhnang	Saamaki Mean Chey	Khpos	169	Srae Mlak	1,813	1,980	10	4	0	6	B	1	1.5	Y	J
Kampong Chhnang	Saamaki Mean Chey	Khpos	171	Meanok Kaeut	1,117	1,220	6	9	0	0	C	0	0.0	Y	J
Kampong Chhnang	Baribour	Chak	174	Pou Mreah	591	645	4	3	0	1	B	10	1.0	Y	J
Kampong Chhnang	Baribour	Chak	176	Chak	472	516	3	3	0	0	C	10	1.5	Y	J
Kampong Chhnang	Baribour	Chak	177	Dangkhau Mau	410	448	3	1	0	2	C	10	1.0	Y	J
Kampong Chhnang	Baribour	Phsaar	178	Kbal Thnal	818	893	5	6	0	0	B	1	1.0	Y	J
Kampong Chhnang	Baribour	Phsaar	179	Kan Prong	515	562	3	4	0	0	B	1	0.8	Y	J
Kampong Chhnang	Baribour	Phsaar	180	Chunteav Botrei	548	599	3	1	0	2	B	10	0.5	Y	J
Kampong Chhnang	Baribour	Phsaar	182	Phniet	591	645	4	1	0	3	A	1	N/A	Y	J
Kampong Chhnang	Baribour	Peech	183	Tang Thnuem	705	770	4	0	0	4	C	0	0.0	N	J
Kampong Chhnang	Baribour	Changvaar	184	Tang Trapeang	548	599	3	0	0	3	C	0	0.0	N	J
Kampong Chhnang	Baribour	Changvaar	186	Krang Kakaoh	322	352	2	0	0	2	C	1	N/A	N	J
Kampong Chhnang	Baribour	Changvaar	187	Tuek Chrodo	452	494	3	0	0	3	B	10	1.5	N	J
Kampong Chhnang	Baribour	Changvaar	188	Thnal	311	340	2	0	0	2	C	N/A	N/A	Y	J
Kampong Chhnang	Baribour	Ponley	189	Ponley	1,537	1,679	8	11	1	0	A	N/A	N/A	Y	J
Kampong Chhnang	Baribour	Ponley	190	Cheung Khnar	1,259	1,375	7	2	0	5	A	0	0.0	N	J
Kampong Chhnang	Baribour	Ponley	193	Ou	1,412	1,542	8	5	0	3	C	4	0.5	Y	J
Kampong Chhnang	Baribour	Trapeang	195	Kandal	895	978	5	4	0	1	C	10	0.5	N	J

Table 8.2 Results of 303 Villages Classification (3/6)

Province	District	Comnune	Village No.	Village Name	Population in 2001	Population in 2005	Necessary Borehole Well (210 psn/well)	Existing Borehole Well	JICA Study Well	Reqired New Borehole Well	Accessibility	Flood damage (times/10 years)	Flood water level (m)	Existence of VDC	Rank
Kampong Chhnang	Baribour	Chan	196	Sang Lang	918	1,003	5	2	0	3	C	0	0.0	N	J
Kampong Chhnang	Baribour	Chan	197	Kbal Damrei	1,179	1,288	7	3	1	3	A	N/A	N/A	Y	J
Kampong Chhnang	Baribour	Anhchanh	199	Andoung Roviang	1,342	1,466	7	8	0	0	C	0	0.0	N	J
Kampong Chhnang	Baribour	Rung	201	Prey Preal	368	402	2	0	0	2	A	0	0.0	N	J
Kampong Chhnang	Baribour	Rung	202	Stueng Thmei	802	876	5	2	0	3	B	3	0.5	Y	J
Kampong Chhnang	Baribour	Rung	203	Thlok Chrov	678	741	4	0	0	4	C	0	0.0	N	J
Kampong Cham	Memot	Dar	7	Dar Cheung	764	834	4	0	0	4	A	0	0.0	Y	A
Kampong Cham	Memot	Dar	8	Dar Lech	997	1,089	6	0	1	5	A	N/A	N/A	N	D
Kampong Cham	Memot	Dar	9	Dar Phsar	1,225	1,338	7	3	0	4	A	0	0.0	N	D
Kampong Cham	Memot	Dar	10	Dar Kandaol	1,868	2,040	10	4	0	6	A	0	0.0	N	D
Kampong Cham	Memot	Dar	11	Prampir Meakbakra	1,066	1,164	6	0	0	6	A	0	0.0	N	B
Kampong Cham	Memot	Dar	12	Dar Tboung	961	1,050	5	1	0	4	B	0	0.0	N	D
Kampong Cham	Memot	Dar	13	Triek	410	448	3	0	0	3	D	0	0.0	Y	H
Kampong Cham	Memot	Dar	14	Speun	1,966	2,147	11	7	0	4	C	0	0.0	N	D
Kampong Cham	Memot	Dar	15	Meaek Puk	450	492	3	0	1	2	C	N/A	N/A	N	D
Kampong Cham	Memot	Dar	16	Sree Chroam	930	1,016	5	0	0	5	A	0	0.0	Y	A
Kampong Cham	Memot	Dar	17	Chhngar Cheung	780	852	5	0	0	5	C	0	0.0	Y	A
Kampong Cham	Memot	Dar	18	Chhngar Kandal	400	437	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Dar	19	Samraong	537	587	3	0	1	2	A	N/A	N/A	N	D
Kampong Cham	Memot	Dar	21	Beng	388	424	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Rung	22	Chambek	953	1,041	5	0	0	5	C	0	0.0	N	B
Kampong Cham	Memot	Rung	24	Doun Roadth Ti Pir	671	733	4	0	0	4	C	0	0.0	N	B
Kampong Cham	Memot	Rung	25	Bos	536	585	3	0	0	3	C	1	0.4	N	B
Kampong Cham	Memot	Rung	26	Choam Tuk	507	554	3	2	0	1	B	0	0.0	N	D
Kampong Cham	Memot	Rung	27	Rung	584	638	4	0	0	4	C	0	0.0	N	B
Kampong Cham	Memot	Rung	28	Taonh	378	413	2	1	0	1	B	0	0.0	Y	C
Kampong Cham	Memot	Rung	29	Doung	504	550	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Rung	30	Beng	461	504	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Rung	31	Masin	647	707	4	0	0	4	C	0	0.0	N	B
Kampong Cham	Memot	Rung	32	Andoung Ta Chou	422	461	3	4	0	0	C	0	0.0	N	F
Kampong Cham	Memot	Rung	33	Soutey	1,089	1,189	6	0	0	6	C	0	0.0	Y	A
Kampong Cham	Memot	Rung	34	Trapeang Ruessei	1,080	1,180	6	0	0	6	C	0	0.0	N	B
Kampong Cham	Memot	Chan Mul	35	Thlok	545	595	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Chan Mul	36	Chan Mul	1,107	1,209	6	1	0	5	C	0	0.0	N	D
Kampong Cham	Memot	Chan Mul	37	Stan	830	907	5	0	0	5	C	0	0.0	N	B
Kampong Cham	Memot	Chan Mul	38	Sree Ta Nong Kaeut	460	502	3	1	0	2	C	0	0.0	N	D
Kampong Cham	Memot	Chan Mul	39	Sree Ta Nong Lech	340	371	2	0	0	2	C	0	0.0	N	B
Kampong Cham	Memot	Chan Mul	44	Kor	561	613	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Ton Lung	46	Kdol Phsar	801	875	5	4	1	0	C	N/A	N/A	N	F
Kampong Cham	Memot	Ton Lung	47	Kdol Lou	406	443	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Ton Lung	48	Changkum Kandal	610	666	4	0	0	4	D	0	0.0	N	H
Kampong Cham	Memot	Ton Lung	50	Beng Kaong	409	447	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Ton Lung	54	Kdol Kraom	760	830	4	0	0	4	C	0	0.0	N	B
Kampong Cham	Memot	Ton Lung	55	Sla Phnum	597	652	4	0	1	3	C	N/A	N/A	N	D
Kampong Cham	Memot	Ton Lung	56	Pong Tuek	412	450	3	0	0	3	A	0	0.0	N	B
Kampong Cham	Memot	Runchek	59	Pnov	390	426	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Runchek	60	Kantuot	377	412	2	0	0	2	A	0	0.0	N	B
Kampong Cham	Memot	Runchek	62	Chheu Khloem	685	748	4	0	0	4	C	1	1.5	N	G
Kampong Cham	Memot	Runchek	63	Kampey	887	969	5	0	0	5	C	10	3.0	N	G
Kampong Cham	Memot	Runchek	64	Khpob	692	756	4	0	0	4	A	10	1.0	N	G
Kampong Cham	Memot	Memot	68	Memot Phsar	3,155	3,446	17	0	0	17	B	0	0.0	Y	B
Kampong Cham	Memot	Memot	69	Memot Kandal	1,184	1,293	7	17	0	0	B	0	0.0	Y	E
Kampong Cham	Memot	Memot	70	Memot Thmei	450	492	3	4	0	0	B	0	0.0	N	F

Table 8.2 Results of 303 Villages Classification (4/6)

Province	District	Commune	Village No.	Village Name	Population in 2001	Population in 2005	Necessary Borehole Well (210 psn/well)	Existing Borehole Well	JICA Study Well	Required New Borehole Well	Accessibility	Flood damage (times/10 years)	Flood water level (m)	Existence of VDC	Rank
Kampong Cham	Memot	Memot	71	Tboung Voat	1,327	1,449	7	8	0	0	B	0	0.0	Y	E
Kampong Cham	Memot	Memot	73	Choam Mtaor	417	455	3	0	0	3	A	0	0.0	Y	A
Kampong Cham	Memot	Memot	74	Trabaek	734	802	4	0	0	4	C	0	0.0	Y	A
Kampong Cham	Memot	Memot	75	Nang Knapeu	357	390	2	0	0	2	B	0	0.0	N	B
Kampong Cham	Memot	Memot	76	Trapeang Reang	1,707	1,864	9	0	0	9	C	0	0.0	Y	A
Kampong Cham	Memot	Memot	77	[illegible]	462	505	3	3	0	0	A	0	0.0	N	F
Kampong Cham	Memot	Memot	78	[illegible]	845	923	5	1	0	4	A	0	0.0	N	D
Kampong Cham	Memot	Memot	79	Chi Peh	987	1,078	6	0	0	6	A	0	0.0	N	B
Kampong Cham	Memot	Memot	80	Chhngar Sala	359	392	2	0	0	2	C	0	0.0	N	B
Kampong Cham	Memot	Memot	81	Mukh Kras	685	639	4	0	0	4	A	0	0.0	N	B
Kampong Cham	Memot	Tramaeng	82	Tramaeng Leu	361	394	2	0	0	2	C	0	0.0	N	B
Kampong Cham	Memot	Tramaeng	85	Tramung	949	1,037	5	2	0	3	B	0	0.0	N	D
Kampong Cham	Memot	Tramaeng	86	Choam Triek	1,040	1,136	6	1	0	5	A	0	0.0	N	D
Kampong Cham	Memot	Tramaeng	87	Roung Chak Skar	301	329	2	0	0	2	A	0	0.0	N	B
Kampong Cham	Memot	Tramaeng	88	Andoung Thma Leu	405	442	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Tramaeng	89	Andoung Thma Kraom	339	370	2	0	0	2	C	0	0.0	N	B
Kampong Cham	Memot	Tramaeng	90	Doung	340	371	2	1	0	1	C	0	0.0	N	D
Kampong Cham	Memot	Tramaeng	91	Choam Trav	417	455	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Tramaeng	92	Chhuk	656	717	4	0	1	3	C	N/A	N/A	N	D
Kampong Cham	Memot	Tramaeng	93	Ngeu Thum	663	724	4	1	0	3	C	0	0.0	N	D
Kampong Cham	Memot	Tramaeng	96	Roung Chakr Lech	2,560	2,796	14	0	0	14	B	0	0.0	N	B
Kampong Cham	Memot	Tramaeng	100	Chrey	477	521	3	0	0	3	B	0	0.0	N	B
Kampong Cham	Memot	Kampoan	101	Lour	1,334	1,457	7	1	1	5	B	N/A	N/A	Y	C
Kampong Cham	Memot	Kampoan	102	Kampoan	1,623	1,773	9	2	0	7	C	0	0.0	Y	C
Kampong Cham	Memot	Kampoan	104	Sree Saom Thnei	793	866	5	0	0	5	C	0	0.0	Y	A
Kampong Cham	Memot	Kampoan	105	Sree Saom Chas	487	532	3	0	0	3	A	0	0.0	Y	A
Kampong Cham	Memot	Kampoan	106	Tuek Tum	486	531	3	0	0	3	A	0	0.0	Y	A
Kampong Cham	Memot	Kakir	110	Sree Poul	674	736	4	0	0	4	C	0	0.0	N	B
Kampong Cham	Memot	Kakir	111	Kakir Cheung	1,485	1,622	8	1	0	7	B	0	0.0	N	D
Kampong Cham	Memot	Kakir	112	Kakir Tboung	1,069	1,168	6	0	0	6	B	0	0.0	Y	A
Kampong Cham	Memot	Kakir	113	Tuol Thma	635	694	4	0	0	4	B	0	0.0	N	B
Kampong Cham	Memot	Kakir	115	Khgaok	575	628	3	0	1	2	C	N/A	N/A	N	D
Kampong Cham	Memot	Kakir	116	Preaek Pusy	1,117	1,220	6	0	0	6	B	0	0.0	N	B
Kampong Cham	Memot	Kakir	120	Thanl Kaeng	384	419	2	0	0	2	C	0	0.0	N	B
Kampong Cham	Memot	Kakir	121	Thma Tobueng Tboung	503	549	3	2	0	1	C	0	0.0	N	D
Kampong Cham	Memot	Kakir	124	Sampov Luh	1,079	1,179	6	0	0	6	C	1	5.0	N	G
Kampong Cham	Memot	Kakir	125	Chumnum Pol	629	687	4	0	0	4	C	0	0.0	N	B
Kampong Cham	Memot	Kakir	126	Kantuot	743	812	4	0	1	3	C	0	0.0	Y	C
Kampong Cham	Memot	Kakir	127	Angkoan	409	447	3	0	1	2	C	0	0.0	N	D
Kampong Cham	Memot	Kakir	130	Bos Ta Oem	1,154	1,260	6	0	0	6	C	0	0.0	N	B
Kampong Cham	Memot	Meenong	132	Memong	1,333	1,456	7	0	0	7	C	0	0.0	N	B
Kampong Cham	Memot	Meenong	136	Triek	361	394	2	0	0	2	C	0	0.0	Y	A
Kampong Cham	Memot	Meenong	137	Choam Khyang	332	363	2	0	0	2	C	0	0.0	Y	A
Kampong Cham	Memot	Meenong	138	Sangkae Thmei	406	443	3	0	0	3	C	0	0.0	Y	A
Kampong Cham	Memot	Meenong	139	Sangkae Chas	1,021	1,115	6	0	0	6	C	0	0.0	Y	A
Kampong Cham	Memot	Choam Kravien	141	Khcheay	659	720	4	2	0	2	A	0	0.0	N	B
Kampong Cham	Memot	Choam Kravien	143	Saturn	1,115	1,218	6	0	0	6	C	0	0.0	N	B
Kampong Cham	Memot	Choam Kravien	144	Kravien Cheung	520	568	3	0	0	3	A	0	0.0	N	B
Kampong Cham	Memot	Choam Kravien	147	Chrey Laeung	326	356	2	1	0	1	C	0	0.0	Y	C
Kampong Cham	Memot	Choam	159	Boeng Chroung	504	550	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Choam	160	Choam Ampil	383	418	2	0	0	2	C	0	0.0	N	B
Kampong Cham	Memot	Choam	162	Cheung	455	497	3	0	0	3	C	0	0.0	N	B
Kampong Cham	Memot	Choam	163	Leach Leu	562	614	3	0	0	3	C	0	0.0	N	B

Table 8.2 Results of 303 Villages Classification (5/6)

Province	District	Commune	Village No.	Village Name	Population in 2001	Population in 2005	Necessary Borehole Well (210 psn/well)	Existing Borehole Well	JICA Study Well	Required New Borehole Well	Accessibility	Flood damage (times/10 years)	Flood water level (m)	Existence of VDC	Rank
Kampong Cham	Memot	Choam	167	Nglev	616	673	4	0	0	4	C	0	0.0	N	B
Kampong Cham	Memot	Choam	168	Leach Kraom	937	1,023	5	0	0	5	C	0	0.0	N	B
Kampong Cham	Ponhea Kraek	Popel	169	Tuol Kandal	687	750	4	0	0	4	B	0	0.0	N	B
Kampong Cham	Ponhea Kraek	Popel	170	Srah	707	772	4	3	0	1	A	0	0.0	Y	C
Kampong Cham	Ponhea Kraek	Popel	171	khsak	1,364	1,490	8	2	1	5	B	N/A	N/A	N	D
Kampong Cham	Ponhea Kraek	Popel	172	Popel	1,337	1,460	7	0	0	7	C	0	0.0	N	B
Kampong Cham	Ponhea Kraek	Kandaol Chrum	179	Tuol Chamlor	1,057	1,154	6	3	0	3	B	0	0.0	Y	C
Kampong Cham	Ponhea Kraek	Kandaol Chrum	180	Sbaek Kueu	868	948	5	3	0	2	A	2	0.5	Y	C
Kampong Cham	Kaoh Soutin	Kaoh Soutin	181	Phum Pir	622	679	4	1	0	3	D	3	1.0	Y	I
Kampong Cham	Kaoh Soutin	Preak Ta Nong	192	Preaek Ta Nong Buon	578	631	4	0	0	4	C	1	0.2	N	I
Kampong Cham	Kaoh Soutin	Pongro	207	Pongro Kaeut	481	525	3	1	0	2	C	10	1.0	N	I
Kampong Cham	Kaoh Soutin	Moha Leaph	209	Damnak Pring Kaeut	1,382	1,509	8	14	0	0	C	10	0.7	N	I
Kampong Cham	Kaoh Soutin	Moha Leaph	210	Damnak Pring Lech	610	666	4	5	0	0	C	10	1.0	N	I
Kampong Cham	Kaoh Soutin	Moha Leaph	211	Chrouy Saset	490	535	3	4	0	0	C	10	1.3	N	I
Kampong Cham	Steung Trang	Preaek Kak	214	Tuol Pou	1,124	1,228	6	3	1	2	A	N/A	N/A	N	I
Kampong Cham	Steung Trang	Ou Mlu	216	Khtuoy Muoy	882	963	5	0	0	5	C	0	0.0	Y	I
Kampong Cham	Steung Trang	Tuol Preah Khleang	217	Doun Tor	972	1,062	6	2	0	4	C	0	0.0	Y	I
Kampong Cham	Steung Trang	Dang Kdar	221	Phum Thnei	351	383	2	0	0	2	C	0	0.0	Y	I
Kampong Cham	Steung Trang	Peam Kaoh Sna	222	Peam Knong	1,062	1,160	6	0	0	6	C	3	1.0	Y	I
Kampong Cham	Steung Trang	Peam Kaoh Sna	223	Kaoh Kandal	1,116	1,219	6	0	0	6	C	10	2.5	N	I
Kampong Cham	Steung Trang	Peam Kaoh Sna	225	Dei Leu	1,495	1,635	8	0	0	8	C	10	3.0	N	I
Kampong Cham	Dambae	Chong Cheach	227	Cheach Cheung	1,231	1,345	7	0	0	7	B	0	0.0	Y	A
Kampong Cham	Dambae	Chong Cheach	228	Cheach Thum	1,558	1,703	9	9	0	0	C	0	0.0	N	F
Kampong Cham	Krouch Chhmar	Chumnik	229	Chumnik	5,120	5,592	27	4	0	23	C	N/A	N/A	N	I
Kampong Cham	Krouch Chhmar	Rokar Khnaor	230	Phum Ti Bei	1,793	1,958	10	30	0	0	C	2	1.3	N	I
Kampong Cham	Krouch Chhmar	Rokar Khnaor	238	Saoy Muoy	1,750	1,911	10	10	0	0	C	3	1.0	Y	I
Kampong Cham	Krouch Chhmar	Rokar Khnaor	239	Saoy Pir	2,008	2,193	11	12	0	0	C	8	1.5	Y	I
Kampong Cham	Krouch Chhmar	Rokar Khnaor	240	Preaek Krouch	2,143	2,341	12	17	0	0	C	3	1.0	Y	I
Kampong Cham	Krouch Chhmar	Rokar Khnaor	241	Antpil	2,065	2,255	11	7	0	4	C	1	1.1	Y	I
Kampong Cham	Krouch Chhmar	Svay Khleang	243	Phum Ti Muoy	1,083	1,183	6	1	0	5	C	4	1.3	Y	I
Kampong Cham	Krouch Chhmar	Svay Khleang	248	Phum Ti Pramnuoy	1,968	2,150	11	5	1	5	C	0	0.0	N	I
Kampong Cham	Krouch Chhmar	Kampong Treas	255	Phum Buon	1,596	1,745	9	6	0	3	C	10	2.5	Y	I
Kampong Cham	Krouch Chhmar	Kampong Treas	256	Phum Pram	1,600	1,748	9	0	0	9	C	10	3.0	N	I
Kampong Cham	Tboung Khmum	Kor	264	Veal Khmum	2,222	2,427	12	0	1	11	B	N/A	N/A	Y	C
Kampong Cham	Tboung Khmum	Kor	266	Tuol Thnei	1,003	1,096	6	10	0	0	B	0	0.0	Y	E
Kampong Cham	Tboung Khmum	Mong Rieng	267	Thnong	1,176	1,284	7	0	0	7	B	1	0.4	N	B
Kampong Cham	Tboung Khmum	Mong Rieng	268	Mong Ti Pramnuoy	672	734	4	0	0	4	B	0	0.0	Y	A
Kampong Cham	Tboung Khmum	Mong Rieng	269	Mong Ti Prampir	772	843	5	1	1	3	B	N/A	N/A	Y	C
Kampong Cham	Tboung Khmum	Mong Rieng	271	Trapeang Sangkae	664	725	4	0	0	4	B	0	0.0	N	B
Kampong Cham	Tboung Khmum	Anhchaeum	272	Trapeang Chak	446	487	3	0	0	3	A	0	0.0	Y	A
Kampong Cham	Tboung Khmum	Anhchaeum	273	Chheu Teal Chrum	403	440	3	0	1	2	A	N/A	N/A	Y	C
Kampong Cham	Tboung Khmum	Lngieng	284	Lvea Thum	749	818	4	2	0	2	B	0	0.0	Y	C
Kampong Cham	Tboung Khmum	Lngieng	285	Lngieng	795	868	5	0	0	5	B	0	0.0	Y	A
Kampong Cham	Tboung Khmum	Vihear Luong	286	Thnal Thnei	1,124	1,228	6	12	0	0	A	0	0.0	N	F
Kampong Cham	Tboung Khmum	Vihear Luong	287	Pnov	646	706	4	0	0	4	B	0	0.0	Y	A
Kampong Cham	Tboung Khmum	Vihear Luong	288	Chi Kae	654	714	4	4	0	0	B	0	0.0	Y	E
Kampong Cham	Tboung Khmum	Vihear Luong	289	Prasrae Leu	537	587	3	0	0	3	B	0	0.0	Y	A
Kampong Cham	Tboung Khmum	Suong	290	Prey Totueng	630	688	4	0	0	4	B	0	0.0	Y	A
Kampong Cham	Tboung Khmum	Suong	291	Chrak Poun	746	815	4	2	0	2	C	0	0.0	Y	C
Kampong Cham	Tboung Khmum	Suong	292	Ponnareay	1,976	2,159	11	7	0	4	A	0	0.0	Y	C
Kampong Cham	Tboung Khmum	Thma Pechr	294	Chambak	1,162	1,269	7	2	0	5	B	0	0.0	N	D
Kampong Cham	Tboung Khmum	Thma Pechr	295	Chieo Ti Muoy	1,117	1,220	6	3	0	3	B	0	0.0	Y	C
Kampong Cham	Tboung Khmum	Roka Po Pram	297	Trapeang Khla	2,217	2,421	12	2	0	10	C	0	0.0	N	D

Table 8.2 Results of 303 Villages Classification (6/6)

Province	District	Commune	Village No.	Village Name	Population in 2001	Population in 2005	Necessary Borehole Well (210 pers/well)	Existing Borehole Well	ACA Study Well	Reqired New Borehole Well	Accessibility	Flood damage (times/10 years)	Flood water level (m)	Existence of VDC	Rank
Kampong Cham	Tboung Khmum	Roka Po Pram	298	Ta Pav Banpenh Teo	2,269	2,478	12	0	0	12	C	0	0.0	N	B
Kampong Cham	Tboung Khmum	Roka Po Pram	299	Pong Tuek	1,530	1,671	8	0	0	8	B	0	0.0	Y	A
Kampong Cham	Tboung Khmum	Chirou Pir	304	Srae Siem	1,830	1,999	10	8	0	2	A	0	0.0	Y	C
Kampong Cham	Tboung Khmum	Chirou Pir	305	Tuol Vihear	2,299	2,511	12	3	0	9	A	0	0.0	Y	C
Kampong Cham	Ou Reang Ov	Daravi	307	Tuol	364	398	2	0	0	2	B	0	0.0	Y	A
Kampong Cham	Ou Reang Ov	Mien	310	Prey Sambour Lech	738	795	4	0	0	4	B	0	0.0	Y	A
Kampong Cham	Ou Reang Ov	Kong Chey	314	Kong Chey	841	919	5	11	0	0	B	7	1.0	Y	E
Kampong Cham	Ou Reang Ov	Kong Chey	315	Saeng	689	753	4	0	0	4	B	0	0.0	Y	A
Kampong Cham	Ou Reang Ov	Kong Chey	316	Tuol Smilau	471	514	3	10	0	0	B	1	0.3	Y	E
Kampong Cham	Ou Reang Ov	Kong Chey	317	Changva	365	399	2	1	0	1	B	1	0.5	Y	C
Kampong Cham	Ou Reang Ov	Kong Chey	318	Thnal Kaeng	578	631	4	5	0	0	B	10	0.5	Y	E
Kampong Cham	Ou Reang Ov	Kong Chey	320	Prum Khet	310	339	2	0	0	2	B	10	0.5	Y	A
Kampong Cham	Ou Reang Ov	Kong Chey	321	Cheung Voet	908	992	5	8	1	0	B	N/A	N/A	N	F
Kampong Cham	Ou Reang Ov	Kong Chey	322	Srae Spey	2,009	2,194	11	12	0	0	C	N/A	N/A	N	F
Kampong Cham	Ou Reang Ov	Kong Chey	324	Stueng Chey	638	697	4	1	0	3	B	7	1.0	Y	G
Kampong Cham	Ou Reang Ov	Chak	325	Chamlak	705	770	4	1	0	3	C	0	0.0	Y	C
Kampong Cham	Ou Reang Ov	Chak	327	Pring	795	868	5	2	0	3	B	0	0.0	N	D
Kampong Cham	Ou Reang Ov	Chak	328	Trach Chrum	578	631	4	5	0	0	C	0	0.0	N	F
Kampong Cham	Ou Reang Ov	Chak	329	Trapeang Kandaol	520	568	3	4	0	0	C	0	0.0	N	F
Kampong Cham	Ou Reang Ov	Tuol Sophy	330	Tuol Sophi	435	475	3	3	0	0	B	0	0.0	N	F
Kampong Cham	Ou Reang Ov	Tuol Sophy	331	Khal Ou	263	287	2	2	0	0	C	0	0.0	Y	E
Kampong Cham	Ou Reang Ov	Tuol Sophy	332	Poung	803	877	5	1	0	4	C	0	0.0	N	D
Kampong Cham	Ou Reang Ov	Tuol Sophy	336	Boeng Phtil	879	960	5	7	0	0	C	0	0.0	N	F
Kampong Cham	Ou Reang Ov	Tuol Sophy	337	Thma Da Lech	629	687	4	0	1	3	A	N/A	N/A	N	D
Kampong Cham	Ou Reang Ov	Tuol Sophy	338	Thma Da Kaeut	566	618	3	0	0	3	B	0	0.0	N	B
Kampong Cham	Ou Reang Ov	Preah Theat	340	Tuol Khleang	1,027	1,122	6	5	0	1	C	5	1.0	Y	G
Kampong Cham	Ou Reang Ov	Preah Theat	341	Preah Theat Kandal	460	502	3	2	0	1	C	0	0.0	N	D
Kampong Cham	Ou Reang Ov	Preah Theat	345	Thnal Leu	948	1,035	5	5	0	0	C	0	0.0	N	F
Kampong Cham	Ou Reang Ov	Ampil Ta Pok	346	Svay Roluos	775	846	5	1	0	4	B	0	0.0	Y	C
Kampong Cham	Ou Reang Ov	Ampil Ta Pok	347	Bos Lhong	920	1,005	5	7	0	0	B	0	0.0	Y	E
Kampong Cham	Ou Reang Ov	Ampil Ta Pok	348	Prey Smilau	780	852	5	8	0	0	B	0	0.0	Y	E
Kampong Cham	Ou Reang Ov	Ampil Ta Pok	349	Tuol Khal Tonsaeng	397	434	3	2	0	1	C	0	0.0	Y	E
Kampong Cham	Ou Reang Ov	Ampil Ta Pok	351	Meas Srae	814	889	5	0	0	5	C	0	0.0	Y	A
Kampong Cham	Chamkar Leu	Bos Khnaor	354	Bos Khnaor	3,736	4,081	20	21	0	0	B	0	0.0	Y	I
Kampong Cham	Chamkar Leu	Lvea Leau	363	Lvea Cheung	1,113	1,216	6	1	1	4	B	0	0.0	Y	I
Kampong Cham	Cheung Prey	Phdau Chrum	369	Chan Neang	1,007	1,100	6	23	0	0	B	5	1.5	N	I
Kampong Cham	Cheung Prey	Kok Roteang	371	Chuok	773	844	5	2	0	3	B	0	0.0	N	I
Kampong Cham	Cheung Prey	Khnaor Dambang	376	Knaor Dambang	1692	1,848	9	9	1	0	B	N/A	N/A	Y	I
				Total	258,993	282,875	1,502	721	30	932					

Accessibility: A: Facing on the main road
B: Accessible both in dry and wet season
C: Accessible in dry season but difficult to access in wet season
D: Impossible to access by 4WD vehicle

Table 8.9 Detail Number of Required Hand Pump for Target Villages (1/2)

No.	Province	District	Commune	Village No.	Village Name	Population in 2001	Population in 2005	Rank	Required No. of HP
1	Kampong Cham	Memot	Dar	7	Dar Cheung	764	834	A	4
2	Kampong Cham	Memot	Dar	8	Dar Lech	997	1,089	D	5
3	Kampong Cham	Memot	Dar	9	Dar Phsar	1,225	1,338	D	4
4	Kampong Cham	Memot	Dar	10	Dar Kandaol	1,868	2,040	D	6
5	Kampong Cham	Memot	Dar	11	Pramplr Measkaksra	1,066	1,164	B	6
6	Kampong Cham	Memot	Dar	12	Dar Tboung	961	1,050	D	4
7	Kampong Cham	Memot	Dar	14	Speun	1,966	2,147	D	4
8	Kampong Cham	Memot	Dar	15	Meaek Puk	450	492	D	2
9	Kampong Cham	Memot	Dar	16	Srae Chroam	930	1,016	A	5
10	Kampong Cham	Memot	Dar	17	Chhngar Cheung	780	852	A	5
11	Kampong Cham	Memot	Dar	18	Chhngar Kandal	400	437	B	3
12	Kampong Cham	Memot	Dar	19	Samraong	537	587	D	2
13	Kampong Cham	Memot	Dar	21	Beng	388	424	B	3
14	Kampong Cham	Memot	Rung	22	Chambak	953	1,041	B	5
15	Kampong Cham	Memot	Rung	24	Doun Roadth Ti Pir	671	733	B	4
16	Kampong Cham	Memot	Rung	25	Bos	536	585	B	3
17	Kampong Cham	Memot	Rung	26	Choeu Tuk	507	554	D	1
18	Kampong Cham	Memot	Rung	27	Rung	584	638	B	4
19	Kampong Cham	Memot	Rung	28	Taonh	378	413	C	1
20	Kampong Cham	Memot	Rung	29	Doung	504	550	B	3
21	Kampong Cham	Memot	Rung	30	Beng	461	504	B	3
22	Kampong Cham	Memot	Rung	31	Mesin	647	707	B	4
23	Kampong Cham	Memot	Rung	33	Soutey	1,089	1,189	A	6
24	Kampong Cham	Memot	Rung	34	Trapeang Ruessei	1,080	1,180	B	6
25	Kampong Cham	Memot	Chan Mul	35	Thlok	545	595	B	3
26	Kampong Cham	Memot	Chan Mul	36	Chan Mul	1,107	1,209	D	5
27	Kampong Cham	Memot	Chan Mul	37	Slam	830	907	B	5
28	Kampong Cham	Memot	Chan Mul	38	Srae Ta Nong Kaeut	460	502	D	2
29	Kampong Cham	Memot	Chan Mul	39	Srae Ta Nong Lech	340	371	B	2
30	Kampong Cham	Memot	Chan Mul	44	Kor	561	613	B	3
31	Kampong Cham	Memot	Ton Lung	47	Kdol Leu	406	443	B	3
32	Kampong Cham	Memot	Ton Lung	50	Beng Kaong	409	447	B	3
33	Kampong Cham	Memot	Ton Lung	54	Kdol Kraom	760	830	B	4
34	Kampong Cham	Memot	Ton Lung	55	Sla Phnum	597	652	D	3
35	Kampong Cham	Memot	Ton Lung	56	Pong Tuek	412	450	B	3
36	Kampong Cham	Memot	Rumchek	59	Phov	390	426	B	3
37	Kampong Cham	Memot	Rumchek	60	Kantuot	377	412	B	2
38	Kampong Cham	Memot	Memot	68	Memot Phsar	3,155	3,446	B	17
39	Kampong Cham	Memot	Memot	73	Choeu Mtaor	417	455	A	3
40	Kampong Cham	Memot	Memot	74	Trabaek	734	802	A	4
41	Kampong Cham	Memot	Memot	75	Nang Krapeu	357	390	B	2
42	Kampong Cham	Memot	Memot	76	Trapeang Reang	1,707	1,864	A	9
43	Kampong Cham	Memot	Memot	78	Bangkom Wean Chey C tan	845	923	D	4
44	Kampong Cham	Memot	Memot	79	Chi Peh	987	1,078	B	6
45	Kampong Cham	Memot	Memot	80	Chhngar Sala	359	392	B	2
46	Kampong Cham	Memot	Memot	81	Mukh Kras	585	639	B	4
47	Kampong Cham	Memot	Tramung	82	Tramaeng Leu	361	394	B	2
48	Kampong Cham	Memot	Tramung	85	Tramung	948	1,037	D	3
49	Kampong Cham	Memot	Tramung	86	Choeu Triek	1,040	1,136	D	5
50	Kampong Cham	Memot	Tramung	87	Roung Chak Skar	301	329	B	2
51	Kampong Cham	Memot	Tramung	88	Andoung Thma Leu	405	442	B	3
52	Kampong Cham	Memot	Tramung	89	Andoung Thma Kraom	339	370	B	2
53	Kampong Cham	Memot	Tramung	90	Doung	340	371	D	1
54	Kampong Cham	Memot	Tramung	91	Choeu Trav	417	455	B	3
55	Kampong Cham	Memot	Tramung	92	Chhuk	656	717	D	3
56	Kampong Cham	Memot	Tramung	93	Ngeu Thun	663	724	D	3
57	Kampong Cham	Memot	Tramung	96	Roung Chakr Lech	2,560	2,796	B	14
58	Kampong Cham	Memot	Tramung	100	Chrey	477	521	B	3
59	Kampong Cham	Memot	Kampoan	101	Lour	1,334	1,457	C	5
60	Kampong Cham	Memot	Kampoan	102	Kampoan	1,623	1,773	C	7
61	Kampong Cham	Memot	Kampoan	104	Srae Saom Thmei	793	866	A	5
62	Kampong Cham	Memot	Kampoan	105	Srae Saom Chas	487	532	A	3
63	Kampong Cham	Memot	Kampoan	106	Tuek Tum	486	531	A	3
64	Kampong Cham	Memot	Kokir	110	Srae Poul	674	736	B	4
65	Kampong Cham	Memot	Kokir	111	Kokir Cheung	1,485	1,622	D	7
66	Kampong Cham	Memot	Kokir	112	Kokir Tboung	1,069	1,168	A	6
67	Kampong Cham	Memot	Kokir	113	Tuol Thma	635	694	B	4
68	Kampong Cham	Memot	Kokir	115	Kngaok	575	628	D	2
69	Kampong Cham	Memot	Kokir	116	Preaek Puoy	1,117	1,220	B	6
70	Kampong Cham	Memot	Kokir	120	Thanl Kaeng	384	419	B	2
71	Kampong Cham	Memot	Kokir	121	Thma Totueng Tboung	503	549	D	1
72	Kampong Cham	Memot	Kokir	125	Chumnum Pol	629	687	B	4
73	Kampong Cham	Memot	Kokir	126	Kantuot	743	812	C	3
74	Kampong Cham	Memot	Kokir	127	Angkaen	409	447	D	2
75	Kampong Cham	Memot	Kokir	130	Bos Ta Oem	1,154	1,260	B	6
76	Kampong Cham	Memot	Memong	132	Memong	1,333	1,456	B	7
77	Kampong Cham	Memot	Memong	136	Triek	361	394	A	2
78	Kampong Cham	Memot	Memong	137	Choeu Khyang	332	363	A	2
79	Kampong Cham	Memot	Memong	138	Sangkae Thmei	406	443	A	3
80	Kampong Cham	Memot	Memong	139	Sangkae Chas	1,021	1,115	A	6
81	Kampong Cham	Memot	Choam Kravien	141	Khcheay	659	720	B	2

Table 8.9 Detail Number of Required Hand Pump for Target Villages (2/2)

No.	Province	District	Commune	Village No.	Village Name	Population in 2001	Population in 2005	Rank	Required No. of HP
82	Kampong Cham	Memot	Choam Kravien	143	Saburi	1,115	1,218	B	6
83	Kampong Cham	Memot	Choam Kravien	144	Kravien Cheung	520	568	B	3
84	Kampong Cham	Memot	Choam Kravien	147	Chrey Laeung	326	356	C	1
85	Kampong Cham	Memot	Choam	159	Boeng Chroung	504	550	B	3
86	Kampong Cham	Memot	Choam	160	Choam Ampil	383	418	B	2
87	Kampong Cham	Memot	Choam	162	Cheung	455	497	B	3
88	Kampong Cham	Memot	Choam	163	Leach Leu	562	614	B	3
89	Kampong Cham	Memot	Choam	167	Ngiev	616	673	B	4
90	Kampong Cham	Memot	Choam	168	Leach Kraom	937	1,023	B	5
91	Kampong Cham	Ponhea Kraek	Popel	169	Tuol Kandal	687	750	B	4
92	Kampong Cham	Ponhea Kraek	Popel	170	Srah	707	772	C	1
93	Kampong Cham	Ponhea Kraek	Popel	171	Khsak	1,364	1,490	D	5
94	Kampong Cham	Ponhea Kraek	Popel	172	Popel	1,337	1,460	B	7
95	Kampong Cham	Ponhea Kraek	Kandaol Chrum	179	Tuol Chamkar	1,057	1,154	C	3
96	Kampong Cham	Ponhea Kraek	Kandaol Chrum	180	Sbaek Kueu	868	948	C	2
97	Kampong Cham	Dambae	Chong Cheach	227	Cheach Cheung	1,231	1,345	A	7
98	Kampong Cham	Tboung Khmum	Kor	264	Veal Khmum	2,222	2,427	C	11
99	Kampong Cham	Tboung Khmum	Mong Reang	267	Thnong	1,176	1,284	B	7
100	Kampong Cham	Tboung Khmum	Mong Reang	268	Mong Ti Prammuoy	672	734	A	4
101	Kampong Cham	Tboung Khmum	Mong Reang	269	Mong Ti Prampir	772	843	C	3
102	Kampong Cham	Tboung Khmum	Mong Reang	271	Trapeang Sangkae	664	725	B	4
103	Kampong Cham	Tboung Khmum	Anhchaeum	272	Trapeang Chak	448	487	A	3
104	Kampong Cham	Tboung Khmum	Anhchaeum	273	Chheu Teal Chrum	403	440	C	2
105	Kampong Cham	Tboung Khmum	Lngieng	284	Lvea Thum	749	818	C	2
106	Kampong Cham	Tboung Khmum	Lngieng	285	Lngieng	795	868	A	5
107	Kampong Cham	Tboung Khmum	Vihear Luong	287	Pnov	646	706	A	4
108	Kampong Cham	Tboung Khmum	Vihear Luong	289	Prasrae Leu	537	587	A	3
109	Kampong Cham	Tboung Khmum	Suong	290	Prey Tobueng	630	688	A	4
110	Kampong Cham	Tboung Khmum	Suong	291	Chrek Poun	746	815	C	2
111	Kampong Cham	Tboung Khmum	Suong	292	Ponnareay	1,976	2,158	C	4
112	Kampong Cham	Tboung Khmum	Thma Pechr	294	Chambek	1,182	1,289	D	5
113	Kampong Cham	Tboung Khmum	Thma Pechr	295	Chieo Ti Muoy	1,117	1,220	C	3
114	Kampong Cham	Tboung Khmum	Roka Po Pram	297	Trapeang Khla	2,217	2,421	D	10
115	Kampong Cham	Tboung Khmum	Roka Po Pram	298	Ta Pav Banpenh Tes	2,269	2,478	B	12
116	Kampong Cham	Tboung Khmum	Roka Po Pram	299	Pong Tuek	1,530	1,671	A	8
117	Kampong Cham	Tboung Khmum	Chirou Pir	304	Srae Siem	1,830	1,999	C	2
118	Kampong Cham	Tboung Khmum	Chirou Pir	305	Tuol Vihear	2,299	2,511	C	9
119	Kampong Cham	Ou Reang Ov	Damrei	307	Tuol	364	398	A	2
120	Kampong Cham	Ou Reang Ov	Mien	310	Pray Sambour Lech	728	795	A	4
121	Kampong Cham	Ou Reang Ov	Kong Chey	315	Soeng	689	753	A	4
122	Kampong Cham	Ou Reang Ov	Kong Chey	317	Changva	365	399	C	1
123	Kampong Cham	Ou Reang Ov	Kong Chey	320	Prum Khet	310	339	A	2
124	Kampong Cham	Ou Reang Ov	Chak	325	Chamlak	705	770	C	3
125	Kampong Cham	Ou Reang Ov	Chak	327	Pring	795	868	D	3
126	Kampong Cham	Ou Reang Ov	Tuol Sophy	332	Poung	803	877	D	4
127	Kampong Cham	Ou Reang Ov	Tuol Sophy	337	Thma Da Lech	629	687	D	3
128	Kampong Cham	Ou Reang Ov	Tuol Sophy	338	Thma Da Kaeut	566	618	B	3
129	Kampong Cham	Ou Reang Ov	Preah Theat	341	Preah Theat Kandal	460	502	D	1
130	Kampong Cham	Ou Reang Ov	Ampil Ta Pok	346	Svay Roluos	775	846	C	4
131	Kampong Cham	Ou Reang Ov	Ampil Ta Pok	351	Meas Snae	814	889	A	5
	Total					108,332	118,320		526

Table 8.13 Form of Spare Parts and Tools Receipt

WELL NO.:_____

Province:_____ District:_____

Commune:_____ Village:_____

Item	Description	Quantity	Remarks
Standard Spare Parts Set		1 set	
	Rod Centralizer	10	
	Bush Bearing	4	
	Valve Bobbing	2	
	'U' Seal	2	
	'O' Ring	2	
Standard Tool Set		1 set	
	Fishing Tool	1	
	Socket Spanner	1	
	Open Ended Spanner	2	

Supplier	**Witness**	**Receiver**
_____	_____	_____
Date	Date	Date
_____	_____	_____
PDRD Staff	WPC Chairman	WPC Caretaker
_____	_____	_____
Signature	Signature	Signature

Table 8.14 Form of Spare Parts Request

WELL NO.:_____

Province:_____ District:_____

Commune:_____ Village:_____

Date:_____

To: Rural Water Supply Bureau, Provincial Department of Rural Development (PDRD)

Subject: Request of Hand Pump Spare Parts

We would like to request you the following hand pump spare parts.

Item	Quantity	Remark

Name of VWC Chairman:_____

Name of WPC Chairman:_____

Name of WPC Caretaker:_____

Table 8.15 Form of Repair / Maintenance Request

WELL NO.:_____

Province:_____ District:_____

Commune:_____ Village:_____

Date:_____

To: Rural Water Supply Bureau, Provincial Department of Rural Development (PDRD)

Subject: Request for Immediate Arrangement for Hand Pump Repair

We would like to request you that the provincial Office will sent your mechanical engineer for our hand pump maintenance as it has been out of order since _____ days ago.

Our WPC's caretaker reports WPC chairman that the matter of problem is major repairing require.

Given the following is the relevant information concerning the hand pump problem.

1._____

2._____

3._____

4._____

Name of VWC Chairman:_____

Name of WPC Chairman:_____

Name of WPC Caretaker:_____

Table 8.16 Form of Repair / Maintenance Record

WELL NO.:_____

Province:_____ District:_____

Commune:_____ Village:_____

Date of Occurrences	Date of Repair	Cost of Repair	Problem	Replaced Spare Parts	By whom repaired

Name of VWC Chairman:_____

Name of WPC Chairman:_____

Name of WPC Caretaker:_____