APPENDIX-G

AGRICULTURAL PRODUCTION SYSTEM

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AGRICULTURAL PRODUCTION SYSTEM

CHAPTER G-1 AGRICULTURAL PRODUCTION AND RURAL INFRASTRUCTURES IN THE STUDY AREA

G-1.1 Canals

Present condition of existing irrigation and drainage system was confirmed in the following manner.

- Inventory Survey
- Survey at District and Communes
- Site Inspection

Procedure of the inventory survey including survey forms is given in the "Planning Guideline for Rehabilitation and Reconstruction of Irrigation Systems in the Kingdom of Cambodia" (hereinafter referred to as "Guideline"). Results of the survey are given in the Main Report (Section II-1.6).

During the first field study period, information on the existing canals was collected and confirmed at commune level. The information includes name, length, dimension and location of the canals, irrigation capacity (area) at present, direction of the water flow, and present condition. The results are given in Table G-1. According to the results of the survey, total length of major irrigation canals amounts to 453 km with present irrigation capacity of 14,533 ha in the rainy season. Table G-2 shows a list of the canals by system.

G-1.2 Reservoirs

There are a number of small reservoirs in the Study Area. They were constructed along (on the upstream side of) roads with gate structures (stop log) and culverts as "intake cum spillway". Constructed during the Pol Pot Regime, most reservoirs have malfunctioned due to sedimentation and flood damage to the dikes or structures. Few reservoirs are being used for the dry season cultivation. It seems that no proper design and planning were made for optimizing the scale of the reservoirs.

There are 31 reservoirs in the Study Area as shown in Table G-3.

Roles and benefit of the reservoirs in the Study Area are considered as follows:

- Regulation in water distribution,
- Supplemental irrigation for the main crops (paddy rice) in the rainy season, and
- Planting of paddy rice in early rainy season, which enables two cropping in a year.

G-1.3 Roads

Condition of the existing roads is mentioned in the Main Report, II-1.9.1 "Rural Road" and illustrated in Fig. II-1.9.1.

Details of the existing roads such as length, width, road surface, present condition, related improvement programs and their funding agencies are given in Table G-4.

G-1.4 Other Infrastructures

Numbers of wells for domestic purposes, latrines, primary schools, etc. which are explained in the Main Report, II-1.9.2 "Other Infrastructures" are given in Table G-5, G-6, and G-7, respectively.

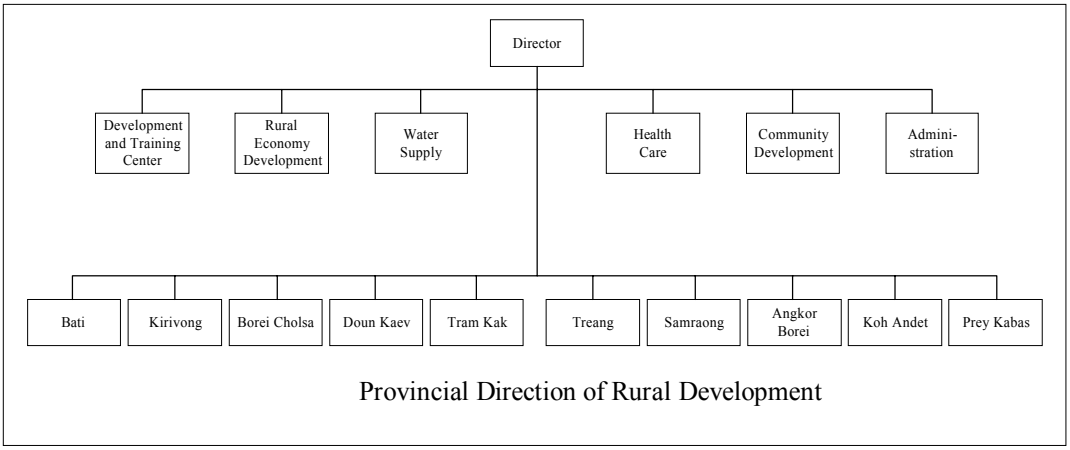
G-1.5 Organizations Related to Agricultural Production and Rural Infrastructures

(1) Department of Water Resources and Meteorology (DWRAM)

Details on MOWRAM and DWRAM are mentioned in the Main Report, Section I-2.5 "MOWRAM".

(2) Department of Rural Development (DRD)

Organization of Department of Rural Development (hereinafter referred to as DRD) is given below.



Provincial Direction of Rural Development

Development Training Center is in charge of guidance and training on operation and

maintenance of equipment such as pumps, engines, etc. The center also carries out some vocational training like weaving for both male and female.

Rural Economy Development Section deals with credit and rice bank related to development works. Water Supply Section mainly deals with development of wells in rural areas. Shallow closed wells (tube well) with hand pumps are mainly provided to the rural areas incorporated in the programs of the RGC, NGOs and IOs. Rural Health Care Section is in charge of introducing and spreading of sanitation facilities (latrine) and health education.

Community Development Section deals with community-based development including small irrigation, road improvement, community center, food security (food for work), etc.

(3) Local Administration

Local administration such as Provincial Office, District Office, Commune, and village are closely involved in development activities. Provincial Rural Development Committee (PRDC) is the top management chaired by the Governor. The committee consists of about 30 members including chiefs of line agencies related to agricultural and rural development. Under the committee, development committees are organized at commune and village levels. In each committee, responsible persons for line agencies (ex. DRD, DWRAM, etc.) are assigned.

(4) Development Plan of Tram Kak District

Tram Kak District of Takeo Province occupies most of the Study Area (85 % in area). According to the Development Plan of Tram Kak District for 2001 – 2005, the development objectives focus on; i) economic service, particularly for agricultural service and improvement of irrigation facilities, ii) transportation and communication services to improve communication between farm fields and towns, iii) human resources development, and iv) health services. Priority projects identified in the Plan are listed in Table G-8.

G-1.6 Projects on Infrastructures in/around the Study Area

(1) Rural Infrastructure Improvement Project (ADB)

The Rural Infrastructure Improvement Project is a loan project which has been conducted since 1997. The first phase (1997 - 2001) has been implemented in six provinces (Takeo, Kampot, Kandal, Svay Rieng, Preyeleng, Kampong Cham) spending US$ 24 million. The project consists of three components, namely,

improvement of road and infrastructures, irrigation development, and well development for domestic use.

Roads improved in the Study Area are listed in the following table.

Roads Improved by ADB Project in the Study Area

Route No.	Location	Length (km)	Completion (year/month)
R1	Tram Kak ~ Trapeang Thum Khang Cheung	16.5	1999.3
R2	Ang Ta Saom ~ Trapeang Thum Khang Cheung	8.3	1998.11
R3	Tram Kak ~ Angk Sdok	2.3	1999.7
R11	Otdam Suriya ~ Lumchang	9.2	2000.7
R16	Ta Phem ~ Samraong	4.2	2001.1

Source: Project office of Takeo for Rural Infrastructure Improvement Project

Eighteen (18) wells with hand pumps were constructed along the above roads. As for irrigation improvement, rehabilitation of Ta Oum Reservoir was implemented in 1999.

The second phase of the project was commenced in 2001. Ten provinces will be covered with a budget of US$ 12 million. The second phase will focus on periodical maintenance for the existing laterite roads, which were damaged by floods.

(2) PRASAC II

PRASAC II was started in March 1999 after completion of PRASAC I (1995 – 1999). The project has four components. They are domestic water supply, sustainable agricultural production (irrigation, agriculture), credit and micro-enterprise, and project management and institutional support, so called community development. The irrigation development has been conducted in five districts, namely, Angkor Borey, Borey Chulsar, Koh Andet, Kiri Vong and Treang. Construction of canals, irrigation borehole, wooden bridges, storage, offices and pump irrigation facilities were constructed.

As for infrastructures, only water supply facilities were provided in the Study Area (Tram Kak District) in cooperation with NGOs (MCC, VSA).

(3) SEILA[1] Program II

SEILA Program was organized by the RGC and UNDP for rural development and capacity building of local administration (Commune) by using grant and loan funds by bilateral and/or multilateral organizations. The first phase had been implemented for five years from 1996 to 2000 covering five provinces (Siem Reap, Battambang,

[1] "SEILA" is a Khmer word which means "stone" or "foundation" in English.

Banteay Meanchey, Ratanakiri, Pursat) with a project cost of US$ 65 million. The second phase is going to be commenced in June 2001 covering 12 provinces including Takeo. The project cost for the second phase is estimated at US$ 93 million.

Main component of SEILA Program is "support to commune". Local Development Fund (LDF), which accounts for 75 % of the project cost, will be distributed to the selected communes at an average rate of US$ 12,000 /year/commune and operational cost (3 % of LDF). Remaining 25 % will be allocated to technical departments on infrastructure development. The target communes are selected or prioritized referring to 28 poverty indicators set by the Department of Planning. LDF is granted only for infrastructure improvement, which is proposed by each commune as "3-year Commune Investment Plan". In Takeo Province, five communes have been selected for the year 2001, two in Prey Kabas District and three in Treang District. By the year 2004, all the 100 communes in Takeo will be covered by the Program. UNDP (UNOPS) is doing technical support for the communes and related departments.

(3) Other Organizations and Activities on Agricultural and Rural Infrastructures

Organization and their activities related to the infrastructure development in/around the Study Area are shown in Table G-9.

CHAPTER G-2 UPPER SLAKOU RIVER IRRIGATION RECONSTRUCTION PLAN

G-2.1 Development Alternatives of Diversion System

(1) Tumnup Lok Reservoir

As mentioned in the Main Report, Tumnup Lok Reservoir was examined for two (2 dike top elevations, i.e., 43.0 m (original elevation) and 44.0 m, and the former alternative was finally adopted.

Five aspects of evaluation, namely, i) construction cost per irrigation area, ii) technical soundness, iii) negative impact, iv) government intention, and v) beneficiaries' intention were examined.

The construction cost largely depends on major works such as earthworks for embankment of dikes and concrete and earthworks for spillway. Other work quantities and materials cost would not have much difference by alternative. The following table shows the earthwork volume and concrete volume of the two alternatives.

Quantity of Major Works by Alternative

Unit: m^3

Work Item	Dike Top EL.43.0m	Dike Top EL.44.0m
Earthworks	65,900	139,300
Concrete	2,300	4,560

(2) Tumnup Lok Small Diversion Weir

The Study has been conducted aiming at formulating of the best plan of rehabilitation and reconstruction for recovering function of existing irrigation facilities, and the two alternative plans were examined for Tumnup Lok Reservoir.

Compared with Kpob Trobek Reservoir, effective storage capacity of Tumnup Lok Reservoir is small, and its main function is considered to divert water from the Slakou River (Tras Stream) to the proposed irrigation area. Thus, the Study Team also examined a possible alternative, namely Tumnup Lok Small Diversion Weir.

Focusing on the diversion function of the reservoir, required crest elevation of the spillway (HWL) to divert the water to the diversion canal is EL.40.4 m, which is 0.9 m lower than that of the proposed plan (dike top is EL.43.0 m and crest elevation of the spillway is EL.41.3 m).

Firstly the Study Team examined irrigable area by the small diversion weir. The

results are given in Section B-5.5 “Additional Water Balance Calculation” in Appendix-B “Meteo-hydrology and Water Utilization”. The irrigable area of the small diversion weir (Alt.3-1-1 in Appendix-B) is 2,600 ha in the rainy season, which is 900 ha smaller than that of the proposed alternative.

Getting the results, the Study Team made discussions with MOWRAM. However, MOWRAM strongly requested to increase the irrigation area as much as possible, and did not agree to abandon the original function as “reservoir” of Tumnup Lok.

Going back to the starting point or the main concept of the Study, namely, restoration of the original function of the existing facilities through the rehabilitation or reconstruction, the alternative of the small diversion weir was not examined further.

(3) Kpob Trobek Reservoir

Two alternatives were also examined for Kpob Trobek Reservoir. The dike top elevations of 39 m (original elevation) and 40 m were compared. Even for the “low” alternative, the existing dike should be raised by 0.50 m along the dike. Therefore, for the “high” alternative, the earthwork volume will be much bigger. The following table shows the earthwork and concrete volume for each alternative.

Quantity of Major Works by Alternative

Unit: m^3

Work Item	Dike Top EL.39.0m	Dike Top EL.40.0m
Earthworks	61,500	185,200
Concrete	1,740	2,800

The elevation of the dike top also affects design of the diversion canal. If the dike top elevation is raised by 1 m to EL. 40.0 m, the water level of the reservoir will also be raised by 1 m, and the longitudinal gradient of the diversion canal would be gentler. Accordingly, the proposed section of the diversion canal would be larger, which would increase the construction cost as well.

(4) Diversion Canal

Location of existing diversion canals is shown in Fig. G-1. From Tumnup Lok Reservoir to O Saray Reservoir, there are two lines of the diversion canal. The first route runs along the district road to O Saray Reservoir (Route-A in Fig. G-1), while the other route starts at about 2,400 m from the beginning point of Route-A and ends at the upstream of O Saray Reservoir (Route-B in Fig. G-1). In the Master Plan Study, Route-A was finally selected. However, according to result of survey work (profile and cross-section at every 200 m) conducted in the Phase-2 Study, cut depth of the proposed canal section was estimated at 3 m at the maximum for Route-A. Thus, the

Study Team examined another route, which follows Route-B up to O Saray Reservoir then makes detour the reservoir area through a new canal route and connect it to the existing diversion canal from O Saray Reservoir to Kpob Trobek Reservoir. Length of the diversion canals of Route-A and the revised route differs only 100 m (the revised route is longer) and the earthwork volume is much less for the revised route. Consequently, the revised route was adopted for the diversion canal.

G-2.2 Development Alternatives of Irrigation Area

(1) Revised Master Plan

According to the modification of irrigation method and dependability of irrigation plan, namely, water saving irrigation method and 80 % dependability, unit design diversion requirement was revised from 1.5 l/s/ha to 1.1 l/s/ha. On the basis of the requirement, construction cost which was estimated for the Master Plan Study was also revised. Irrigation area and design discharge of each irrigation canal are shown in an irrigation diagram in Fig. G-2. Major quantities of construction works and number of canal related structures of the main canals are given in Table G-10. Work quantities of secondary and tertiary systems were also re-estimated accordingly. Hydraulic parameters of the main canals are given in the following table.

Hydraulic Parameters of Main Canals for the Master Plan

Parameters	Canal 33	Koh Kaek (Existing)
Irrigation area (ha)	1,025	2,150
Discharge at head (m^3/s)	1.45	1.87
Longitudinal gradient	1/5,000~1/1,200	1/7,500~1/2,500
Lining	Earth canal (n=0.035)	Earth lined canal (n=0.025)
Side slope	1:2.0	1:2.0
Bed width at head (m)	1.7	1.8
Water depth at head (m)	1.2	1.2
Velocity at head (m/s)	0.31	0.37

(2) New Koh Kaek Main Canal

As mentioned in the Main Report, the existing Koh Kaek Canal has not functioned as "canal". Even if reconstruction of the existing canal were conducted, the cut depth would be extraordinary big of 7 m or more at the maximum, which would not be technically sound, and make both construction and O & M costs very high. As shown in Table G-10, earthwork volume of the reconstruction would be about 320,000 m^3, which would cost about US$ 1.2 million.

New Koh Kaek Canal which was proposed to start at Main Canal 33 would have to run through the existing paddy field and house yard in villages. However, as shown

in Table G-11, the earthwork volume remains at about 80,000 m^3 which would cost less than half of that of the reconstruction of the existing Koh Kaek Canal. Taking into such advantage, New Koh Kaek Canal was recommended for Alternative-1. The hydraulic parameters of New Koh Kaek Canal are given below:

Hydraulic Parameters of New Koh Kaek Canal

Parameters	New Koh Kaek Canal
Irrigation area (ha)	1,601
Discharge at head (m^3/s)	1.76
Longitudinal gradient	1/15,000~1/2,000
Lining	Earth lined canal (n=0.025)
Side slope	1:2.0
Bed width at head (m)	1.5
Water depth at head (m)	1.3
Velocity at head (m/s)	0.41

(3) Alternative-1

Irrigation area of Alternative-1 consists of the command areas of New Koh Kaek Canal (1,601 ha), Main Canal 33 (1,441 ha), Canal 24 (443 ha) and Tumnup Lok Reservoir (15 ha). A schematic irrigation diagram is given in Fig. G-3. Work quantity and cost of the main systems (Main Canal 33 and New Koh Kaek Canal) are given in Table G-11.

Hydraulic parameters of Main Canal 33 for Alternative-1 are given in the following table, while those of New Koh Kaek Canal are shown above.

Hydraulic Parameters of Main Canal 33 for Alternative-1

Parameters	Main Canal 33
Irrigation area (ha)	1,441
Discharge at head (m^3/s)	1.59
Longitudinal gradient	1/1,500~1/1,200
Lining	Earth canal (n=0.035)
Side slope	1:2.0
Bed width at head [1)] (m)	1.5
Water depth at head (m)	0.94
Velocity at head (m/s)	0.50

Note: "Head" means the canal section of Canal 33 on the downstream of diversion structure to Koh Kaek Canal

(4) Alternative-2

Irrigation area of Alternative-2 consists of the command areas of Main Canal 33 (2,924 ha), Canal 24 (561 ha) and Tumnup Lok Reservoir (15 ha). A schematic irrigation diagram is given in Fig. G-4. Work quantity and cost of the main systems (Main Canal 33 and New Koh Kaek Canal) are given in Table G-12.

Hydraulic parameters of Main Canal 33 for Alternative-2 are given in the following

table.

Hydraulic Parameters of Main Canal 33 for Alternative-2

Parameters	Main Canal 33
Irrigation area (ha)	2,924
Discharge at head (m^3/s)	3.2
Longitudinal gradient	1/5,000~
Lining	Earth canal (n=0.035)
Side slope	1:2.0
Bed width at head (m)	2.0
Water depth at head (m)	1.6
Velocity at head (m/s)	0.38

G-2.3 Possible Development of Koh Kaek Canal Command Area

(1) Explanation of the Study Results to Samraong and Trapeang Thum Khang Tboung Communes

Command area of Koh Kaek Main Canal being finally excluded from USP Area, the Study Team explained the process of the Study and discussed on future development of the area with representatives of Tram Kak District, Samraong Commune and Trapeang Thum Khang Tboung Commune.

After making due explanation and discussion, the representatives accepted the results of the Study and requested irrigation development with other development plans such as SRP and PDP. Minutes of the meeting are given in Fig G-5.

(2) Utilization of the Existing Koh Kaek Canal

As shown in Fig. III-1.1 of the Main Report, there are several depressions along the canal profile, and water flowing into the canal from the right bank remains stagnant in such depressions. By repairing the dike of the existing canal and installing some structures, the section can be used as reservoir or pond. According to the survey results (profile and cross-section at every 200 m), there are two stretches that could be used as reservoirs as shown in Fig. G-6. The stretch from the beginning point up to 1,600 m whose catchment area is 2.4 km, the longitudinal gradient is adverse direction and the water flows toward Kpob Trobek Reservoir.

From 1,600 m to 3,300 m, there is the first depression that could be used as a reservoir (hereinafter referred to as "Reservoir-A"). The catchment area is 3.3 km^2. The total volume at a water elevation of EL. 38.0 m is estimated at 38,600 m^3. In this section, an existing secondary, Canal 22 originates. Compared with the catchment area, storage volume and irrigable area of Ang 160 Reservoir (catchment area=2.0 km^2, total storage volume=36,300 m^3, irrigable area=25 ha), an irrigable area of 40 to 50 ha is expected by Reservoir-A.

From 3,300 m to 5,300 m, there is the second depression that could also be used as a reservoir (hereinafter referred to as "Reservoir-B"). The catchment area of the stretch is 4.8 km^2. The total volume at a water elevation of EL. 38.5 m is estimated at 87,400 m^3. Having nearly 2.5 times as large catchment area and storage volume as those of Ang 160 Reservoir, 60 to 100 ha of irrigation area is expected. An irrigation canal would be reconstructed along the existing drain from the proposed Reservoir-B as a "new canal" which could be connected to an existing small reservoir, Prey Preal Reservoir, which was selected for SRP.

From 5,300 m and downward, the longitudinal gradient of the canal is toward downstream, and the water from the catchment (about 25 km^2) would be utilized either along the canal or on the downstream. An irrigation area of about 300 ha is expected. Sdok Sap Reservoir (Samraong Commune) is also located in this area, which would accommodate the command areas of Canal 14 and part of Canal 15. Rehabilitation of these canals was requested by the commune at the explanation meeting mentioned in the previous section.

Consequently, 400 to 500 ha would be irrigated by utilizing of the existing Koh Kaek Canal as small reservoir or pond.

(3) Other Small Reservoirs

In the Master Plan Study, 15 small reservoirs were selected for SRP. Out of 15 reservoirs, 11 reservoirs are located in/around the command area of Koh Kaek Canal.

In the selection process, six (6) criteria were identified. They were; water source availability, construction volume, technical soundness, increase of irrigation area, possibility of participation of beneficiaries, and location. The criterion of "location" was evaluated as follows:

Location	Score
Located within USP Area:	1
Located on the downstream of USP Area:	3
Located outside the USP Area:	5

The score of the above criterion would be revised for the reservoirs located in the command area of Koh Kaek Canal, because the area was excluded from USP Area.

Table G-13 shows the revised scores of SRP selection[2]. According to the result, Ang Prey Kdei Reservoir would also be proposed for SRP.

[2] Original selection of the Master Plan is shown in Table II-4.3.3 of the Main Report.

G-2.4 Related Facilities on USP

(1) Project Office

A project office would be constructed along District Road No.33 at Ta Phem Commune (Fig. F-7 "Location Map of Depot" in Appendix-F). The project office or compound also includes FWUC Apex office and assembling and shipping facility which would be handled by FWUC. The office will be established at the initial stage of the project implementation so that design works be conducted there. After completion of the construction, the project office will be handed over to FWUC.

The area of the compound will be 5,000 m^2 in total. The compound will be newly constructed on the existing paddy field with due consolidation works, parking shed, entrance gates and fencing. A tubewell will also be constructed. As for equipment, a pick-up truck, eight motorcycles, three walky-talkies, a copy machine, a generator unit, two sets of computer and printer, and furniture are proposed.

(2) Assembling and Shipping Facility

Assembling and shipping facility for marketing activities of FWUC will be constructed in the compound of the project office. The size of the building will be 31 m by 14 m (434 m^2). Scales for measuring weight of agricultural products, a computer set, a mobile phone set, two trucks, and a generator will be equipped.

(3) Office of FWUC and Depots

As mentioned above, the office of FWUC Apex will be established in the project office building. FWUCs at secondary system level will be set up with the depots which will be distributed as shown in Fig. F-7. Function and dimensions of the depots are mentioned in Appendix-F "Agro-processing and Marketing". The scales for measuring weight of agricultural products and furniture will be equipped.

G-2.5 Water Management and Operation

(1) Principles

Main principles of water management and operation procedure of USP are

1) Operations of the diversion system (from the Slakou River to Kpob Trobek Reservoir, including intake gates of Main Canal 33 and Canal 24) and irrigation system (secondary canals, tertiary canals and watercourses) would be conducted independently. In case that water level at Kpob Trobek Reservoir is lower than the proposed water level, water distribution to the irrigation system would be reduced. Even in such operation, water distribution schedule would be strictly

maintained for attaining equal distribution, even the proposed water requirement is not satisfied.

2) The system is capable of supplying irrigation water demand of a maximum, 1.1 l/s/ha at watercourse outlet.
3) When the Water Requirement (WR) is at the maximum during rainy season, the whole system would be operated simultaneously and continuously with all canals running at full supply level with design discharge.
4) When WR is below the maximum or when the available water is not sufficient to meet WR, smaller water volume would be applied by a shorter application time while maintaining the design discharge. Tertiary canals are classified into two (2) groups, and each group would be operated during a part of irrigation cycle (IC), which is "On" period. Off-take gates of the group would be closed while the other group is irrigated, whose irrigation cycle is defined as "Off" period.
5) When a tertiary canal is "On", it basically operates with the design discharge. The duties at heads of watercourse vary depending on its command area.
6) Within the tertiary block, full flow of the watercourse is diverted into a single watercourse for part of the "On" period, which is in proportion to the WR served by field outlet in the watercourse. Then, the full flow is diverted to another watercourse. All the watercourses would have received the required water within their allocated time.
7) In case that discharge of diverted water to the tertiary canal is less than the designed capacity (due to shortage of water or small diversion requirement to the secondary canal), period of diversion would be prolonged.

(2) Operation of Diversion System

1) Tumnup Lok Reservoir

Operation of Tumnup Lok Reservoir would be undertaken by an SO of FWUC Apex in charge of the reservoirs and diversion canals. Basically, the operation of the gates would be done on half-monthly basis. Intake gates to the diversion canal would be fully opened during irrigation period in order to divert as much water as possible. The diversion canal is designed with a capacity of 3.5 m^3/s and excess water would be discharged through the overflow spillway. The intake gates would be closed only during maintenance period of the diversion canal or Kpob Trobek Reservoir. No minute operation of the intake gates according to the water levels of diversion canal or Kpob Trobek Reservoir is required.

Without such minute operation, certain amount of the diverted water might not

be utilized and spilled away into the Krouch Stream at O Saray Rservoir, or into the Don Phe Stream at Kpob Trobek Reservoir. However, the water would return to the Slakou River through those streams and be utilized on the downstream.

A maintenance gate beside the spillway would basically be closed during the irrigation period. The gate would be opened for maintenance period of the reservoir and/or for maintaining of certain river maintenance flow as discussed with related organizations.

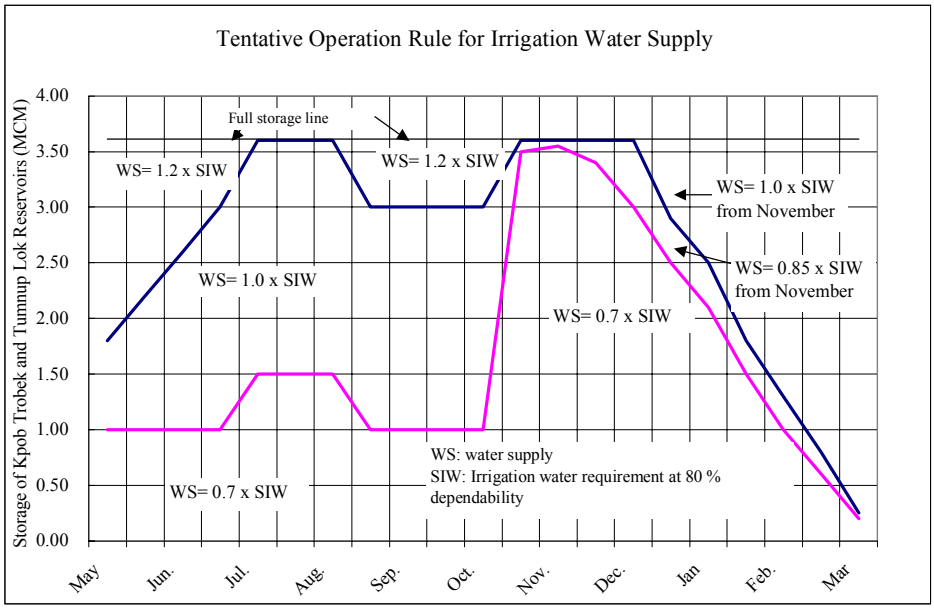
Intake gates for two tertiary blocks (TL-1, TL-2) would be operated by the SO of FWUC Apex in charge of the reservoirs on half-monthly basis.

2) Diversion Canal

No control structure is proposed along the diversion canal. A side spillway is proposed near the inlet of a siphon structure at O Saray Reservoir, so that excess water in the canal be drained before siphon. At the ending point of the diversion canal, no gate structure is proposed. Even at the maximum water level of Kpob Trobek Reservoir, flow of the water in the canal would not be affected.

3) Kpob Trobek Reservoir

The figure on the following shows the operation rule of Kpob Trobek Reservoir.



Irrigation Water Requirement (SIW)

Unit : m^3/sec

May		June		July		August		September		October		November		December		January		February		March	
1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0.00	0.11	0.22	0.31	0.33	1.41	1.71	1.89	3.06	3.28	1.99	2.27	3.39	2.36	1.36	0.70	0.38	0.44	0.54	0.41	0.30	0.12

According to the "water depth ~ storage volume curve" of the reservoir and total irrigation water requirement (necessary storage at the reservoir), target water level was set on half-monthly basis as given in the figure. If the water level at certain period is below the target level, release of the water from the reservoir should be controlled. If the water level is over the target level, more water could be released to the irrigation canal for accommodating the area located on the downstream of the command area.

As mentioned above, the operation of the reservoir would be conducted on half-monthly basis and the operation should follow only this operation rule. During dry period, the released water might not satisfy the total demand, however, the priority should be given to maintain the target water level of the reservoir. For emergency case, FWUC Apex would either open or close the gates. In case that ad hoc operation (which does not follow the rule) is conducted, FWUC Apex would properly notify SC FWUCs and FWUGs as well.

Two maintenance gate structures which are proposed at the existing spillways, would be closed during the irrigation period. The gates would be opened for maintenance period of the reservoir and/or for maintaining certain amount of river maintenance flow as discussed with related organizations.

(3) Operation of Main System

Operation of Main Canal 33 would be conducted by an SO of FWUC Apex in charge of the main system. The SO would control the gate opening of the diversion structures to the secondary canals (Canal 3U, 23, 22, 21, 20, 20S, and 3D) to maintain planned diversion discharge on half-monthly basis. At the diversion points to the secondary canals, discharge would be confirmed by observing water levels on the upstream and downstream of the gate by reading gauges installed at the structure. In case that the discharge in the main canal is smaller than the scheduled one, the discharge to be diverted to the secondary canal at the point should also be reduced proportionally. If the release of water to the main canal is controlled at 70 % of the proposed one, the diversion discharge to the secondary canals would also be at 70 %. The SO for the main canal should inform the modification of the diversion discharge immediately to the SOs of SC FWUCs.

(4) Operation of Secondary System

Secondary canals would also be operated continuously without any rotation. The operation of the secondary canals is conducted by SOs of SC FWUCs. The discharge of water diverted to the secondary canal would be constant for half month whose actual discharge would be informed by the SOs of FWUC Apex to the SOs of SC FWUCs.

Each SO would distribute the water to tertiary block according to the "Water Distribution Schedule" (WDS) determined by the FWUC Apex before the irrigation starts.

In this section, a prototype WDS is presented and explained.

1) Unit of Operation

O & M of a secondary system is conducted by an SC FWUC which consists of FWUGs. An FWUG consists of one or few tertiary blocks. In USP Area, 72 FWUGs are proposed for 106 tertiary blocks whose list and location are shown in Table H-1, Fig. H-1 and Fig. H-2 (Appendix-H Farmer Water User Community). Half-monthly diversion requirements[3] which were derived from "weighted average of the water requirements of proposed crops" are given in Table G-14.

2) Approach of Rotational Irrigation

As for the irrigation for the tertiary blocks, rotational irrigation is proposed so that efficient water distribution be maintained. The following approach was adopted in determination of the rotational distribution.

- Capacity of the tertiary canal would be used as much as possible by making the rotation period shorter.
- Shorter rotation cycle would be adopted for diversified crops considering their low persistence against drought.
- A secondary system would properly be divided into two or three rotation blocks taking balance between capacity of the tertiary canals and the diversion requirement into account.

[3] Diversion requirements (unit: l/s) for continuous irrigation. For rotational operation, the requirements would be bigger.

3) Prototype WDS

Table G-15 shows a prototype WDS by secondary canal. As example, some cycles or months of WDS for Canal 23 are explained in the following.

May (2nd half)

- This period consists of two cycles of 8 days.
- Three rotation blocks are set.
- 8 days or 192 hours are divided into three, namely, 2.7 days or 64 hours.
- Block 23-A will be irrigated for the first 64 hours, Block 23-B will be irrigated for the second 64 hours, finally, Block 23-C will be irrigated for the last 64 hours.
- Another cycle will be conducted

As shown in on the bottom of the column May of the table, required number of days for the irrigation (full capacity) is one day. However, the planned discharge of diversion of the period is smaller than the capacity of the canal even for the increased discharge for the rotational irrigation. Thus the irrigation period requires more than one day.

August

- This month consists of 6 cycles of 5 days.
- Two rotation blocks are set.
- Block 23-I will be irrigated for 5 days, then Block 23-II will be irrigated for 5 days.
- These cycles will be repeated for three times during the month. Finally, required irrigation days with full capacity (15 days as shown in the table) will be satisfied.

September

- The rotational irrigation is not applied
- Each tertiary block should be irrigated for 25 days with full capacity of the canals.

(5) Tertiary Level Operation

The water distribution on the tertiary level would be determined according to the above-mentioned WDS.

Provided that a tertiary block, which has 10 water courses and a water distribution period of 100 hours, full irrigation of 10 hours will be applied for each watercourse.

(6) Water Management at Farm Plot Level

"Water Saving Irrigation Method" should be applied at the very end of the irrigation system, namely, farm plot. As illustrated in Fig.II-3.2.2 of the Main Report, characteristic of the water saving irrigation method is limited application of water after establishment stage. After the establishment, the water should be applied for compensating percolation loss but not for ponding on the field.

Even on the tertiary or watercourse level, growing stage varies plot by plot, and the above-mentioned water application could not be conducted. Thus, it is very important that FWUC, FO and village extension workers (VEW) clearly explain the concept of the water saving irrigation method and let each farmer operate inlet and outlet of his (her) farm plot for saving the irrigation water.

The water saving irrigation method in USP Area does not require very sophisticated canal operation, but requires right application of water at the farm plot level by each farmer. Continuous explanation and extension on the irrigation method are considered necessary.

G-2.6 Maintenance

(1) Responsibility

O & M of the irrigation facilities would be undertaken by FWUC. For four years after completion of construction, technical support by Technical Support and Assistance Unit (TSAU) as shown in Fig. IV-5.4.1 in the Main Report would be given, however, FWUC itself would substantially conduct the O & M activities.

O & M Unit of FWUC Apex Committee would manage and coordinate O & M works on the main canal and reservoir systems. Two Scheme Operators (SO) would be in charge of the main canal and reservoirs systems.

As for secondary canal systems, FWUC at secondary canal level (SC FWUC) would play a role of O & M management. Each SC FWUC would have an SO as a chief of technical staff for O & M of the irrigation system.

O&M works of tertiary and on-farm irrigation systems would be managed and coordinated by Farmer Organizers (FO). An FO would take care of one or two tertiary blocks. In total, 72 FOs would engage in USP for 72 FWUGs.

Staff of FWUC Apex (12 persons including temporary staff) and SC FWUC (106 persons, including FOs and temporary staff) would be “paid-staff” for O & M activities. Besides, FWUC would have 9 persons for marketing activities.

As mentioned in the Main Report (IV-2.5 "Maintenance of Irrigation Facilities"), FWUG members would take responsibility of actual O & M works not only for their own tertiary blocks but also for related secondary or main canals as coordinated by FOs and SOs.

(2) O & M Works and Cost

Annual O & M works consist of routine maintenance and periodical maintenance. These maintenance works would involve FWUG members, and labor force would be contributed by them. Expense of O & M for annual maintenance works would consist of purchase of grease/oil and anticorrosive paint and materials/equipment for canal repair works. The following table shows number of gates which are proposed for USP irrigation system.

Number of Gates

Gate	Number
1) Tumnup Lok Reservoir	
Gate (1.5mx1.5m)	2 nos.
Gate(1.2x1.2m)	2 nos.
Gate(0.6x0.6m)	2 nos.
2) Kpob Trobek Reservoir	
Gate (1.5mx1.5m)	2 nos.
Gate (1.2x1.2m)	2 nos.
Gate (0.8x0.8m)	2 nos.
3) Irrigation Canal System	
Gate(1.5x1.5m)	12 nos.
Gate(1.0x1.0m)	4 nos.
Gate(0.8x0.8m)	58 nos.
Gate(0.6x0.6m)	156 nos.
4) Tertiary Development	
Steel Plate	700 nos.

According to the number and size of the gates, necessary quantity of anticorrosive paint and grease for spindles were estimated as follows:

Quantity of Anticorrosive Paint and Grease

Item	Reservoir/Main	Secondary/Teratiary
Anticorrosive paint	90 lit/year (4 kg per gate)	350 lit/year (1 kg per gate)
Grease	100 kg/year (4 kg per gate)	220 kg/year (1 kg per gate)

The retail prices of anticorrosive paint (per liter) and grease (per kg) are about Riel 8,000, respectively. Thus the material cost for maintaining the gate would be Riel 1,520,000 for the reservoirs/main system (FWUC Apex) and Riel 4,560,000 for the secondary and tertiary system (SC FWUC).

As for other maintenance costs beside labor (contribution), earthworks such as slope re-shaping with excavated materials and embankment with transported materials are required. At this stage, annual maintenance cost of Riel 14 million is accounted for the reservoir and main systems (FWUC Apex) and the secondary and tertiary systems, respectively, including the above-mentioned material costs. Larger part of the O & M cost would be spent for the earthworks for the main/reservoir system considering larger capacity and discharge of the main canal and diversion canal, and also maintenance of dike of the reservoirs.

Periodical rehabilitation works would be conducted every five years as mentioned in the Main Report. The cost for the periodical rehabilitation is set at Riel 70 million which was determined also taking into account revenue of ISF.

G-2.7 Drainage in USP Area

(1) Basic Concept

As mentioned in the Main Report, major drainage improvement works of the USP Area are not proposed taking into consideration poor drainage capacity of the main drain, namely, the Slakou River and absence of drainage network. Drainage development will require extraordinary high cost for excavation of new drains, flood routing of the Slakou River, etc.

Having a topographic gradient of 1/400 ~ 1/1,500, water into the Area can be drained within certain period. One of the constraints on the drainage in the Area is lack of crossing structures of enough capacity, which let the drained water stagnate along road and dikes for longer period.

The basic concept and approach of drainage improvement of USP Area are summarized as follows:

- Primary target of the drainage improvement would be; “to drain the irrigation water into the area smoothly to lower reach”,
- Certain period and depth of inundation would be allowed,
- Original or existing capacity of the existing canal would be maintained,
- Construction of new drains or excavation of existing would not be undertaken,
- Crossing structure would be properly distributed,

(2) Unit Drainage Requirement

As mentioned in the Main Report, unit drainage requirement was estimated at 1.6 l/s/ha, assuming the following conditions:

- Inundation depth of 150 mm on the paddy field is allowed,

- Inundation period of 3-days or 72 hours is allowed,
- 3-day rainfall of 1-in-10-year recurrence period is applied, and
- Initial water depth of 50 mm is assumed.

(3) Drains in the Area

On the basis of topographic maps of 1 in 50,000, 1 in 10,000 scales, and survey results, drainage network in the Area was identified as shown in Fig. G-6. On the upper reach of USP Area, the topographic slope runs from south to north with gradient ranging from 1/400 to 1/600, and the water would be drained northward through three drains.

In the middle reach, the topographic slope runs for north-east with gradient of 1/700~1/1,000. There are several drains running south to north along roads and the water would be drained toward the Slakou River.

In the down-most reach, Canal 22 runs eastward along the highest elevation. The water south of Canal 22 would be drained southward to Drain 3, while the water north of Canal 22 would be drained to the Slakou River. There are existing drains between the secondary canals, and they can be used for draining the excess water. The topographic gradient in the area ranges from 1/1,000 to 1/1,500.

The drainage system of USP Area is given in Fig.G-7 with the identified existing drains, their command area and drainage requirement.

About 80 crossing structures were proposed in the Area. The crossing structure are composed of concrete pipes of 600mm or 800mm in diameter. A concrete pipe of 600mm can drain 200 l/s, while that of 800 mm has capacity of 450 l/s. Number of lines of the culvert would be determined according to the drainage requirement at the proposed location.

CHAPTER G-3 SMALL RESERVOIR REHABILITATION PLAN

G-3.1 Irrigation System of Ang 160 SRP

(1) Irrigable Area

As mentioned in the Main Report, there is a small stream flowing through Ang 160 reservoir whose catchment area is 2.0 km^2 on the Noreay Mountain. The stream seems to originate from some springs judging from its runoff that could be observed even in dry season. According to the water balance examination, irrigable area was estimated at 25 ha.

(2) Irrigation System

Irrigation system of the small reservoirs would be managed by FWUGs. As for Ang 160, the irrigation system other than the reservoir itself is not available, and canals would be newly constructed.

Taking into consideration the location of existing stream on the downstream of the reservoir, the spillway was designed at 90 m from the north end of the main dike. The irrigation area is divided into two parts with the spillway, and two intake structures were proposed on both sides, of which locations were determined through discussion with beneficiaries. According to the location of the intake structures, a prototype irrigation layout was examined as shown in Fig. G-8. The irrigation area is composed of two blocks, namely, Block-A and Block-B, of which command areas are about 12.5 ha, respectively. According to the unit irrigation requirement (1.0 l/s/ha) for Ang 160 SRP, design capacity of the canals would be only 10 l/s[4]. Taking steep topographic slope into account, the irrigation canal would be of earth lined canal with the minimum capacity (dimensions) for O&M works. The canal bed width would be 0.3 m and the depth would be 0.5 m including freeboard.

G-3.2 Irrigation System of Kim Sei SRP

(1) Irrigable Area

Main water source of Kim Sei Reservoir is Canal No.8 and drained water from catchment area of 5.2 km^2. Having a larger catchment area than that of Ang 160 SRP, irrigable area was estimated at 27 ha.

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[4] Irrigation plots at head reach would be directly irrigated through off-take structures at the intake gates and capacity of the canals would not necessarily include these blocks.

(2) Irrigation System

Irrigation canals of Kim Sei Reservoir are existing at present. There are four lines of canals (watercourses) with four intake structures. The canals run eastward for about 500 m and are being used during the rainy season.

The irrigation canals would be utilized as they are, but intake structures would be replaced with new ones with intake gates. According to the location of the existing intake structures, a prototype irrigation layout was examined as shown in Fig. G-9. The irrigation area is composed of four blocks, namely, Block-A, Block-B, Block-C and Block-D, of which command areas ranges from 4 to 10 ha. Taking into account existing capacity and the irrigation area, the proposed irrigation water can be distributed through the existing canals. Off-take structures on the existing canals would be provided for better water distribution.

CHAPTER G-4 SMALL POND DEVELOPMENT PLAN

G-4.1 Project Formulation

(1) Development Process of Each Pond

Small Pond Development Project (PDP) was proposed in this Study as a development model of "pond-based small irrigation system". In the Study Area or large part of paddy rice production area in Cambodia, paddy rice monoculture is predominant. Most of such monoculture areas depend on rainfall without any irrigation system. Farmers' living and income are also affected by fluctuation of rice production and/or market price. Most farmers raise livestock for getting cash income as a kind of safety net of their living or risk management.

Small ponds have been utilized in rural area of Cambodia not only for agriculture but for domestic purposes. Nursery of paddy rice, vegetable cultivation, domestic water, drinking water for livestock, fish culture, planting of fuel woods and other rural activities are supported by the ponds. Even with such small water volume, the pond provides additional or supplemental cash income, and production to save living expenditures.

Construction cost of a pond is not big and little technical difficulty is expected. Main difficulty of PDP is considered to be "large number of ponds" to be constructed. The management of construction and development fund would be the main issues for PDP. In order to realize smooth and quick implementation, process of pond development would be formulated in a fixed and simplified form.

In this Study, three kinds of forms were prepared, namely, identification form, survey form and design form. Application procedure of the forms is described in the "Planning Guideline for Rehabilitation and Reconstruction of Irrigation Systems of the Kingdom of Cambodia" prepared in this Study.

(2) Fund Allocation

PDP was formulated for covering all the farm households that are not commanded by either USP or SRP. No specific criteria or classification was applied to select target groups. Therefore, the target households (18,000 in total) consist of rich farmers, land owners, poor landless farmers, and all types of farm households.

Some rich farmers have already constructed their own ponds on their own field by paying cash to labor, but most poor farmers can not afford such investment. On the other hand, funds available for the Study Area or Cambodia have various background and conditions for application, such as grant aid, low-interest loan,

commercial–based loan, etc.

Even the construction cost for one pond is small, a big fund (PDP Fund) is required for constructing a number of ponds which would be owned and operated various types of farmers and groups. It is considered necessary to establish certain criteria and classification on the beneficiary households or groups, and establish PDP Fund with several kinds of individual funds.

For instance, if a PDP Fund is composed of grant aid of 10 %, low-interest loan of 70% and commercial–based fund of 20 %, the "poor beneficiaries" which are defined with the criteria or classification would probably be supported by the grant aid portion, which would not be necessarily refunded. Then 70 % of beneficiaries would be accommodated by the low-interest loan which would be refunded within certain period of time with certain interest.

According to the PRA Workshop held in December 2001 (end of Phase-2), at Trapeang Snao Village, the farmers would accept refunding of 20% of the project cost (excavation cost of ponds) for 10 years.

G-4.2 Demonstration Plot at DWRAM Takeo

(1) Purpose

There are a number of ponds in the Study Area. Most of them are used as multi-purpose ponds. In general, the ponds have been constructed by individual farmers or programs of MRD or related NGOs. MOWRAM does not have development plans of the ponds for irrigation, and the concept of PDP (mainly for irrigation of diversified crops) was new not only for farmers but also for MOWRAM. Thus the Study Team decided to examine technical feasibility of PDP focusing on the following issues:

- Confirmation of actual pond water usage (volume) required for irrigation,
- Cultivation of vegetables and diversified crops during rainy season,
- High ridge cultivation during the rainy season,
- Cultivation without agro-chemicals, etc.

(2) Demonstration Plot

There is a small pond in the compound of DWRAM Takeo Office. The size of the pond is 21 m x 14 m and the depth is about 1.8 m. Total capacity of the pond is estimated at 428 m^3, while effective capacity is estimated at 253 m^3, which is about 1.4 times big as that of the model pond operated by individual farmers. A ditch connects the pond with a drain along the main road.

Beside the pond (10 m from the pond), the Study Team constructed a demonstration plot for diversified crops in late August 2001. The size of the plot is 20 m x 30 m, i.e., 0.06 ha, which is equivalent to the irrigation area of an individual pond (0.07 ha).

As for PDP, two-cropping was proposed, namely, from August to October, and from November to January. The Study Team started nursery and planting in early September. Crops planted are listed below:

Photo Pond used for the Demonstration Plot (as of December 2001)

Cucumber (local, hybrid), Tomato, Eggplant, Okra, Yard long bean, String bean, Chili, Cassava, Taro, Lemon grass, Kangkong, Salad vegetable, Stone leek, Amaranths, Winged bean, Coriander, Coleus, Ginger, Saffron, Basil, Peppermint, Hyacinth bean, Celery, Papaya, Sponge guard, Mustard green, and some flowers.

A crop layout plan is given in Fig. G-10.

During the planting period, farmers of Trapeang Snao Village were invited to the Demonstration Plot, and the counterpart personnel from MOWRAM and DAFF explained the crop and pest management during the rainy season.

(3) Results and Findings

The demonstration plot was successfully operated by an extension officer of DAFF (counterpart) and a farmer operator. Irrigation was conducted manually with watering pots every morning and evening. The following things were found and confirmed through the demonstration plot operation.

- Water of the pond was sufficient for the plot. Even during the dry season, water

depth went down by only 0.5 m from the full water level. Then, one-time rainfall recovered the water depth of the pond to the full level.

- Even during the midst of the rainy season, vegetables could be cultivated by high ridge cultivation of 0.2 m. The crops were not damaged even while continuous rainfall inundated the plot. An open ditch for Taro planting around the plot worked as a drain and avoided inundation of the plot itself.
- Vegetables and other plants were successfully harvested without applying agro-chemicals. Malting and other intensive crop management seem to be required for rainy season cultivation.
- Some crops could be continuously harvested during the operation, which seemed to help the farmers earn some cash income throughout the cultivation period.
- One farm labor can manage a farm plot of diversified crops of 0.06 ha without using pumps and any other machines.
- Well-trained and earnest extension workers or officers, and support of DAFF and DWRAM are prerequisite for the operation of the demonstration plot.

Photo The Demonstration Plot (as of November 2001)

Tables

Table G-1 List of Existing Canals by Commune (1/2)

No.	Name	Canal Type	Dimension				Irrigation Capacity (ha)	Construc-tion year	Const-ructed by	Number of Structures			
			Length (m)	Top Width (m)	Bed Width (m)	Depth (m)				spillway	bridge	gate	pipe
Tram Kak District, Takeo Province (1/2)													
	Angk Ta Saom Commune		38,350				1,175			0	12	0	5
1	Canal 10	Secondary	3,500	4	3	0.8	130	1976	Pol Pot		1		
2	Canal 11	Secondary	2,700	4	3	0.7	110	1976	Pol Pot		1		
3	Canal 12	Secondary	3,250	5	3	0.9	120	1976	Pol Pot		2		
4	Canal 13	Secondary	3,650	5	3	0.9	140	1976	Pol Pot				
5	Canal 14	Secondary	5,000	5	3	0.9	125	1976	Pol Pot		2		
6	Canal 15	Secondary	5,250	5	3	0.8	135	1977	Pol Pot		1		1
7	Canal 16	Secondary	5,200	5	3	0.8	115	1977	Pol Pot				1
8	Canal 17	Secondary	2,500	5	3	0.8	80	1977	Pol Pot		2		3
9	Canal 60	Secondary	3,500	6	4	1.0	100	1976	Pol Pot		3		
10	Canal 65	Secondary	3,800	8	5	1.4	120	1975	Pol Pot				
	Cheng Tong Commune		22,950				1,734			0	2	5	11
1	Canal 19	Secondary	2,000	5	3	0.6	60	1973	Pol Pot		1		2
2	Canal 20	Secondary	2,200	5	3	0.7	66	1973	Pol Pot		1	1	
3	Canal 21	Secondary	3,500	5	3	0.6	1,050	1973	Pol Pot			1	2
4	Canal 22	Secondary	5,100	5	3	0.6	153	1973	Pol Pot				5
5	Canal 23	Secondary	5,150	5	3	0.7	155	1973	Pol Pot			1	2
6	Canal 60	Secondary	3,000	5	3	0.7	90	1973	Pol Pot				
7	Canal 33	Main	2,000	12	7	1.5	160	1973	Pol Pot			2	
	Kus Cpommune		44,050				905			0	6	7	4
1	Canal 60	Secondary	4,500	3	1.5	1.0	115	1975	Pol Pot		3	1	
2	Canal 10	Secondary	10,000	3	1.5	1.0	200	1976	Pol Pot		2		
3	Canal 11	Secondary	9,200	3	1.5	1.0	180	1976	Pol Pot		1		1
4	Canal 12	Secondary	8,500	3	1.5	1.0	150	1976	Pol Pot			4	
5	Canal 13	Secondary	7,000	3	1.5	1.0	130	1976	Pol Pot			1	2
6	Canal 54 (Koh Kaek)	Main	4,850	12	6	1.3	130	1976	Pol Pot			1	1
	Leay Bour Commune		56,700				1,105			0	25	1	34
1	Canal 15	Secondary	7,250	5	3	0.8	115	1975	Pol Pot		4		
2	Canal 16	Secondary	7,750	5	3	0.9	130	1975	Pol Pot				
3	Canal 17	Secondary	8,000	5	3	0.9	145	1976	Pol Pot		1		1
4	Canal 18	Secondary	8,500	5	3	0.8	160	1976	Pol Pot				1
5	Canal 19	Secondary	6,250	5	3	0.9	115	1976	Pol Pot				
6	Canal 20	Secondary	4,000	5	3	1.0	100	1977	Pol Pot		2		
7	Canal 21	Secondary	450	5	3	0.9	80	1975	Pol Pot				
8	Canal 68	Secondary	6,000	12	8	1.4	110	1975	Pol Pot			1	2
9	Canal 33	Main	8,500	10	7	1.3	150	1975	Pol Pot		18		30
	Nhaeng Nhang Commune		24,250				255			0	4	4	0
1	Canal 06	Secondary	6,000	5	3	0.7	15	1976	Pol Pot				
2	Canal 07	Secondary	6,000	5	3	0.8	20	1976	Pol Pot				
3	Canal 08	Secondary	6,000	8	6	1.0	150	1977	Pol Pot		4	4	
4	Canal 09	Secondary	4,250	5	3	0.9	50	1976	Pol Pot				
5	Canal 10	Secondary	2,000	4	2	0.7	20	1976	Pol Pot				
	Otdam Sourya Commune		15,700				615			0	5	0	0
1	Canal 20	Secondary	2,700	15	10	2.0	130	1975	Pol Pot		1		
2	Canal 21	Secondary	3,500	10	7	1.5	150	1975	Pol Pot				
3	Canal 22	Secondary	4,500	10	7	1.5	165	1975	Pol Pot		2		
4	Canal 68	Secondary	5,000	30	15	3.5	170	1977	Pol Pot		2		
	O Saray Commune		12,400				452			0	0	4	1
1	Canal 21	Secondary	1,000	5	3	0.6	30	1975	Pol Pot				
2	Canal 22	Secondary	1,900	5	3	0.6	57	1975	Pol Pot				
3	Canal 23	Secondary	2,500	5	3	0.6	75	1975	Pol Pot			1	
4	Koh Kaek	Main	4,000	15	10	1.7	150	1975	Pol Pot				
5	Canal 33	Main	3,000	14	8	1.6	140	1975	Pol Pot			3	1
	Popel Commune		13,750				365			0	1	0	5
1	Canal 20	Secondary	1,750	5	3	0.9	35	1977	Pol Pot				
2	Canal 21	Secondary	4,000	4	3	0.5	120	1977	Pol Pot				5
3	Canal 22	Secondary	4,000	4	3	0.5	100	1977	Pol Pot				
4	Canal 23	Secondary	4,000	4	3	0.5	110	1977	Pol Pot		1		
	Samraong Commune		18,150				590			0	2	2	1
1	Canal 13	Secondary	4,000	5	2	1.0	180	1976	Pol Pot				1
2	Canal 14	Secondary	4,150	5	3	0.6	124	1976	Pol Pot		1		
3	Canal 15	Secondary	4,250	5	3	0.7	128	1976	Pol Pot		1		
4	Koh Kaek	Main	2,750	12	7	1.5	68	1975	Pol Pot			1	
5	Canal 16	Secondary	3,000	5	3	0.6	90	1976	Pol Pot			1	

Source : DWRAM. Information from Commune Office collected during the first Study period.

Table G-1 List of Existing Canals by Commune (2/2)

	No.	Name	Canal Type	Dimension				Irrigation Capacity (ha)	Construc-tion year	Const-ructed by	Number of Structures			
				Length (m)	Top Width (m)	Bed Width (m)	Depth (m)				spillway	bridge	gate	pipe
Tram Kak District, Takeo Province (2/2)	Srae Ronoung Commune			26,000				926			0	15	0	81
	1	Canal 05	Secondary	3,000	6	4	0.7	130	1976	Pol Pot		2		10
	2	Canal 06	Secondary	4,000	6	4	0.6	140	1976	Pol Pot		4		15
	3	Canal 07	Secondary	5,000	6	4	0.6	156	1976	Pol Pot				
	4	Canal 08	Secondary	5,000	8	6	1.0	80	1977	Pol Pot		5		30
	5	Canal 10	Secondary	1,500	6	4	0.6	150	1975	Pol Pot		1		6
	6	Canal 11	Secondary	500	6	4	0.6	110	1975	Pol Pot		1		5
	7	Canal 65	Secondary	7,000	8	6	1.0	160	1977	Pol Pot		2		15
	Ta Phem Commune			31,515				1,710			0	17	6	6
	1	Canal 14	Secondary	200	4	3	0.4	150	1976	Pol Pot				
	2	Canal 15	Secondary	1,815	6	4	0.5	120	1976	Pol Pot		2	1	
	3	Canal 16	Secondary	3,000	5	3	0.7	200	1976	Pol Pot		2		
	4	Canal 17	Secondary	3,000	5	3	0.7	180	1976	Pol Pot		2		
	5	Canal 18	Secondary	2,000	5	3	0.5	160	1976	Pol Pot				
	6	Canal 19	Secondary	6,000	4	2	0.5	230	1976	Pol Pot				4
	7	Canal 20	Secondary	6,500	8	6	0.5	260	1976	Pol Pot		2		1
	8	Canal 60	Secondary	5,000	8	6	0.5	220	1976	Pol Pot		3		1
	9	Canal 33	Main	4,000	10	8	1.5	190	1975	Pol Pot		6	5	
	Tram Kak Commune			18,250				415			0	3	0	4
	1	Canal 06	Secondary	3,050	5	3	0.7	150	1975	Pol Pot		3		
	2	Canal 07	Secondary	200	5	3	0.5	20	1975	Pol Pot				1
	3	Canal 08	Secondary	6,000	5	3	0.8	70	1977	Pol Pot				
	4	Canal 09	Secondary	3,500	5	3	0.8	100	1976	Pol Pot				
	5	Koh Kaek	Main	5,500	12	6	1.3	75	1976	Pol Pot				3
	Trapeang Thum Khang Cheung Commune			35,250				1,445			0	2	8	3
	1	Canal 20	Secondary	1,150	5	3	0.7	345	1976	Pol Pot			2	2
	2	Canal 21	Secondary	6,500	5	3	0.7	150	1976	Pol Pot				1
	3	Canal 22	Secondary	8,250	5	3	0.7	210	1976	Pol Pot			1	
	4	Canal 23	Secondary	9,000	5	3	0.5	270	1976	Pol Pot			1	
	5	Canal 24	Secondary	5,200	5	4	0.3	120	1976	Pol Pot			1	
	6	Canal 33	Main	5,150	12	7	2.5	350	1976	Pol Pot		2	3	
	Trapeang Kranhung Commune			7,000				330			0	0	2	0
	1	Tumnup Lok	Connection	5,500	25	15	5.0	80	1975	Pol Pot			1	
	2	Prey Kdouch	Secondary	1,500	5	3	1.0	250	1976	Pol Pot			1	
	Trapenag Thum Khang Tboung Commune			21,300				825			0	1	4	4
	1	Canal 16	Secondary	2,000	5	3	0.7	60	1975	Pol Pot		1	1	
	2	Canal 17	Secondary	3,000	5	3	0.8	90	1975	Pol Pot				1
	3	Canal 18	Secondary	4,000	5	3	0.7	120	1975	Pol Pot				1
	4	Canal 19	Secondary	5,000	5	3	0.8	150	1975	Pol Pot				1
	5	Canal 20	Secondary	2,500	5	3	0.6	105	1975	Pol Pot				1
	6	Koh Kaek	Main	4,800	12	8	2.0	300	1975	Pol Pot			3	
Samraong District, Tak	Lumchang Commune			19,200				402			0	6	6	7
	1	Canal 73	Secondary	3,500	5	3	1.0	35	1977	Pol Pot			2	
	2	Canal 74	Secondary	3,800	5	3	1.0	40	1977	Pol Pot				
	3	Canal 20	Main	2,800	10	5	2.0	50	1977	Pol Pot		1	3	1
	4	Canal 21	Secondary	2,500	5	2.5	0.7	10	1977	Pol Pot		1		1
	5	Canal 22	Secondary	1,800	5	2.5	0.7	8	1977	Pol Pot		1		2
	6	Canal 23	Secondary	1,500	5	2.5	0.7	9	1977	Pol Pot			1	3
	7	Slakou River	River	2,600	50	40	3.0	250				3		
	8	Toul Trea	Secondary	700	3	1.5	1.0							
Treang District, Takeo Province	Roneam Commune			24,300				0			0	0	0	5
	1	Vat Sophy	Secondary	4,800	4	2		NA	1976	Pol Pot				1
	2	Doem Pou	Secondary	2,800	3	2	0.5	NA	1976	Pol Pot				
	3	Trapeang Chak	Secondary	2,000	3	2		NA	1976	Pol Pot				
	4	Phum Thkov	Secondary	6,000	4	2	0.5	NA	1977	Pol Pot				
	5	Lork Prey Paa	Secondary	5,000	4	2	1.0	NA	1977	Pol Pot				4
	6	Vat Trapeang Thum	Secondary	2,500	3	2	0.5	NA	1977	Pol Pot				
	7	Trapeang Ankeuh	Secondary	1,200	3	2		NA	1978	Pol Pot				
	Khvav Commune			23,800				1,304			0	4	0	4
	1	Tap Srov	Secondary	4,800	4	2	0.7	1,304	1976	Pol Pot		1		1
	2	Banla Saait	Secondary	3,500	4	2	0.7	NA	1977	Pol Pot		1		
	3	Kouk Roveang	Secondary	1,000	6	3	1.0	NA	1977	Pol Pot				
	4	Trapeang Krasang	Secondary	3,000	3	1	0.5	NA	1976	Pol Pot				
	5	Vat Thmei	Secondary	2,000	3	1	0.5	NA	1977	Pol Pot				
	6	Dum Per	Secondary	3,700	3	1	0.5	NA	1976	Pol Pot				
	7	Khang Loch Doun Per	Secondary	1,300	3	1	0.5	NA	1977	Pol Pot				
	8	Chhuk Veng	Secondary	2,000	3	1	0.6	NA	1978	Pol Pot				
	9	Dam Tnot	Secondary	2,500	3	1	0.6	NA	1976	Pol Pot		2		3
	Total			452,915				14,553			0	105	49	175

Source : DWRAM. Information from Commune Office collected during the first Study period.

Table G-2 List of Existing Canals by System

Name	Type of Canal	Total Length (m)	Present Irrigation Area (ha)	Number of Structures				Remarks
				spillway	bridge	gate	pipe	
Canal 05	Secondary	3,000	130		2		10	
Canal 06	Secondary	13,050	305		7		15	Start from Tram Kak Commune (Route 3)
Canal 07	Secondary	11,200	196				1	
Canal 08	Secondary	17,000	300		9	4	30	Start from Koh Kaek
Canal 09	Secondary	7,750	150					
Canal 10	Secondary	17,000	500		4		6	
Canal 11	Secondary	12,400	400		3		6	
Canal 12	Secondary	11,750	270		2	4		
Canal 13	Secondary	14,650	450			1	3	Start from Koh Kaek
Canal 14	Secondary	9,350	399		3			Start from Sdok Sap Reservoir
Canal 15	Secondary	18,565	498		8	1	1	Start from Koh Kaek
Canal 16	Secondary	20,950	595		3	2	1	Start from Koh Kaek
Canal 17	Secondary	16,500	495		5		5	Start from Ou Ta Ma Reservoir
Canal 18	Secondary	14,500	440				2	Start from Ang 160 Reservoir
Canal 19	Secondary	19,250	555		1		7	Start from Canal 60
Canal 20	Secondary	23,600	1,091		7	6	5	Start from Canal 33
Canal 21	Secondary	21,450	1,590		1	1	9	Start from Koh Kaek and Canal 33
Canal 22	Secondary	25,550	693		3	1	7	Start from Canal 33
Canal 23	Secondary	22,150	619		1	4	5	Start from Canal 33
Canal 24	Secondary	5,200	120			1		Start from Kpob Trabek Reservoir
Canal 33	Main	22,650	990		26	13	31	Start from Kpob Trabek Reservoir
Canal 60	Secondary	16,000	525		9	1	1	Start from Canal 20
Canal 65	Secondary	10,800	280		2		15	Drain from Otdam Suriya is connected.
Canal 68	Secondary	11,000	280		2	1	2	Start from the Slakou River at Route 3
Canal 73	Secondary	3,500	35			2		
Canal 74	Secondary	3,800	40					
Koh Kaek	Main	21,900	723			5	4	Start from Kpob Trabek Reservoir
Prey Kdouch	Secondary	1,500	250			1		Independent
Tumnup Lok	Feeder	5,500	80			1		Start from the Slakou River at Tumnup Lok
Vat Sophy	Secondary	4,800					1	Roneam, Treang District
Doem Pou	Secondary	2,800						Roneam, Treang District
Trapeang Chak	Secondary	2,000						Roneam, Treang District
Phum Thkov	Secondary	6,000						Roneam, Treang District
Lork Prey Paa	Secondary	5,000					4	Roneam, Treang District
Vat Trapeang Thum	Secondary	2,500						Roneam, Treang District
Trapeang Ankeuh	Secondary	1,200						Roneam, Treang District
Tap Srov	Secondary	4,800	1,304		1		1	Khvav, Treang District
Banla Saait	Secondary	3,500			1			Khvav, Treang District
Kouk Roveang	Secondary	1,000						Khvav, Treang District
Trapeang Krasang	Secondary	3,000						Khvav, Treang District, Canal 6
Vat Thmei	Secondary	2,000						Khvav, Treang District, Canal 5
Dum Per	Secondary	3,700						Khvav, Treang District, Canal 65
Khang Loch Doun Per	Secondary	1,300						Khvav, Treang District
Chhuk Veng	Secondary	2,000						Khvav, Treang District
Dam Tnot	Secondary	2,500			2		3	Khvav, Treang District
Slakou River	River	2,600	250		3			Lumchang Commune, Samraong District
Toul Trea	Secondary	700						Lumchang Commune, Samraong District
Total		452,915	14,553	0	105	49	175	

Source : DWRAM. Information from Commune Office collected during the first Study period.

Table G-3 Existing Small Reservoirs in the Study Area

No.	Name	Coimmune	Result of Field Survey and Estimation									Remarks
			Length(m)	Width(m)	Height of Dike(m)	Effective Operation Water Depth(m)	Effective Water Volume(m^3)	Average of Supplemental Irrigation (mm)	Irrigable Area by Effective Volume (ha)	Water Source(*)	Present Use	
1	San Dor	Cheang Tong	-	-	-	-	-	-	-	-	no	completely damaged by flood
2	Tumnup Ta Oum		980	84	2.5	0.60	49,392	350	15	R		
3	Ang Khnar	Leay Bour	440	130	2.5	0.24	13,728	350	4	RF	irrigation	only wet season
4	Ang Ongk Kcheay	Leay Bour	115	110	1.7	0.40	5,060	350	1	RF	non-irrigation	animal, domestic
5	Tumnup Kim Sei	Nhaeng Nhang	460	350	2.0	0.45	72,450	350	21	C	irrigation	
6	Ang Rom Lech Svay	Otdam Souriya	-	-	-	-	-	-	-	R	no	completely damaged by flood
7	Tumnup Kpob Trabek	O Saray	Upper Slakou Irrigation System									
8	Ang Boeung Sa Tong	T.T.K.Cheung	200	160	1.7	0.44	14,080	350	4	RF	irrigation	only wet season
9	Sdok Sap	Samraong	1200	200	2.4	0.30	72,000	350	21	R	irrigation	only wet season, natural inflow
10	Ang Srei Ronoung	Srae Ronoung	540	460	2.0	0.28	69,552	350	20	R	irrigation	domestic, animal
11	Ang Ta Phem	Ta Phem	-	-	-	-	-	-	-	-	no, converted	paddy field, completely damaged
12	Ang Vatcham Pa	Ta Phem	-	-	-	-	-	-	-	-	non-irrigation	only for domestic, animal
13	Ang Kol Korm	Tram Kak	420	220	4.0	0.49	45,276	350	13	C	irrigation	on Koh Kaek Main Canal
14	Trapeang Lean	Kus	330	180	2.0	0.59	35,046	350	10	C	irrigation	wet season only, Koh Kaek
15	Ou Romdoul	Tram Kak	688	360	2.7	0.80	198,144	350	57	R	irrigation	all season, natural stream
16	Ang Yeay Chrong	Tram Kak	290	75	2.2	0.40	6,620	350	2	R	non-irrigation	natural stream
17	Trapeang Svay	T.T.K.Cheung	-	-	-	-	-	-	-	-	no, converted	paddy field, completely damaged
18	Prey Sbat	T.T.K.Cheung	130	400	3.1	0.50	26,000	350	7	C	irrigation	wet season only
19	Prey Dok Por	T.T.K.Cheung	300	200	2.1	0.58	34,800	350	10	C	irrigation	wet season only
20	Tumnup Lok	T. Kranhung	Upper Slakou Irrigation System									
21	O Saray	O Saray	650	600	4.0	0.60	234,000	350	67	R	irrigation	studied in the master plan study
22	Prey Kdouch(North)	T. Kranhung	560	150	1.9	0.50	42,000	350	12	C	irrigation	reservoir on the upstream
23	Prey Kdouch(South)	T. Kranhung	360	270	2.7	0.60	58,320	350	17	R	irrigation	additionally identified.
24	Ang Prey Preal	T.T.K.Tboung	500	230	1.9	0.46	52,900	350	15	R	irrigation	wet season only
25	Ang Prey Kdei	Samraong	690	300	3.0	0.20	41,400	350	12	R,C	irrigation	wet season only, Koh Kaek
26	Ang 160	T.T.K.Tboung	360	400	2.6	0.50	72,000	350	21	R	irrigation	natural stream
27	Boeung Kbalromeas	Phong	390	340	2.0	0.35	46,410	350	13	C	non-irrigation	fish pond
28	Toul Khcheay	Basedth	900	350	3.2	0.40	126,000	350	36	R	irrigation	damaged by flood in 1991
29	Tumnup Ta Ses	Kus	240	340	2.3	0.43	35,088	350	10	R	irrigation	wet season only
30	Ta Moung	Kus	-	-	-	-	-	-	-		no	completely damaged
31	160 Reservoir	Tram Kak	300	120	1.8	0.97	34,920	350	10	C	irrigation	additionally identified. Koh Kaek
							Total Irrigable Area(ha)=		330			

Note: Dimensions and other parameters were estimated on the basis of the information obtained at Commune offices and site inspection.

R: river or stream
C: canal
RF: rainfall

Table G-4 List of Roads by Commune in the Study Area (1/7)

Name of Road	Beginning Point	Ending Point	Length (m)	Width (m)	Condition			Surface		Remarks
					good	fair	poor	Earth	Laterite	
Angk ta Saom Commune			43,830							
Trapeang Keat	Route 3	Prey Mok, Srae Ronoung	2,000	5.0			x	x		
Vat Odom Seila	Route 3	Traoeang Chhuk, Ley Bour	2,800	5.0		x		x	x	
Trapeang Khna	Route 3	Vat Trapeang Khna	200	5.0	x				x	
Prey Dam Rei	Route 3	Chamkar Ang, Kus	1,000	4.0			x	x		
Trapeang Trabek	Route 3	Tumnup Ang Moeng	8,850	5.0		x		x		
Srok Chek	Route 3	Prey Peay	2,000	5.0		x		x		
Toul Mon	Route 3	Tumnup Ang Tnot	2,000	5.0		x		x		
Vat Ang Tnot	Route 3	Vat Ang Tnot Chhuteal Pra Kaab	3,500	3.0	x				x	
Prey Chhuk Teal	Route 3	Moha Se Na village	3,000	6.0		x		x		ADB
O Pot	Ang Tnot Lech	O Pot Lok Prasath Thmei	8,500	2.5			x	x		
Ang Moeng	Ang Tnot	Ang Run, Kus	8,000	5.0			x	x		
Khnach Choar Trapeang Sramgae	Trapeang Srangae	Khnach Choar, Kus	1,980	4.0		x		x		WFP
Chueng Tong Commune			26,199							
Moeng Char	Route 33	Vat Moeng Char	4,600	5.0		x		x		
Prey Sbat	Route 33	Vat Prey Sbat	4,200	5.0		x		x		
Moeng Char	Damnak Roveang	Prey Sbat	5,700	5.0			x	x		
Toul Roka	Prey Sbat	Toul Roka	1,300	5.0	x				x	
Veal Thum	Trapeang Tuk	Moeng Char	1,000	3.0			x	x		
No Mou	No Mou	Totung Thngay	2,500	4.0			x	x		
Trapeang Srangae	Trapaeng Srangae	Srae Krou	1,106	5.0		x		x		
Ang Baksei	Ang Baksei	Srae Krou	1,000	5.0		x		x		
Ang Kralanh	Ang Baksei	No Mou	1,500	5.0			x	x		
Trav Em	Ka Ngoak Pong,Po Pel Comm	Vat Ang Baksei	793	4.0	x			x		WFP
Ti Pat	Route 33	Canal 20	1,000	4.0		x		x		
Route 33	Ti Pat Village	Srae Khvav Village	1,500	6.0	x				x	ADB
Kus Commune (1/2)			31,196							
Ang Ponareay	Route 3	Tram kak	9,500	4.5		x		x		
Tram Kak	Pen Meas,Somrong Commune	Neal,Tram kak Commune	4,000	6.0	x				x	ADB
Ta Leak	Vat Ang Ponareay	Tom Nup Ta Oum	1,885	4.0		x			x	WFP
Prey Ta Khab	Trapeang Ta Sok	Prey Ta Khab	1,730	4.0		x		x		WFP
Krang Ta Chan	Vat Nikrouth	Trapeang Ampil	1,100	3.0		x		x		community

Source: DRD. Collected from communes during the Study.

Table G-4 List of Roads by Commune in the Study Area (2/7)

Name of Road	Beginning Point	Ending Point	Length (m)	Width (m)	Condition			Surface		Remarks
					good	fair	poor	Earth	Laterite	
Kus Commune (2/2)										
Munirangsei	Ang Ta ngil	Vat Munirangsei	1,247	4.0		x		x		WFP
Mean Chey	Vat Bakhong	Knach Choar	1,100	3.0		x		x		community
Knach Choar,Trapeang Srangae	Trapeang Srangae	Vat Munirangsei	2,784	4.0		x		x		WFP
Ni Krouth Khang Tbong	Vat Nikrouth	Ta Leak Khang Tbong	1,200	3.0		x		x		community
Ang Me Trei	Kus Commune Center	Route 3	3,800	4.0		x		x		community
Tuk Thla	Route 3	Tonsoang Ro	1,000	4.0		x		x		community
Ang Run	Route 3	Sala Ang Run	1,350	4.0		x		x		WFP
Tuk Thla	Sala Prey Rak	Tuk Thla	500	3.5		x		x		community
Leay Bour Commune			59,950							
Vat Leay Bor	Route 22	Ang Rompeak,Odomsoriya	6,000	4.0		x		x		
Vat Vihear Kpos Lech	Bak kot	Prey Men Village	1,700	4.0		x		x		WFP
Vat Vihear Kpos	Route 22	Vat Vihear Kpos	2,000	4.0	x				x	
Ang Thlok	Raiway,Tia Village	Trapeang Run, Odomsoriya	6,500	4.0		x		x		
Prey Theat	Route 22	Trapeang Trakeat,Odomsoriya	4,500	4.0		x		x		
Vat Ta Leur	Ang Ta Chan,Leay Bor Com	Vat Ang Chhuk	4,200	4.0		x		x		WFP
Vat Khna	Route 22	Vat Khna	4,000	4.0	x				x	
Plov Kandal	Raiway,Sen Born Village	Trapeang Chhuk Village	8,000	4.0		x		x		WFP
Vat AmPil	Route 22	Sen Born Village	2,200	4.0		x		x		
Phum Sla	Route 22	Prey Mok, Srae Ronoung	3,700	3.0		x		x		
Trapeang Chhuk	Route 22	Prey Mok, Srae Ronoung	3,700	3.0			x	x		
Kach Trak	Route 22	Kach Trak Village	2,000	3.0			x	x		
Ang Neareay	Route 22	Ang Neareay Village	1,300	3.0		x		x		
Phum Prey Kuy	Route 22	Prey Kuy Village	1,000	3.0						
Toul Tbeng	Route 22	Vat Ang Chhuk	2,500	4.0		x		x		
Phum Toul Tbeng	Route 3	Toul Tbeng Village	1,200	3.0		x		x		
Trapeang Trach	Trapeang Trach Village	Trapeang Trach Village	750	3.0		x		x		
Phum Boeung	Route 22	Boeung Village	1,500	3.0		x		x		
Phum Prey Theat	Route 22	Toul Tbeng Village	1,500	3.0		x		x		
Trapeang Kou	Route 22	Trapeang Trach Village	1,700	4.0		x		x		

Source: DRD. Collected from communes during the Study.

Table G-4 List of Roads by Commune in the Study Area (3/7)

Name of Road	Beginning Point	Ending Point	Length (m)	Width (m)	Condition			Surface		Remarks
					good	fair	poor	Earth	Laterite	
Nhaeng Nhang Commune			13,700							
Komsei	Route 3	Canal 07	2,000	4.0			x	x		People
Russei Srok	Route 3	Ang Ta Soam Village	2,500	4.0			x	x		WFP
Sleng Koang,Chrey Tnot	Route 16	Chrey Tnot	4,600	4.0			x	x		WFP
Ta Tai	Route 3	Vat Ta Tai	2,300	4.0			x	x		WFP
Ta Tai	Route 16	Vat Ta Tai	1,000	4.0		x		x		community
Srae Ronoung	Route 3	Krang Svay Srae Ronoung	1,300	6.0	x				x	ADB
Otdam Suriya Commune			30,945							
Damnak Ta Sek	Route 3	Praseat,Lumchang Commune	6,400	6.0	x				x	ADB
Vat Leay Bor	Vat Pou Vann	Seima, Leay Bor Commune	2,000	4.0		x		x		
Rompeak Pen	Trapeang Phong	Route 3	2,395	4.0		x		x		WFP
Vat Ta Leur	Route 3	Ang Ta Nou,Leay Bor Comm	2,200	4.0		x		x		WFP
Trapeang Run	Trapeang Phong	Trapeang Run Village	4,200	4.0		x		x		WFP
Dak Van	Trapeang Chhuk Village	Dak Van Village	1,700	3.0		x		x		
Chung Ang	Ta So Village	Chung Ang Village	2,050	4.0		x		x		EU
PteasTa Phoeuk	Ta So Village	Dak Van Village	2,000	2.5			x	x		
Phum Romlech Svay	Vat Pou Vann	Romlech Svay Village	2,000	3.0		x		x		
Phum Ta So	Ta So Village	Stung Village	2,500	3.0		x		x		
Chamkar Dong	Trapeang Chhuk Village	ChamKar Dong Village	1,000	2.5			x	x		
Prab Siem	Prab Siem Village	Trapeang Run Village	2,500	2.0			x	x		
O Saray Commune (1/2)			48,211							
Phum Tnot Chum	Tnot Chum	Damnak Khlong	3,750	3.6		x			x	WFP
Ang Doung	Phsa Trapeang Andoe	Damnak Khlong	4,550	3.2		x		x		
Damnak Khlong	Damnak Khlong	Sokram	320	3.2		x		x		WFP
Thnal Thlok	Russei Moy Kum	Thnal Thlok	4,676	3.8	x				x	WFP
Vat Banteay Chum	Trapeang Krasang	Trapeang Kachao	2,820	3.8	x				x	WFP
Tnot Chum	Route 33	Ang Trav	3,480	3.8	x				x	WFP
Trapeang Dang Tuk	Trapeang Dang Tuk	Boeung Satong	2,050	3.2		x		x		
Ang Thlok Raingsei	Damnak Khlong	Trapeang Chak	4,500	2.8		x		x		
Phum Stung	Route 33	Ang Trav	2,200	3.2		x		x		
Phum Trapeang Plou	Trapeang Plou	Sokram	3,500	2.8		x		x		
Route 33	Trapeang Krasang	Russei Moy Kum	7,500	6.0		x		x		
Knong Phum	Tnot Chum Khang Tbong	Trapeang Krasang Village	1,865	2.5		x		x		Community

Source: DRD. Collected from communes during the Study.

Table G-4 List of Roads by Commune in the Study Area (4/7)

Name of Road	Beginning Point	Ending Point	Length (m)	Width (m)	Condition			Surface		Remarks
					good	fair	poor	Earth	Laterite	
O Saray Commune (2/2)										
Trapeang Krasang	Trapeang Krasang	Boeung Satong	1,400	2.5		x		x		
Phum Trapeang Krasang	Trapeang Krasang	Stung Village	3,500	2.5		x		x		
Toul Khlong	Plov Ang Doung	Route 33,Russei Moy Kum	2,100	2.5		x		x		
Popel Commune			30,200							
Prey Chour	Route 3	Ang Baksei,Chutong Commune	4,600	4.0		x		x	x	Laterite2,200m
Moeng Char	Route 3	Trapeang Pou,Chutong Commu	4,600	4.0		x		x		WFP
Trapeang Pring	Route 3	Trapeang Pring Village	1,000	3.0		x		x		
Champul	Route 3	Trapeang Pring Village	3,000	4.0		x		x		WFP
Plov Totung Trapeang Pring	Trapeang Pring Village	Prey Chour Village	3,000	2.0			x	x		
Vat Prasoung	Route 3	Vat Ang Chum	1,300	4.0		x		x		
Plov Totung Trapeang Kak	Prey Chour Village	Trapeang Kak Village	2,000	3.0		x		x		
Plov Totung Phum Kangoak po	Vat Prey Chour	Kangoak Pong Village	4,500	2.0			x	x		
Prey Chuteal	Prey Chour Village	Ang Baksei Village	2,000	2.0			x	x		
Trav Em	Route 3	Ang Baksei,Chutong Commune	4,200	4.0		x		x		
Samraon Commune			36,515							
Tramkak	Trapeang Thmor	Prasoth Thmei	3,000	5.2	x				x	ADB
Vat Pchuk Chrum	Pchuk Chrum	Krang Banteay	5,800	4.0		x		x		
Phum Prasoth Thmei	ADB Road	Krang Banteay	3,500	2.5		x		x		O Pot Road
Pen Meas	ADB Road	Krang Banteay	4,000	2.5		x		x		
Phum Prasoth Thmei	ADB Road	Ta Sman	2,700	2.5		x		x		
Phum Krabei Prey	Krabei Prey	Sdok Sap	2,200	2.5		x		x		
Krabei Prey	ADB Road	Chan Teap	2,535	3.6		x		x		Community
Phum Ta Soam	Ta Soam	Trapeang Chhuk	1,000	2.5			x	x		
Phum Chan Teap	Chan Teab	Pravong	1,200	3.8		x		x		WFP
Phum Chan Teap	Chan Teab	Ba Khong Khang Lech	1,480	3.8		x		x		WFP
Phum Sombour	Sombour	Ta Pen	1,200	2.5			x	x		
Chan Teap,Trapeang Ta Chan	Chan Teab	Prey Koki	2,700	3.0		x		x		
Phum Trapeang Thmor	Trapeang Thmor	Chan Teap	2,700	2.5		x		x		
Phum Prey Kdei	Prey Kdei	Ta Pen	2,500	2.5		x		x		

Source: DRD. Collected from communes during the Study.

Table 3.6.4 G-4 List of Roads by Commune in the Study Area (5/7)

Name of Road	Beginning Point	Ending Point	Length (m)	Width (m)	Condition			Surface		Remarks
					good	fair	poor	Earth	Laterite	
Srae Ronoung Commune			28,717							
Srae Ronoung	Krang Svay	Srae Chhu Neang Village	7,160	6.0	x	x		x	x	ADB/on-going
Plov Phum Thmei	Phum Thmei	Phum Trach	2,000	3.0			x	x		
Plov Phum Thum	Vat Srae Ronoung	Phum Thum	2,500	3.0			x	x		
Plov Phum Trapeang Ronoung	Trapeang Ronoung Village	Trapeang Ronoung Village	2,000	3.0			x	x		
Plov Prey Mok	Krang Svay Village	Prey Mok Village	3,857	4.0		x		x		WFP
Plov Trapeang Tonlop	Trapeang Tonlop Village	Pravoney Village	3,150	4.0		x		x		WFP
Plov Srae Thlok	Srae Thlok Village	Trapeang Thnal Village	3,050			x		x		WFP
Plov Chrey Veng	Samaki Village	Chrey Veng Village	5,000	3.0			x	x		Old Road
Ta Phem Commune			28,860							
Ang Chum Mean Leak	Route 33	O Pot Village	4,160	6.0	x				x	ADB
Pou Preas Sang	Route 3	Ang Kralanh,Chungtong Comm	7,800	4.0		x		x		WFP
Chan Teab	Ang Chum Mean Leak	Koh Nhay,Somrong Commune	1,100	4.0		x		x		WFP
Tom Nop Trapeang Krasang	Route 33	Ta So Village	2,000	4.0		x		x		WFP
Pralay No 17	Ta So Village	Ta Kam Village	5,000	4.0			x	x		WFP
Pravong	Ang Chum ADB	Trapeang Chaing,Somrong Com	2,100	4.0			x	x		WFP
Phlov No 33	Prey Chhuteal Village	Ta Mum,Ta Phem Commune	3,700	6.0	x				x	ADB
Pravong	ADB Road	Trapeang Svay Village	2,000	4.0	x			x		WFP
Ang Tnot	Chhuteal Prakeab Ang Ta Soam	Ba Khong Khang Ket Village	1,000	3.0		x		x		
Tram Kak Commune			25,400							
Koh Ka ek	Koh Ka ek	Thmor Keo	4,000	6.0	x				x	ADB
Boeung Makak	Route 3	Doem Pou Village	1,200	2.5			x	x		Old Road
Krang KOR	ADB Road	Boeung Makak Village	2,400	2.5			x	x		Old Road
Trapeang Khlot	Route 3	Doem Pou Village	1,700	2.5			x	x		Old Road
Koh Ka ek	Koh Ka ek	Trapeang Ta Sok	2,900	2.5			x	x		Old Road
Trapeang Chak	Yeay Lor	Prey Romdoul	3,000	2.5			x	x		Old Road
Trapeang Russei	ADB Road	Tom Nup Lork	3,000	2.5			x	x		Old Road
Chrey Tnot	Route 3	Champei Commune	2,500	2.5			x	x		WFP
Sleng Koang,Chrey Tnot	Tramkak,Trapeang Rompeak	Chrey Tnot	1,800	4.0		x		x		WFP
Ang Roneap	Ang Roneap	Sen Oak Village	1,300	2.5			x	x		Old Road
Prey Romdoul	Trapeang Kes	Prey Romdoul	1,600	2.5			x	x		Old Road

Source: DRD. Collected from communes during the Study.

Table G-4 List of Roads by Commune in the Study Area (6/7)

Name of Road	Beginning Point	Ending Point	Length (m)	Width (m)	Condition			Surface		Remarks
					good	fair	poor	Earth	Laterite	
Trapeang Thum Khang Cheung Commune			39,470							
Trapeang Kul, Tramkak	Ang Trach Village	Prakeab,Trapeang Thum Tbon	700	6.0	x				x	ADB
Mongkul Mean Leak,Pou Run	Vat MongKul Mean Leak	Vat Pou Run	5,800	4.0			x	x		WFP
Pou Dos	Route 33	Pou Dos Village	4,370	4.0	x				x	WFP
Phum Trapeang Svay	Route 33	Prey Dok Por	1,200	3.0			x	x		
Ang Peak Bang Oang	Route 33	Ang Trav Village	1,000	3.0			x	x		
Veal Norea	Pou Dos	Prey Sbat Village	1,050	3.0			x	x		
Andong Chub	Pou Dos	Boeung Satong Village	1,500	3.0			x	x		
Trapeang Luk	Vat Pou Dos	Route 33	3,500	3.0			x	x		
Damnak Trach	ADB Road	Vat Serei Damnak	4,500	4.0		x		x		
Prey Sbat	Prey Sbat Village	Prey Kdouch Village	1,300	3.0			x	x		
Pralay 23	Peak Bang Oang Village	Prey Sbat Village	5,500	3.0			x	x		
Plov Lak 33	Srae Khvav Village	Peak Bang Oang Village	5,000	6.0	x				x	ADB 2050m
Moeng Char	Toul Tbeng Village	Pou Dos Village	4,050	4.0		x		x		
Trapeang Kranhung Commune			24,930							
Prey Kdouch	Prey Kdouch	Ta Am	2,400	3.0		x		x		
Trapeang Skea	Trapeang Skea	Ta Am	3,500	3.0		x		x		
Trapeang Chak	Trapeang Chak	Ang Sang Ke	1,800	2.8		x		x		
Trapeang Kranhung	Trapeang Chak	Kbob Svay	3,230	3.6		x			x	WFP
Plov Lork	Plov Lork	Kbob Svay	2,500	3.6		x			x	WFP
Trapeang Skea	Trapeang Skea	Kbob Svay	1,800	3.6		x			x	WFP
Route 33	Russei Moy Kum	Trapeang Kranhung	9,700	6.0		x		x		
Trapeang Thum Khang Tbong (1/2)			43,480							
Tram Kak Road	Prey Preal	Prey Kdei	4,500	6.0			x		x	ADB
Pchuk Chrum Road	Route 3	Samraong	2,300	4.0			x	x		
Vat Trapeang Thum Road	Prey Romdoul	Trapeang Chhuk	2,800	10.0			x	x		
Trapeang Khan Road	Vat Pchuk Chrum	Trapeang Koh	2,500	4.0			x	x		WFP
Trapeang Tnot Road	Vat Trapeang Thum	Trapeang Kor	4,000	4.0		x		x		community
Prey Kdei Road	ADB Road	Ta Phem	2,300	3.0			x	x		
Theat Trapeng Thnd Road	ADB Road	Trapeang Chrey	3,500	4.0			x	x		
Lo Ieo Road	ADB Road	Trapeang Chhuk	3,500	4.0			x	x		
Trapeang Ses Road	ADB Road	Pralay Thum	2,000	4.0			x	x		
Pralay Lu Ta Born Road	ADB Road	Trapeang Tnot	2,000	3.0			x	x		

Source: DRD. Collected from communes during the Study.

Table G-4 List of Roads by Commune in the Study Area (7/7)

Name of Road	Beginning Point	Ending Point	Length (m)	Width (m)	Condition			Surface		Remarks
					good	fair	poor	Earth	Laterite	
Trapeang Thum Khang Tbong (2/2)										
Phlov Tov 160 Road	ADB Road	Phnom Damrei Romeal	3,000	4.0			x	x		
Toul Krus Road	ADB Road	Toul Krus	2,500	4.0			x	x		
Phum Khum Road	ADB Road	Phnom Damrei Romeal	4,500	4.0			x	x		
Prey Preal Road	ADB Road	Vat Serei Domnak	4,080	4.0			x	x		
Lumchang Commune			21,000							
Svay Prey Road	Svay Prey	Route-3	9,000	4.0	x				x	ADB
Phum Pong Tuk Road	Pra Saat	Khvav	4,000	3.0			x	x		
Phum Ta Mong Road	Ta Mong	Khvav	4,000	3.0			x	x		
Phum Roung Road	Roung	Seima Leay Bour Commune	4,000	3.0			x	x		
Phum Kdol Road	Kdol	Toul Trea	2,000	4.0					x	Oxfam
Roneam Commune			15,900							
Sa La Khum Road	Treang District Center	Srae Ronoung	8,400	6.0		x		x		
Vat Prey Pha Ie	Route-2	Srae Ronoung	7,500	5.0			x	x		
Ang Kaev Commune			15,900							
	Route-2	Route-31	8,200	6.0			x	x		
	Pi Muk Sek	Khnos	5,500	5.0			x	x		
Vat Russei Sok Road	Route-2	Vat	2,200	5.0		x				
Khvav Commune			21,000							
Srei Sith Road	Roneam Commune	Champei Commune	11,000	5.4			x	x		
Kdei Run	Prey Sluk Commune	Ra Thomada	10,000	5.4			x	x		
Total			585,403							

Source: DRD. Collected from communes during the Study.

Table G-5 Number of Wells by Commune

Commune	Tubewell (Hand Pump)		Open Well		Tubewell (EnginePump)		Total	House-hold	House-Hold per well
	Pub	Priv	Pub	Priv	Pub	Priv			
Tram Kak Dist.	463	143	158	47	110	7	928	28,826	31.1
Angk Ta Saom	4	67	3	11		2	87	2,781	32.0
Cheang Tong	5	35	2	5	1	5	53	1,981	37.4
Kus	15	1	8	1	3		28	2,653	94.8
Leay Bour	87	27	25	13	24		176	3,501	19.9
Nhaeng Nhang	21	3	11	3	3		41	1,157	28.2
Otdam Souriya	22	5	31	3	22		83	1,712	20.6
O Saray	5		8	1			14	2,112	150.8
Popeel	26		7	6	22		61	1,446	23.7
Samraong	11	1	11	2			25	1,216	48.6
Srae Ronoung	43		2		4		49	1,433	29.2
Ta Phem	26		32		6		64	2,539	39.7
Tram Kak	33		4		20		57	2,236	39.2
T.T.K. Cheung	37	1	7		2		47	1,521	32.4
T. Kranhung	43		6				49	996	20.3
T.T.K.Tboung	85	3	1	2	3		94	1,542	16.4
Samraong Dist.	12	33	8	5	3	2	63	1,090	17.3
Lumchang	12	33	8	5	3	2	63	1,090	17.3
Treang Dist.	54	8	39	14	1	0	116	3,946	34.0
Roneam	19	5	12	1			37	1,520	41.1
Angk Kaev	13		3				16	634	39.6
Khvav	22	3	24	13	1		63	1,792	28.4
Total	529	184	205	66	114	9	1,107	33,862	30.6

Table G-6 Number of Latrines by Commune

	Latrine (nos.)			Household (nos.)	No. of Household per Latrine
	Public	Private	Total		
Tram Kak District	53	1,804	1,857	28,826	15.5
Angk Ta Saom	11	757	768	2,781	3.6
Cheang Tong	5	224	229	1,981	8.7
Kus	8	11	19	2,653	139.6
Leay Bour	4	39	43	3,501	81.4
Nhaeng Nhang	2	19	21	1,157	55.1
Otdam Souriya	4	22	26	1,712	65.8
O Saray	5	12	17	2,112	124.2
Popeel	4	123	127	1,446	11.4
Samraong	4	9	13	1,216	93.5
Srae Ronoung	4	248	252	1,433	5.7
Ta Phem	0	33	33	2,539	76.9
Tram Kak	2	48	50	2,236	44.7
T.T.K. Cheung	0	175	175	1,521	8.7
T. Kranhung	0	0	0	996	
T.T.K. Tboung	0	84	84	1,542	18.4
Samraong	0	92	92	1,090	11.8
Lumchang	0	92	92	1,090	11.8
Treang	13	78	91	3,946	43.4
Roneam	7	41	48	1,520	31.7
Angk Kaev	2	2	4	634	158.5
Khvav	4	35	39	1,792	45.9
Total	66	1,974	2,040	33,862	16.6

Note for Table G-5 and G-6: T.=Trapeang, T.T.K=Trapeang Thum Kham
Source of Table G-5 and G-6: Number of wells -> DRD, 2001 (collected from communes during the Study)
Household number-> Population Census Cambodia 1998

Table G-7 Number of Primary School, Classroom, Classes and Students in the Related Districts

Districts	No. of Schools	No. of Class Room	No. of Classes	Students			No. of Students per Classroom
				Male	Female	Total	
Tram Kak District	59	643	843	19,108	16,268	35,376	55
Angk Ta Saom	5	59	86	1,508	1,497	3,005	51
Cheang Tong	3	29	39	864	819	1,683	58
Kus	6	64	79	1,771	1,587	3,358	52
Leay Bour	6	61	89	2,091	1,636	3,727	61
Nhaeng Nhang	3	25	29	611	509	1,120	45
Otdam Souriya	3	48	70	1,621	1,415	3,036	63
O Saray	5	43	59	1,510	1,167	2,677	62
Popeel	3	35	50	1,197	954	2,151	61
Samraong	2	23	33	755	596	1,351	59
Srae Ronoung	4	40	46	885	716	1,601	40
Ta Phem	4	48	62	1,386	1,178	2,564	53
Tram Kak	5	61	70	1,928	1,486	3,414	56
T.T.K. Cheung	5	49	57	1,262	1,146	2,408	49
T. Kranhung	2	10	23	510	470	980	98
T.T.K. Tboung	3	48	51	1,209	1,092	2,301	48
Samraong	1	19	28	1,124	508	1,632	86
Lumchang	1	19	28	1,124	508	1,632	86
Treang	17	107	109	3,213	2,237	5,450	51
Roneam	11	49	38	1,502	889	2,391	49
Angk Kae	2	7	14	339	207	546	78
Khvav	4	51	57	1,372	1,141	2,513	49
Total	77	769	980	23,445	19,013	42,458	55

Note: T.=Trapeang, T.T.K=Trapeang Thum Kham
Source: Number of wells -> DRD, 2001 (collected from communes during the Study)
Household number-> Population Census Cambodia 1998

Table G-8 Priority Projects on Infrastructures in the Tram Kak District Development Plan for the Year 2001 – 2005 (1/2)

Development Item	Sector	Location / Commune	Works
Water Resources and Meteorology Sector (MOWRAM)			
Tumnup Lok Reservoir	Irrigation	Trp. Kranhung	Rehabilitation for 1,550 ha
Kpob Trobek Reservoir	Irrigation	O Saray	Rehabilitation for 6,200 ha
O Sary Reservoir	Irrigation	O Saray	Rehabilitation for 320 ha
Prey Preal Reservoir	Irrigation	T.T.K. Tbong	Rehabilitation for 30 ha
Ang 160 Reservoir	Irrigation	T.T.K. Tbong	Rehabilitation for 200 ha
Ang Kol Korm Reservoir	Irrigation	Tram Kak	Rehabilitation for 200 ha
O Romdoul Reservoir	Irrigation	Tram Kak	Rehabilitation for 510 ha
Canal 23	Irrigation	Not specified	Rehabilitation from O Saray to Leay Bour for 26.5 km and 5,000 ha
Canal 22	Irrigation	Not specified	Rehabilitation from for 23.8 km and 2,000 ha
Canal 8	Irrigation	Not specified	Rehabilitation from for 1,400 ha
Rural Development (MRD)			
Route 3 to Vat Ang Pomareay	Road	Kus	Construction Requested to ADB, L=9.5 km (partly on-going)
Route 33 to Trp. Tasok Village	Road	Samraong	Construction Requested to ADB, L=9.8 km
Maeng Kul Laek to Prey Kdouch (road to O Saray)	Road	Not Specified	Construction Requested to ADB, L=20 km
Route 3 (Popel) to Taset Village (T.T.K.Cheung)	Road	Not Specified	Construction Requested to ADB, L=14.5 km
Route 22 to Vat Porvam	Road	Leay Bour, Otdam Suriya	Construction Requested to ADB, L=8.1 km
Route 33 to Vat Moueng Cha	Road	Cheang Tong	Construction Requested to ADB, L=4.6 km
Trp. Tasok Village	Road	Kus	Construction Requested to WFP, L=1.73 km
Koh Nhai Village	Road	Samraong	Construction Requested to WFP, L=2.58 km
Khnach Choar Village	Road	Kus	Construction Requested to WFP, L=2.79 km
Thnot Chum Village	Road	O Sray	Construction Requested to WFP, L=3.187 km
Pordos Village	Road	T.T.K. Cheung	Construction Requested to WFP
Vat Mony Raingsei to Prey Khab	Road	Kus	Rehabilitation Requested to WFP, L=2.5 km
Tumnup Chrey to Route 3	Road	-	Rehabilitation Requested to WFP, L=3.5 km
Trp. Ampil to Khnach Choar	Road	Kus	Rehabilitation Requested to WFP, L=4.1 km
Kus Thmei to Talaek Khang Tbong	Road	Kus	Rehabilitation Requested to WFP, L=9.2 km
Vat Ang Sangker to Trp. Robang	Road	Trp. Kranhung	Rehabilitation Requested to WFP, L=4.5 km
Ta Am Road to Prey Kdouch	Road	Trp. Kranhung	Rehabilitation Requested to WFP, L=3.66 km

Note: Trp=Trapeang, T.T.K.= Trapeang Thum Khang

Source: Development Plan of Tram Kak District Year 2001 -2005

Table G-8 Priority Projects on Infrastructures in the Tram Kak District Development Plan for the Year 2001 – 2005 (2/2)

Development Item	Sector	Location / Commune	Works
Ang Doung Road to Boeung Thnong	Road	O Saray	Rehabilitation Requested to WFP, L=3.0 km
Steung to Khlong	Road	O Saray	Rehabilitation Requested to WFP, L=7.5 km
Trp. Doun Tuek to Trp. Khchao	Road	-	Rehabilitation Requested to WFP, L=2.0 km
Toul Khlong to Russei Mouy Kum	Road	O Saray	Rehabilitation Requested to WFP, L=1.75 km
Route 33 to Trp. Tasok	Road	Samraong, Kus	Rehabilitation Requested to WFP, L=9.2 km
Angkor Chummean Laek to Penmeas	Road	Samraong	Rehabilitation Requested to WFP, L=5.3 km
Trp. Kak to Prey Chour	Road	Popel	Rehabilitation Requested to WFP, L=2.0 km
Trp. Pring to Prey Chour	Road	Popel	Rehabilitation Requested to WFP, L=3.0 km
Prey Chour to Ang Baksai	Road	Popel, Cheng Tong	Rehabilitation Requested to WFP, L=3.0 km
Pond Rehabilitation	Irrigation	All districts	120 ponds
Well development	Water supply	All districts	555 wells
Water treatment pond	Water supply	O Saray, Samraong, Kus	9 water treatment ponds for drinking water
Education (MOE)			
School building	Education	Not specified	Construction of 30 school buildings
School building	Education	Not specified	Repair of 15 school buildings

Note: Trp=Trapeang, T.T.K.= Trapeang Thum Khang

Source: Development Plan of Tram Kak District Year 2001 -2005

Table G-9 Projects and Programs Related to Infrastructures in/around the Study Area

No	Name of Project / Name of Organization	Target District	Activities	Related Organization
1	PRASAC II	• Kirivong • Koh Andeth • Borei Chulasa • Angkor Borei • Treang • Tram Kak	• Water supply • Irrigation • Credit • Agricultural extension • Community development	• MOWRAM • MAFF • MRD
2	WFP	• Tram Kak • Samraong • Bati • Treang • 10 district (hospitals)	• Road improvement • Hospital • Orphan center	• MO.Health • MO.Education • MRD
3	Rural Infrastructure Improvement Project – 2 (ADB)	• Doun Kaev	• Periodical maintenance of roads damaged by floods	• MRD
4	UNICEF	• 10 districts	• School construction	• MO.Education
5	AIT	• Tram Kak • Samraong • Bati • Treang	• Extension of fish ponds	• MAFF
6	AMDA	• Tram Kak • Doun Kaev	• Hospital • Health Center	• MOH
7	Community Aid Abroad (CAA)	• Treang • Prey Kabas	• Irrigation improvement • Drainage culvert • Latrine • Well	• MOWRAM • MAFF • MRD
8	Voluntee Service Abroad (VSA)	• Tram Kak • Doun Kaev	• Village development • Health	• MOH • MO.Education • MRD
9	Cambodian Red Croth (CRC)	• 10 districts	• Road improvement in cooperation with WFP	• MRD • MOH
10	VSF	• Tram Kak • Samraong	• Construction of pond • Well and pipes	• MRD • MAFF
11	Assemblies of God CAMBODIA	• Samraong	• School	• MO. Education
12	Gret	• Samraong • Tram Kak	• Open well • Tubewell	• MRD
13	Mennonite Central Committee (MCC)	• Tram Kak • Doun Kaev • Treang	• Forest community • Bridge construction	• Provincial Gov. • MO. Environment • MAFF • MRD • MOH
14	Rural Development and Resettlement Project	• Tram Kak • Doun Kaev • Samraong • Treang	• Agriculture • Integrated rural development • Irrigation • Capacity building	• MAFF • MOWRAM • MRD
15	Takeo Livelihood Project, Oxfam/CAA	• Takeo	• Rural development • Agricultuer	• MOWRAM • MAFF, MRD

Source: Provincial Department of Rural Development, MRD

Note : MO.=Ministry of…

Table G-10 Construction Cost of Revised M/P for Main Canal

1. Main Canal 33 (Unit : US$)

1. Canal Earth Work	**Q'ty**	**Unit Price**	**Cost**
1) Excavation	4,000 m^3	US$3.70	14,800
2) Embankment	11,000 m^3	US$9.55	105,100
3) Slope Finishing Work (Excavation)	8,000 m^2	US$2.02	16,200
4) Slope Finishing Work (Embankment)	15,000 m^2	US$1.55	23,300
5) Stripping	7,500 m^2	US$1.40	10,500
6) Sodding	3,500 m^2	US$5.72	20,000
Sub-total			**189,900**
2. Canal Related Structure			
1) Diversion Structure	6 nos.	-	172,500
2) Drop	1 no.	-	9,500
3) Bridge	1 no.	-	5,700
4) Box Culvert	4 nos.	-	26,400
Sub-total			**214,100**
3. Miscellaneous			
1) Demolishing		-	**15,400**
4. Total			**419,400**

2. Existing Koh Kaek Main Canal (Unit : US$)

1. Canal Earth Work	**Q'ty**	**Unit Price**	**Cost**
1) Excavation	314,000 m^3	US$3.70	1,161,800
2) Embankment	5,000 m^3	US$9.55	47,800
3) Inspection Road	3,500 m^3	-	52,000
4) Slope Finishing Work (Excavation)	186,000 m^2	US$2.02	375,700
5) Slope Finishing Work (Embankment)	6,500 m^2	US$1.55	10,100
6) Lining (Laterite)	32,000 m^3		590,300
7) Sodding	2,500 m^2	US$5.72	14,300
Sub-total			**2,252,000**
2. Canal Related Structure			
1) Diversion Structure	8 nos.	-	198,800
3) Bridge	8 no.	-	43,500
4) Box Culvert	5 nos.	-	34,800
Sub-total			**277,100**
3. Miscellaneous			
1) Demolishing		-	**25,000**
4. Total			**2,554,100**

Grand Total	**2,973,500**

Table G-11 Construction Cost of Alternative-1 for Main Canals

1. Main Canal 33 (Unit : US$)

		Q'ty	Unit Price	Cost
1	**Canal Earth Work**			
	1) Excavation	6,000 m^3	US$3.70	22,200
	2) Embankment	12,000 m^3	US$9.55	114,600
	3) Slope Finishing Work (Excavation)	13,000 m^2	US$2.02	26,300
	4) Slope Finishing Work (Embankment)	16,000 m^2	US$1.55	24,800
	5) Stripping	9,000 m^2	US$1.40	12,600
	6) Sodding	4,000 m^2	US$5.72	22,900
	Sub-total			**223,400**
2	**Canal Related Structure**			
	1) Diversion Structure	6 nos.	-	172,500
	2) Drop	1 no.	-	8,500
	3) Bridge	1 no.	-	5,700
	4) Box Culvert	4 nos.	-	26,400
	Sub-total			**213,100**
3	**Miscellaneous**			
	1) Demolishing		-	**15,400**
4	**Total**			**451,900**

2. New Koh Kaek Main Canal (Unit : US$)

		Q'ty	Unit Price	Cost
1	**Canal Earth Work**			
	1) Excavation	35,000 m^3	US$3.70	129,500
	2) Embankment	44,000 m^3	US$9.55	420,200
	3) Inspection Road (laterite)	3,500 m^3	-	52,000
	4) Slope Finishing Work (Excavation)	59,000 m^2	US$2.02	119,200
	5) Slope Finishing Work (Embankment)	100,000 m^2	US$1.55	155,000
	6) Lining (Laterite)	9,870 m	-	479,600
	7) Lining (Soil Cement)	1,700 m	-	145,700
	8) Stripping	102,000 m^2	US$1.40	142,800
	9) Sodding	18,400 m^2	US$5.72	105,200
	Sub-total			**1,749,200**
2	**Canal Related Structure**			
	1) Diversion Structure	2 nos.	-	38,500
	2) Diversion with Offtake	4 nos.		81,000
	3) Offtake	8 nos.		29,900
	4) Cross Drain	22 nos.	-	51,900
	5) Foot Bridge	35 nos.	-	145,000
	6) Box Culvert	12 nos.	-	75,600
	Sub-total			**421,900**
3	**Total**			**2,171,100**

Grand Total	**2,623,000**

Table G-12 Construction Cost of Alternative-2 for Main Canal

Main Canal 33 (Unit : US$)

	Q'ty	Unit Price	Cost
1. Canal Earth Work			
1) Excavation	14,000 m^3	US$3.70	51,800
2) Embankment	30,000 m^3	US$9.55	286,500
3) Slope Finishing Work (Excavation)	32,000 m^2	US$2.02	64,600
4) Slope Finishing Work (Embankment)	44,000 m^2	US$1.55	68,200
5) Stripping	24,000 m^2	US$1.40	33,600
6) Sodding	10,000 m^2	US$5.72	57,200
Sub-total			**561,900**
2. Canal Related Structure			
1) Diversion Structure	6 nos.	-	178,000
2) Drop	1 no.	-	9,500
3) Bridge	1 no.	-	5,700
4) Box Culvert	4 nos.	-	26,400
Sub-total			**219,600**
3. Miscellaneous			
1) Demolishing		-	**15,400**
4. Total			**796,900**
	Grand Total		**796,900**

Table G-13 Modified Small Reservoir Rehabiltation Plan

No.	Name	Commune	Related Village	Total Evaluation	Estimated Irrigable Area (ha)
5	*Tumnup Kim Sei*	*Nhaeng Nhang*	*Kim Sei*	*A*	*21*
26	Ang 160	Trapeang Thum Khang Tboung	Trapeang Chhuk	A	21
13	*Ang Kol Korm*	*Tram Kak*	*Kol Korm*	*B*	*13*
22	Prey Kdouch(North)	Trapeang Kranhung	Prey Kdouch	B	12
23	Prey Kdouch(South)	Trapeang Kranhung	Trapeang Robang	B	17
29	Tumnup Ta Ses	Kus	Trapeang Lean	B	10
2	Tumnup Ta Oum	Kus	Leak Khang Tboung, Trapeang Thmor, Leak Khang Cheung	B	15
9	Sdok Sap	Samraong	Pen Meas, Ta Sman	B	21
15	Ou Romdoul	Tram Kak	Trapeang Russei	B	57
25	*Ang Prei Kdei*	*Trapeang Thum Khang Tboung*		*D → C*	*12*
31	160 Reservoir	Tram Kak	Trapeang Russei, Kol Korm	C	10
10	*Ang Srei Ronoung*	*Srae Ronoung*	*Thmei, Samaki*	*C → B*	*20*
14	*Trapeang Lean*	*Kus*	*Trapeang Lean*	*C*	*10*
28	Toul Khcheay	Basedth, Kompong Spueu		C	36
19	Prey Dok Por	Trapeang Thum Khang Cheung		C	10
24	*Ang Prey Preal*	*Trapeang Thum Khang Tboung*	*Prey Preal, Prakeab*	*C → B*	*15*

Note: Score of "location" of reservoirs No.5, 10, 13, 14, 24 and 25 were revised.

Table G-14 Half-monthly Irrigation Water Requirement by Canal (1/3)

Canal	FWUG No.	Related Tertiary Blocks		FWUG Area (ha)	Required Discharge by Canal for Continuous Irrigation (l/s)																					
					May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar	
		Name	Area (ha)		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Canal 24 & Canal 3U, Total FWUGs = 13 nos., Total tertiary blocks = 14nos.																										
	24-1	TL-1	5.0	15.0		0.2	0.3	0.5	0.5	2.0	2.5	2.7	4.4	4.7	2.9	3.3	4.9	3.4	2.0	1.0	0.6	0.7	0.8	0.6	0.5	0.2
		TL-2	10.0			0.3	0.6	0.9	1.0	4.0	4.9	5.4	8.7	9.4	5.7	6.5	9.7	6.8	3.9	2.0	1.1	1.3	1.5	1.2	0.9	0.3
	24-2	C-1L	66.3	66.3		2.0	4.0	6.0	6.6	26.5	32.5	35.8	57.7	62.3	37.8	43.1	64.3	45.1	25.9	13.3	7.3	8.6	9.9	8.0	6.0	2.0
	24-3	C-2L	75.9	75.9		2.3	4.6	6.8	7.6	30.4	37.2	41.0	66.0	71.3	43.3	49.3	73.6	51.6	29.6	15.2	8.3	9.9	11.4	9.1	6.8	2.3
	24-4	C-3L	66.6	66.6		2.0	4.0	6.0	6.7	26.6	32.6	36.0	57.9	62.6	38.0	43.3	64.6	45.3	26.0	13.3	7.3	8.7	10.0	8.0	6.0	2.0
	24-5	C-4L	80.2	80.2		2.4	4.8	7.2	8.0	32.1	39.3	43.3	69.8	75.4	45.7	52.1	77.8	54.5	31.3	16.0	8.8	10.4	12.0	9.6	7.2	2.4
	24-6	C-5L	70.2	70.2		2.1	4.2	6.3	7.0	28.1	34.4	37.9	61.1	66.0	40.0	45.6	68.1	47.7	27.4	14.0	7.7	9.1	10.5	8.4	6.3	2.1
	24-7	C-6L	58.7	58.7		1.8	3.5	5.3	5.9	23.5	28.8	31.7	51.1	55.2	33.5	38.2	56.9	39.9	22.9	11.7	6.5	7.6	8.8	7.0	5.3	1.8
	24-8	C-7L	30.8	30.8		0.9	1.8	2.8	3.1	12.3	15.1	16.6	26.8	29.0	17.6	20.0	29.9	20.9	12.0	6.2	3.4	4.0	4.6	3.7	2.8	0.9
	24-9	C-8L	57.6	57.6		1.7	3.5	5.2	5.8	23.0	28.2	31.1	50.1	54.1	32.8	37.4	55.9	39.2	22.5	11.5	6.3	7.5	8.6	6.9	5.2	1.7
	24-10	C-9L	54.7	54.7		1.6	3.3	4.9	5.5	21.9	26.8	29.5	47.6	51.4	31.2	35.6	53.1	37.2	21.3	10.9	6.0	7.1	8.2	6.6	4.9	1.6
	24-11	A3U-1L	45.6	45.6		1.4	2.7	4.1	4.6	18.2	22.3	24.6	39.7	42.9	26.0	29.6	44.2	31.0	17.8	9.1	5.0	5.9	6.8	5.5	4.1	1.4
	24-12	A3U-2L	44.1	44.1		1.3	2.6	4.0	4.4	17.6	21.6	23.8	38.4	41.5	25.1	28.7	42.8	30.0	17.2	8.8	4.9	5.7	6.6	5.3	4.0	1.3
	24-13	A3U-3L	47.7	47.7		1.4	2.9	4.3	4.8	19.1	23.4	25.8	41.5	44.8	27.2	31.0	46.3	32.4	18.6	9.5	5.2	6.2	7.2	5.7	4.3	1.4
Sub-total (1)				713.4		21.4	42.8	64.2	71.3	285.4	349.6	385.2	620.7	670.6	406.6	463.7	692.0	485.1	278.2	142.7	78.5	92.7	107.0	85.6	64.2	21.4
Canal 23, Total FWUGs = 16 nos., Total tertiary blocks = 23nos.																										
	23-1	A23-1L	45.7	45.7		1.4	2.7	4.1	4.6	18.3	22.4	24.7	39.8	43.0	26.0	29.7	44.3	31.1	17.8	9.1	5.0	5.9	6.9	5.5	4.1	1.4
	23-2	A23-1R	44.3	44.3		1.3	2.7	4.0	4.4	17.7	21.7	23.9	38.5	41.6	25.3	28.8	43.0	30.1	17.3	8.9	4.9	5.8	6.6	5.3	4.0	1.3
	23-3	A23-2L	35.5	35.5		1.1	2.1	3.2	3.6	14.2	17.4	19.2	30.9	33.4	20.2	23.1	34.4	24.1	13.8	7.1	3.9	4.6	5.3	4.3	3.2	1.1
	23-4	A23-3L	47.5	47.5		1.4	2.9	4.3	4.8	19.0	23.3	25.7	41.3	44.7	27.1	30.9	46.1	32.3	18.5	9.5	5.2	6.2	7.1	5.7	4.3	1.4
	23-5	A23-4L	49.6	49.6		1.5	3.0	4.5	5.0	19.8	24.3	26.8	43.2	46.6	28.3	32.2	48.1	33.7	19.3	9.9	5.5	6.4	7.4	6.0	4.5	1.5
	23-6	A23-5L	74.0	74.0		2.2	4.4	6.7	7.4	29.6	36.3	40.0	64.4	69.6	42.2	48.1	71.8	50.3	28.9	14.8	8.1	9.6	11.1	8.9	6.7	2.2
	23-7	A23-6L	17.1	17.1		0.5	1.0	1.5	1.7	6.8	8.4	9.2	14.9	16.1	9.7	11.1	16.6	11.6	6.7	3.4	1.9	2.2	2.6	2.1	1.5	0.5
	23-8	A23-6R	30.1	30.1		0.9	1.8	2.7	3.0	12.0	14.7	16.3	26.2	28.3	17.2	19.6	29.2	20.5	11.7	6.0	3.3	3.9	4.5	3.6	2.7	0.9
	23-9	A23-7R	29.8	29.8		0.9	1.8	2.7	3.0	11.9	14.6	16.1	25.9	28.0	17.0	19.4	28.9	20.3	11.6	6.0	3.3	3.9	4.5	3.6	2.7	0.9
	23-10	A23-7L	51.3	51.3		1.5	3.1	4.6	5.1	20.5	25.1	27.7	44.6	48.2	29.2	33.3	49.8	34.9	20.0	10.3	5.6	6.7	7.7	6.2	4.6	1.5
	23-11	A23-8R	24.6	37.8		0.7	1.5	2.2	2.5	9.8	12.1	13.3	21.4	23.1	14.0	16.0	23.9	16.7	9.6	4.9	2.7	3.2	3.7	3.0	2.2	0.7
		A23-9R	13.2			0.4	0.8	1.2	1.3	5.3	6.5	7.1	11.5	12.4	7.5	8.6	12.8	9.0	5.1	2.6	1.5	1.7	2.0	1.6	1.2	0.4
	23-12	A23-9L	38.7	80.7		1.2	2.3	3.5	3.9	15.5	19.0	20.9	33.7	36.4	22.1	25.2	37.5	26.3	15.1	7.7	4.3	5.0	5.8	4.6	3.5	1.2
		A23-11L	42.0			1.3	2.5	3.8	4.2	16.8	20.6	22.7	36.5	39.5	23.9	27.3	40.7	28.6	16.4	8.4	4.6	5.5	6.3	5.0	3.8	1.3
	23-13	A23-10R	18.2	47.8		0.5	1.1	1.6	1.8	7.3	8.9	9.8	15.8	17.1	10.4	11.8	17.7	12.4	7.1	3.6	2.0	2.4	2.7	2.2	1.6	0.5
		A23-11R	29.6			0.9	1.8	2.7	3.0	11.8	14.5	16.0	25.8	27.8	16.9	19.2	28.7	20.1	11.5	5.9	3.3	3.8	4.4	3.6	2.7	0.9
	23-14	A23-12L	46.8	70.0		1.4	2.8	4.2	4.7	18.7	22.9	25.3	40.7	44.0	26.7	30.4	45.4	31.8	18.3	9.4	5.1	6.1	7.0	5.6	4.2	1.4
		A23-12R	23.2			0.7	1.4	2.1	2.3	9.3	11.4	12.5	20.2	21.8	13.2	15.1	22.5	15.8	9.0	4.6	2.6	3.0	3.5	2.8	2.1	0.7
	23-15	A23-13L	15.1	28.9		0.5	0.9	1.4	1.5	6.0	7.4	8.2	13.1	14.2	8.6	9.8	14.6	10.3	5.9	3.0	1.7	2.0	2.3	1.8	1.4	0.5
		A23-13R	13.8			0.4	0.8	1.2	1.4	5.5	6.8	7.5	12.0	13.0	7.9	9.0	13.4	9.4	5.4	2.8	1.5	1.8	2.1	1.7	1.2	0.4
	23-16	A23-14L	27.4	83.5		0.8	1.6	2.5	2.7	11.0	13.4	14.8	23.8	25.8	15.6	17.8	26.6	18.6	10.7	5.5	3.0	3.6	4.1	3.3	2.5	0.8
		A23-14R	21.9			0.7	1.3	2.0	2.2	8.8	10.7	11.8	19.1	20.6	12.5	14.2	21.2	14.9	8.5	4.4	2.4	2.8	3.3	2.6	2.0	0.7
		A23-15L	34.2			1.0	2.1	3.1	3.4	13.7	16.8	18.5	29.8	32.1	19.5	22.2	33.2	23.3	13.3	6.8	3.8	4.4	5.1	4.1	3.1	1.0
Sub-total (2)				773.6		23.2	46.4	69.6	77.4	309.4	379.1	417.7	673.0	727.2	441.0	502.8	750.4	526.0	301.7	154.7	85.1	100.6	116.0	92.8	69.6	23.2

Table G-14 Half-monthly Irrigation Water Requirement by Canal (2/3)

Canal	FWUG No.	Related Tertiary Blocks		FWUG Area (ha)	Required Discharge by Canal for Continuous Irrigation (l/s)																					
					May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar	
		Name	Area (ha)		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Canal 22, Total FWUGs = 13 nos., Total tertiary blocks = 21nos.																										
	22-1	A22-1L	30.5	77.8		0.9	1.8	2.7	3.1	12.2	14.9	16.5	26.5	28.7	17.4	19.8	29.6	20.7	11.9	6.1	3.4	4.0	4.6	3.7	2.7	0.9
		A22-1R	47.3			1.4	2.8	4.3	4.7	18.9	23.2	25.5	41.2	44.5	27.0	30.7	45.9	32.2	18.4	9.5	5.2	6.1	7.1	5.7	4.3	1.4
	22-2	A22-2L	46.5	65.9		1.4	2.8	4.2	4.7	18.6	22.8	25.1	40.5	43.7	26.5	30.2	45.1	31.6	18.1	9.3	5.1	6.0	7.0	5.6	4.2	1.4
		A22-2R	19.4			0.6	1.2	1.7	1.9	7.8	9.5	10.5	16.9	18.2	11.1	12.6	18.8	13.2	7.6	3.9	2.1	2.5	2.9	2.3	1.7	0.6
	22-3	A22-3L	55.3	55.3		1.7	3.3	5.0	5.5	22.1	27.1	29.9	48.1	52.0	31.5	35.9	53.6	37.6	21.6	11.1	6.1	7.2	8.3	6.6	5.0	1.7
	22-4	A22-3R	35.6	35.6		1.1	2.1	3.2	3.6	14.2	17.4	19.2	31.0	33.5	20.3	23.1	34.5	24.2	13.9	7.1	3.9	4.6	5.3	4.3	3.2	1.1
	22-5	A22-4L	35.4	72.2		1.1	2.1	3.2	3.5	14.2	17.3	19.1	30.8	33.3	20.2	23.0	34.3	24.1	13.8	7.1	3.9	4.6	5.3	4.2	3.2	1.1
		A22-4R	36.8			1.1	2.2	3.3	3.7	14.7	18.0	19.9	32.0	34.6	21.0	23.9	35.7	25.0	14.4	7.4	4.0	4.8	5.5	4.4	3.3	1.1
	22-6	A22-5L	17.9	17.9		0.5	1.1	1.6	1.8	7.2	8.8	9.7	15.6	16.8	10.2	11.6	17.4	12.2	7.0	3.6	2.0	2.3	2.7	2.1	1.6	0.5
	22-7	A22-5R	63.2	63.2		1.9	3.8	5.7	6.3	25.3	31.0	34.1	55.0	59.4	36.0	41.1	61.3	43.0	24.6	12.6	7.0	8.2	9.5	7.6	5.7	1.9
	22-8	A22-6L	14.1	46.4		0.4	0.8	1.3	1.4	5.6	6.9	7.6	12.3	13.3	8.0	9.2	13.7	9.6	5.5	2.8	1.6	1.8	2.1	1.7	1.3	0.4
		A22-7L	16.5			0.5	1.0	1.5	1.7	6.6	8.1	8.9	14.4	15.5	9.4	10.7	16.0	11.2	6.4	3.3	1.8	2.1	2.5	2.0	1.5	0.5
		A22-7R	15.8			0.5	0.9	1.4	1.6	6.3	7.7	8.5	13.7	14.9	9.0	10.3	15.3	10.7	6.2	3.2	1.7	2.1	2.4	1.9	1.4	0.5
	22-9	A22-8L	13.7	27.0		0.4	0.8	1.2	1.4	5.5	6.7	7.4	11.9	12.9	7.8	8.9	13.3	9.3	5.3	2.7	1.5	1.8	2.1	1.6	1.2	0.4
		A22-8R	13.3			0.4	0.8	1.2	1.3	5.3	6.5	7.2	11.6	12.5	7.6	8.6	12.9	9.0	5.2	2.7	1.5	1.7	2.0	1.6	1.2	0.4
	22-10	A22-9L	24.7	39.6		0.7	1.5	2.2	2.5	9.9	12.1	13.3	21.5	23.2	14.1	16.1	24.0	16.8	9.6	4.9	2.7	3.2	3.7	3.0	2.2	0.7
		A22-9R	14.9			0.4	0.9	1.3	1.5	6.0	7.3	8.0	13.0	14.0	8.5	9.7	14.5	10.1	5.8	3.0	1.6	1.9	2.2	1.8	1.3	0.4
	22-11	A22-10L	22.4	22.4		0.7	1.3	2.0	2.2	9.0	11.0	12.1	19.5	21.1	12.8	14.6	21.7	15.2	8.7	4.5	2.5	2.9	3.4	2.7	2.0	0.7
	22-12	A22-10R	30.4	30.4		0.9	1.8	2.7	3.0	12.2	14.9	16.4	26.4	28.6	17.3	19.8	29.5	20.7	11.9	6.1	3.3	4.0	4.6	3.6	2.7	0.9
	22-13	A22-11L	29.9	55.1		0.9	1.8	2.7	3.0	12.0	14.7	16.1	26.0	28.1	17.0	19.4	29.0	20.3	11.7	6.0	3.3	3.9	4.5	3.6	2.7	0.9
		A22-11R	25.2			0.8	1.5	2.3	2.5	10.1	12.3	13.6	21.9	23.7	14.4	16.4	24.4	17.1	9.8	5.0	2.8	3.3	3.8	3.0	2.3	0.8
Sub-total (3)				608.8		18.3	36.5	54.8	60.9	243.5	298.3	328.8	529.7	572.3	347.0	395.7	590.5	414.0	237.4	121.8	67.0	79.1	91.3	73.1	54.8	18.3
Canal 21, Total FWUGs = 12 nos., Total tertiary blocks = 19nos.																										
	21-1	A21-1L	31.3	51.2		0.9	1.9	2.8	3.1	12.5	15.3	16.9	27.2	29.4	17.8	20.3	30.4	21.3	12.2	6.3	3.4	4.1	4.7	3.8	2.8	0.9
		A21-1R1	19.9			0.6	1.2	1.8	2.0	8.0	9.8	10.7	17.3	18.7	11.3	12.9	19.3	13.5	7.8	4.0	2.2	2.6	3.0	2.4	1.8	0.6
	21-2	A21-2L	17.2	61.7		0.5	1.0	1.5	1.7	6.9	8.4	9.3	15.0	16.2	9.8	11.2	16.7	11.7	6.7	3.4	1.9	2.2	2.6	2.1	1.5	0.5
		A21-2R	13.4			0.4	0.8	1.2	1.3	5.4	6.6	7.2	11.7	12.6	7.6	8.7	13.0	9.1	5.2	2.7	1.5	1.7	2.0	1.6	1.2	0.4
		A21-1R2	31.1			0.9	1.9	2.8	3.1	12.4	15.2	16.8	27.1	29.2	17.7	20.2	30.2	21.1	12.1	6.2	3.4	4.0	4.7	3.7	2.8	0.9
	21-3	A21-3L	25.3	25.3		0.8	1.5	2.3	2.5	10.1	12.4	13.7	22.0	23.8	14.4	16.4	24.5	17.2	9.9	5.1	2.8	3.3	3.8	3.0	2.3	0.8
	21-4	A21-3R	16.6	16.6		0.5	1.0	1.5	1.7	6.6	8.1	9.0	14.4	15.6	9.5	10.8	16.1	11.3	6.5	3.3	1.8	2.2	2.5	2.0	1.5	0.5
	21-5	A21-4L	37.0	37.0		1.1	2.2	3.3	3.7	14.8	18.1	20.0	32.2	34.8	21.1	24.1	35.9	25.2	14.4	7.4	4.1	4.8	5.6	4.4	3.3	1.1
	21-6	A21-4R	30.3	30.3		0.9	1.8	2.7	3.0	12.1	14.8	16.4	26.4	28.5	17.3	19.7	29.4	20.6	11.8	6.1	3.3	3.9	4.5	3.6	2.7	0.9
	21-7	A21-5L	23.2	79.8		0.7	1.4	2.1	2.3	9.3	11.4	12.5	20.2	21.8	13.2	15.1	22.5	15.8	9.0	4.6	2.6	3.0	3.5	2.8	2.1	0.7
		A21-5R	40.6			1.2	2.4	3.7	4.1	16.2	19.9	21.9	35.3	38.2	23.1	26.4	39.4	27.6	15.8	8.1	4.5	5.3	6.1	4.9	3.7	1.2
		A21-6R	16.0			0.5	1.0	1.4	1.6	6.4	7.8	8.6	13.9	15.0	9.1	10.4	15.5	10.9	6.2	3.2	1.8	2.1	2.4	1.9	1.4	0.5
	21-8	A21-6L	28.4	28.4		0.9	1.7	2.6	2.8	11.4	13.9	15.3	24.7	26.7	16.2	18.5	27.5	19.3	11.1	5.7	3.1	3.7	4.3	3.4	2.6	0.9
	21-9	A21-7L	24.5	68.2		0.7	1.5	2.2	2.5	9.8	12.0	13.2	21.3	23.0	14.0	15.9	23.8	16.7	9.6	4.9	2.7	3.2	3.7	2.9	2.2	0.7
		A21-7R	21.3			0.6	1.3	1.9	2.1	8.5	10.4	11.5	18.5	20.0	12.1	13.8	20.7	14.5	8.3	4.3	2.3	2.8	3.2	2.6	1.9	0.6
		A21-8L	22.4			0.7	1.3	2.0	2.2	9.0	11.0	12.1	19.5	21.1	12.8	14.6	21.7	15.2	8.7	4.5	2.5	2.9	3.4	2.7	2.0	0.7
	21-10	A21-8R	47.0	47.0		1.4	2.8	4.2	4.7	18.8	23.0	25.4	40.9	44.2	26.8	30.6	45.6	32.0	18.3	9.4	5.2	6.1	7.1	5.6	4.2	1.4
	21-11	A21-9L	26.8	26.8		0.8	1.6	2.4	2.7	10.7	13.1	14.5	23.3	25.2	15.3	17.4	26.0	18.2	10.5	5.4	2.9	3.5	4.0	3.2	2.4	0.8
	21-12	A21-9R	17.5	17.5		0.5	1.1	1.6	1.8	7.0	8.6	9.5	15.2	16.5	10.0	11.4	17.0	11.9	6.8	3.5	1.9	2.3	2.6	2.1	1.6	0.5
Sub-total (4)				489.8		14.7	29.4	44.1	49.0	195.9	240.0	264.5	426.1	460.4	279.2	318.4	475.1	333.1	191.0	98.0	53.9	63.7	73.5	58.8	44.1	14.7

Table G-14 Half-monthly Irrigation Water Requirement by Canal (3/3)

Canal	FWUG No.	Related Tertiary Blocks		FWUG Area (ha)	Required Discharge by Canal for Continuous Irrigation (l/s)																					
					May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar	
		Name	Area (ha)		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Canal 20+20S, Total FWUGs = 12 nos., Total tertiary blocks = 20 nos.																										
	20-1	A20-1L	42.4	61.9		1.3	2.5	3.8	4.2	17.0	20.8	22.9	36.9	39.9	24.2	27.6	41.1	28.8	16.5	8.5	4.7	5.5	6.4	5.1	3.8	1.3
		A20-1R	19.5			0.6	1.2	1.8	2.0	7.8	9.6	10.5	17.0	18.3	11.1	12.7	18.9	13.3	7.6	3.9	2.1	2.5	2.9	2.3	1.8	0.6
	20-2	A20-2L	34.4	64.7		1.0	2.1	3.1	3.4	13.8	16.9	18.6	29.9	32.3	19.6	22.4	33.4	23.4	13.4	6.9	3.8	4.5	5.2	4.1	3.1	1.0
		A20-2R	30.3			0.9	1.8	2.7	3.0	12.1	14.8	16.4	26.4	28.5	17.3	19.7	29.4	20.6	11.8	6.1	3.3	3.9	4.5	3.6	2.7	0.9
	20-3	A20-3L	29.1	73.0		0.9	1.7	2.6	2.9	11.6	14.3	15.7	25.3	27.4	16.6	18.9	28.2	19.8	11.3	5.8	3.2	3.8	4.4	3.5	2.6	0.9
		A20-3R	43.9			1.3	2.6	4.0	4.4	17.6	21.5	23.7	38.2	41.3	25.0	28.5	42.6	29.9	17.1	8.8	4.8	5.7	6.6	5.3	4.0	1.3
	20-4	A20-4L	49.2	49.2		1.5	3.0	4.4	4.9	19.7	24.1	26.6	42.8	46.2	28.0	32.0	47.7	33.5	19.2	9.8	5.4	6.4	7.4	5.9	4.4	1.5
	20-5	A20-4R	47.7	47.7		1.4	2.9	4.3	4.8	19.1	23.4	25.8	41.5	44.8	27.2	31.0	46.3	32.4	18.6	9.5	5.2	6.2	7.2	5.7	4.3	1.4
	20-6	A20-5L	20.0	26.0		0.6	1.2	1.8	2.0	8.0	9.8	10.8	17.4	18.8	11.4	13.0	19.4	13.6	7.8	4.0	2.2	2.6	3.0	2.4	1.8	0.6
		A20-5R	6.0			0.2	0.4	0.5	0.6	2.4	2.9	3.2	5.2	5.6	3.4	3.9	5.8	4.1	2.3	1.2	0.7	0.8	0.9	0.7	0.5	0.2
	20-7	A20-6L	44.6	80.3		1.3	2.7	4.0	4.5	17.8	21.9	24.1	38.8	41.9	25.4	29.0	43.3	30.3	17.4	8.9	4.9	5.8	6.7	5.4	4.0	1.3
		A20-6R	35.7			1.1	2.1	3.2	3.6	14.3	17.5	19.3	31.1	33.6	20.3	23.2	34.6	24.3	13.9	7.1	3.9	4.6	5.4	4.3	3.2	1.1
	20-8	A20-7R	26.9	26.9		0.8	1.6	2.4	2.7	10.8	13.2	14.5	23.4	25.3	15.3	17.5	26.1	18.3	10.5	5.4	3.0	3.5	4.0	3.2	2.4	0.8
	20-9	A20-8L	26.4	76.7		0.8	1.6	2.4	2.6	10.6	12.9	14.3	23.0	24.8	15.0	17.2	25.6	18.0	10.3	5.3	2.9	3.4	4.0	3.2	2.4	0.8
		A20-8R	50.3			1.5	3.0	4.5	5.0	20.1	24.6	27.2	43.8	47.3	28.7	32.7	48.8	34.2	19.6	10.1	5.5	6.5	7.5	6.0	4.5	1.5
	20-10	A20-9R	27.4	27.4		0.8	1.6	2.5	2.7	11.0	13.4	14.8	23.8	25.8	15.6	17.8	26.6	18.6	10.7	5.5	3.0	3.6	4.1	3.3	2.5	0.8
	20-11	A20S-1L	17.1	38.8		0.5	1.0	1.5	1.7	6.8	8.4	9.2	14.9	16.1	9.7	11.1	16.6	11.6	6.7	3.4	1.9	2.2	2.6	2.1	1.5	0.5
		A20S-1R	21.7			0.7	1.3	2.0	2.2	8.7	10.6	11.7	18.9	20.4	12.4	14.1	21.0	14.8	8.5	4.3	2.4	2.8	3.3	2.6	2.0	0.7
	20-12	A20S-2L	11.0	46.4		0.3	0.7	1.0	1.1	4.4	5.4	5.9	9.6	10.3	6.3	7.2	10.7	7.5	4.3	2.2	1.2	1.4	1.7	1.3	1.0	0.3
		A20S-2R	35.4			1.1	2.1	3.2	3.5	14.2	17.3	19.1	30.8	33.3	20.2	23.0	34.3	24.1	13.8	7.1	3.9	4.6	5.3	4.2	3.2	1.1
Sub-total (5)				619.0		18.6	37.1	55.7	61.9	247.6	303.3	334.3	538.5	581.9	352.8	402.4	600.4	420.9	241.4	123.8	68.1	80.5	92.9	74.3	55.7	18.6
Canal 3D, Total FWUGs = 6 nos., Total tertiary blocks = 8nos.																										
	3D-1	A3D-1L	19.6	19.6		0.6	1.2	1.8	2.0	7.8	9.6	10.6	17.1	18.4	11.2	12.7	19.0	13.3	7.6	3.9	2.2	2.5	2.9	2.4	1.8	0.6
	3D-2	A3D-2L	37.9	37.9		1.1	2.3	3.4	3.8	15.2	18.6	20.5	33.0	35.6	21.6	24.6	36.8	25.8	14.8	7.6	4.2	4.9	5.7	4.5	3.4	1.1
	3D-3	A3D-3L	22.4	69.7		0.7	1.3	2.0	2.2	9.0	11.0	12.1	19.5	21.1	12.8	14.6	21.7	15.2	8.7	4.5	2.5	2.9	3.4	2.7	2.0	0.7
		A3D-4L	47.3			1.4	2.8	4.3	4.7	18.9	23.2	25.5	41.2	44.5	27.0	30.7	45.9	32.2	18.4	9.5	5.2	6.1	7.1	5.7	4.3	1.4
	3D-4	A3D-5L1	23.2	61.3		0.7	1.4	2.1	2.3	9.3	11.4	12.5	20.2	21.8	13.2	15.1	22.5	15.8	9.0	4.6	2.6	3.0	3.5	2.8	2.1	0.7
		A3D-5L2	38.1			1.1	2.3	3.4	3.8	15.2	18.7	20.6	33.1	35.8	21.7	24.8	37.0	25.9	14.9	7.6	4.2	5.0	5.7	4.6	3.4	1.1
	3D-5	A3D-6L	33.5	33.5		1.0	2.0	3.0	3.4	13.4	16.4	18.1	29.1	31.5	19.1	21.8	32.5	22.8	13.1	6.7	3.7	4.4	5.0	4.0	3.0	1.0
	3D-6	A3D-7L	38.1	73.4		1.1	2.3	3.4	3.8	15.2	18.7	20.6	33.1	35.8	21.7	24.8	37.0	25.9	14.9	7.6	4.2	5.0	5.7	4.6	3.4	1.1
		A3D-8L	35.3			1.1	2.1	3.2	3.5	14.1	17.3	19.1	30.7	33.2	20.1	22.9	34.2	24.0	13.8	7.1	3.9	4.6	5.3	4.2	3.2	1.1
Sub-total (6)				295.4		8.9	17.7	26.6	29.5	118.2	144.7	159.5	257.0	277.7	168.4	192.0	286.5	200.9	115.2	59.1	32.5	38.4	44.3	35.4	26.6	8.9
Grand Total				3,500.0		105	210	315	350	1,400	1,715	1,890	3,045	3,290	1,995	2,275	3,395	2,380	1,365	700	385	455	525	420	315	105

Table G-15 Water Distribution Schedule by Tertiray Block (1/4)

1. Canal 24

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1		C-1L	C-8L	24-I	24-all Open 4 days Close 1 day in turn	24-I	24-all Open 4 days Close 1 day	24-A 24-B 24-C	C-1L C-2L C-3L C-4L C-5L C-6L C-7L C-8L	C-8L C-1L C-2L C-3L C-4L C-5L C-6L C-7L	C-2L C-3L C-4L C-5L C-6L C-7L C-8L C-1L
2		C-2L	24-A 24-B 24-C							C-1L	C-3L
3		C-3L								C-2L	C-4L
4		C-4L								C-3L	C-5L
5		C-5L						24-A 24-B 24-C	C-5L C-6L C-7L C-8L	C-4L	C-6L
6		C-6L	24-A 24-B 24-C	24-II		24-II				C-5L	C-7L
7		C-7L								C-6L	C-8L
8		C-8L								C-7L	C-1L
9		C-1L						24-A 24-B 24-C	C-1L C-2L C-3L C-4L C-5L C-6L C-7L C-8L	C-8L	C-2L
10		C-2L	24-A 24-B 24-C							C-1L	C-3L
11		C-3L		24-I						C-2L	C-4L
12		C-4L								C-3L	C-5L
13		C-5L				24-I				C-4L	C-6L
14		C-6L	24-A 24-B 24-C							C-5L	C-7L
15		C-7L								C-6L	C-8L
16	C-1L	C-8L								C-7L	C-1L
17	C-2L	C-1L		24-II		24-II		24-A 24-B 24-C	C-1L C-2L C-3L C-4L C-5L C-6L C-7L C-8L	C-8L	C-2L
18	C-3L	C-2L	24-A 24-B 24-C							C-1L	C-3L
19	C-4L	C-3L								C-2L	C-4L
20	C-5L	C-4L								C-3L	C-5L
21	C-6L	C-5L		24-I		24-I		24-A 24-B 24-C	C-5L C-6L C-7L C-8L	C-4L	C-6L
22	C-7L	C-6L	24-A 24-B 24-C							C-5L	C-7L
23	C-8L	C-7L								C-6L	C-8L
24	C-1L	C-8L								C-7L	C-1L
25	C-2L	C-1L						24-A 24-B 24-C	C-1L C-2L C-3L C-4L C-5L C-6L C-7L C-8L	C-8L	C-2L
26	C-3L	C-2L	24-A 24-B 24-C	24-II		24-II					C-3L
27	C-4L	C-3L									C-4L
28	C-5L	C-4L								C-1L	C-5L
29	C-6L	C-5L						24-A	C-5L		C-6L
30	C-7L	C-6L						24-B	C-6L		C-7L
31	C-8L	C-7L						24-C	C-7L		C-8L
Total	1.0	2.0	7.0	15.0	25.0	17.0	23.0	8.0	3.5	3.5	2.0

Note: Total= days to be irrigated with full capacity per month for each tertiary block
C-1L~9L tertiary blocks of Canal 24.
24-A consists of C-1L~3L (208.8ha in total)
24-B consists of C-4L~6L (209.1ha in total)
24-C consists of C-7L~9L (143.1ha in total)
24-I consists of C-1L~4L (289ha in total)
24-II consists of C-5L~9L (272ha in total

2. Canal 3U

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1		3U-1	3U-1	3U-1	3U-all Open 4 days Close 1 day in turn	3U-1	3U-all Open 4 days Close 1 day in turn	3U-1		3U-1	3U-1
2		3U-2	3U-2	3U-2		3U-2		3U-2		3U-2	3U-2
3		3U-3	3U-3			3U-2		3U-3	3U-1	3U-3	3U-3
4		3U-1							3U-2		3U-1
5		3U-2	3U-1	3U-3		3U-3		3U-1	3U-3	3U-1	3U-2
6		3U-3	3U-2	3U-2				3U-2		3U-2	3U-3
7		3U-1	3U-3					3U-3	3U-1	3U-3	3U-1
8		3U-2				3U-1			3U-2		3U-2
9		3U-3	3U-1					3U-1	3U-3	3U-1	3U-3
10		3U-1	3U-2	3U-1		3U-2		3U-2		3U-2	3U-1
11		3U-2	3U-3	3U-3				3U-3	3U-1	3U-3	3U-2
12		3U-3				3U-3			3U-2		3U-3
13		3U-1	3U-1					3U-1	3U-3	3U-1	3U-1
14		3U-2	3U-2	3U-2		3U-4		3U-2		3U-2	3U-2
15		3U-3		3U-3				3U-3	3U-1	3U-3	3U-3
16	3U-1	3U-1	3U-3			3U-2			3U-2		3U-1
17	3U-2	3U-2	3U-1	3U-1		3U-3		3U-1	3U-3	3U-1	3U-2
18	3U-3	3U-3	3U-2	3U-2				3U-2		3U-2	3U-3
19		3U-1	3U-3	3U-3		3U-3		3U-3	3U-1	3U-3	3U-1
20		3U-2							3U-2		3U-2
21		3U-3	3U-1	3U-1		3U-4		3U-1	3U-3	3U-1	3U-3
22		3U-1	3U-2					3U-2		3U-2	3U-1
23		3U-2	3U-3			3U-2			3U-1	3U-3	3U-2
24		3U-3		3U-2				3U-3	3U-2		3U-3
25	3U-1	3U-1	3U-1			3U-3		3U-1	3U-3	3U-1	3U-1
26		3U-2	3U-2	3U-3				3U-2		3U-2	3U-2
27	3U-2	3U-3	3U-3					3U-3	3U-1	3U-3	3U-3
28	3U-3	3U-1							3U-2		3U-1
29		3U-2						3U-1	3U-3		3U-2
30		3U-3						3U-2			3U-3
31								3U-3			
Total	1.0	2.0	7.0	15.0	25.0	17.0	23.0	8.0	3.5	3.5	2.0

Note: Total= days to be irrigated with full capacity per month for each tertiary block

Table G-15 Water Distribution Schedule by Tertiray Block (2/4)

1. Canal 23

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1								23-A 23-B 23-C			
2			23-A 23-B 23-C	23-I		23-I			23-A 23-B 23-C		23-A 23-B 23-C
3		23-A 23-B 23-C						23-A 23-B 23-C		23-A 23-B 23-C	
4			23-A 23-B 23-C								
5				23-II		23-II					
6								23-A 23-B 23-C			
7			23-A 23-B 23-C								
8									23-A 23-B 23-C		
9				23-I	23-all	23-I	23-all	23-A 23-B 23-C		23-A 23-B 23-C	23-A 23-B 23-C
10		23-A 23-B 23-C	23-A 23-B 23-C								
11					Open 4 days		Open 4 days				
12								23-A 23-B 23-C			
13			23-A 23-B 23-C		Close 1 day in turn		Close 1 day in turn				
14				23-II		23-II					
15								23-A 23-B 23-C			
16	23-A 23-B 23-C		23-A 23-B 23-C						23-A 23-B 23-C		23-A 23-B 23-C
17		23-A 23-B 23-C		23-I		23-I				23-A 23-B 23-C	
18								23-A 23-B 23-C			
19			23-A 23-B 23-C								
20								23-A 23-B 23-C			
21				23-II		23-II					
22			23-A 23-B 23-C								
23				23-I		23-I					
24								23-A 23-B 23-C			
25											
26	23-A 23-B 23-C	23-A 23-B 23-C	23-A 23-B 23-C	23-II		23-II			23-A 23-B 23-C		23-A 23-B 23-C
27								23-A 23-B 23-C			
28											
29											
30											
31											
Total	1.0	2.0	7.0	15.0	25.0	17.0	23.0	8.0	3.5	3.5	2.0

Note: Total= days to be irrigated with full capacity per month for each tertiary block
23-A consists of FWUGs of 23-1~6 (6 tertiary blocks, 296.6ha in total)
23-B consists of FWUGs of 23-7~12 (8 tertiary blocks, 246.8ha in total)
23-C consists of FWUGs of 23-13~16 (9 tertiary blocks, 230.2ha in total)
23-I consists of FWUGs of 23-1~10 (10 tertiary blocks, 424.9ha in total)
23-II consists of FWUGs of 23-11~16 (13 tertiary blocks, 348.7ha in total)

2. Canal 22

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1								22-A 22-B 22-C			
2			22-A 22-B 22-C	22-I		22-I			22-A 22-B 22-C		22-A 22-B 22-C
3		22-A 22-B 22-C						22-A 22-B 22-C		22-A 22-B 22-C	
4			22-A 22-B 22-C								
5				22-II		22-II					
6								22-A 22-B 22-C			
7			22-A 22-B 22-C								
8									22-A 22-B 22-C		
9				22-I	22-All	22-I	22-All	22-A 22-B 22-C		22-A 22-B 22-C	22-A 22-B 22-C
10		22-A 22-B 22-C	22-A 22-B 22-C								
11					Open 4 days		Open 4 days				
12								22-A 22-B 22-C			
13			22-A 22-B 22-C		Close 1 day in turn		Close 1 day in turn				
14				22-II		22-II					
15								22-A 22-B 22-C			
16	22-A 22-B 22-C		22-A 22-B 22-C						22-A 22-B 22-C		22-A 22-B 22-C
17		22-A 22-B 22-C		22-I		22-I				22-A 22-B 22-C	
18								22-A 22-B 22-C			
19			22-A 22-B 22-C								
20								22-A 22-B 22-C			
21				22-II		22-II					
22			22-A 22-B 22-C								
23				22-I		22-I					
24								22-A 22-B 22-C			
25											
26	22-A 22-B 22-C	22-A 22-B 22-C	22-A 22-B 22-C	22-II		22-II			22-A 22-B 22-C		22-A 22-B 22-C
27								22-A 22-B 22-C			
28											
29											
30											
31											
Total	1.0	2.0	7.0	15.0	25.0	17.0	23.0	8.0	3.5	3.5	2.0

Note: Total= days to be irrigated with full capacity per month for each tertiary block
22-A consists of FWUGs of 22-1~4 (6 tertiary blocks, 234.6ha in total)
22-B consists of FWUGs of 22-5~8 (7 tertiary blocks, 199.7ha in total)
22-C consists of FWUGs of 22-9~13 (8 tertiary blocks, 174.5ha in total)
22-I consists of FWUGs of 22-1~5 (8 tertiary blocks, 306.8ha in total)
22-II consists of FWUGs of 22-6~13 (13 tertiary blocks, 302.0ha in total)

Table G-15 Water Distribution Schedule by Tertiray Block (3/4)

1. Canal 21

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1								21-A 21-B 21-C			
2			21-A 21-B 21-C	21-I		21-I			21-A 21-B 21-C		21-A 21-B 21-C
3		21-A 21-B 21-C								21-A 21-B 21-C	
4								21-A 21-B 21-C			
5			21-A 21-B 21-C	21-II		21-II					
6											
7								21-A 21-B 21-C			
8			21-A 21-B 21-C		21-all Open 4 days Close 1 day in turn		21-all Open 4 days Close 1 day in turn		21-A 21-B 21-C		21-A 21-B 21-C
9				21-I		21-I		21-A 21-B 21-C			
10		21-A 21-B 21-C								21-A 21-B 21-C	
11			21-A 21-B 21-C								
12								21-A 21-B 21-C			
13				21-II		21-II					
14											
15								21-A 21-B 21-C			
16	21-A 21-B 21-C		21-A 21-B 21-C						21-A 21-B 21-C		21-A 21-B 21-C
17		21-A 21-B 21-C		21-I		21-I				21-A 21-B 21-C	
18								21-A 21-B 21-C			
19			21-A 21-B 21-C								
20				21-II		21-II					
21								21-A 21-B 21-C			
22											
23			21-A 21-B 21-C	21-I		21-I					
24											
25								21-A 21-B 21-C			
26	21-A 21-B 21-C	21-A 21-B 21-C							21-A 21-B 21-C		21-A 21-B 21-C
27			21-A 21-B 21-C	21-II		21-II					
28											
29								21-A 21-B 21-C			
30											
31											
Total	1.0	2.0	7.0	15.0	25.0	17.0	23.0	8.0	3.5	3.5	2.0

Note: Total= days to be irrigated with full capacity per month for each tertiary block
21-A consists of FWUGs of 21-1~5 (8 tertiary blocks, 191.8ha in total)
21-B consists of FWUGs of 21-6~8 (5 tertiary blocks, 138.5ha in total)
21-C consists of FWUGs of 21-9~12 (6 tertiary blocks, 159.5ha in total)
21-I consists of FWUGs of 21-1~6 (9 tertiary blocks, 222.1ha in total)
21-II consists of FWUGs of 21-11~16 (10 tertiary blocks, 267.7ha in total)

2. Canal 20+20S

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1								20-A 20-B 20-C			
2			20-A 20-B 20-C	20-I		20-I			20-A 20-B 20-C		20-A 20-B 20-C
3		20-A 20-B 20-C								20-A 20-B 20-C	
4								20-A 20-B 20-C			
5			20-A 20-B 20-C	20-II		20-II					
6											
7								20-A 20-B 20-C			
8			20-A 20-B 20-C		20-all Open 4 days Close 1 day in turn		20-all Open 4 days Close 1 day in turn		20-A 20-B 20-C		20-A 20-B 20-C
9				20-I		20-I		20-A 20-B 20-C			
10		20-A 20-B 20-C								20-A 20-B 20-C	
11			20-A 20-B 20-C								
12								20-A 20-B 20-C			
13				20-II		20-II					
14											
15								20-A 20-B 20-C			
16	20-A 20-B 20-C		20-A 20-B 20-C						20-A 20-B 20-C		20-A 20-B 20-C
17		20-A 20-B 20-C		20-I		20-I				20-A 20-B 20-C	
18								20-A 20-B 20-C			
19			20-A 20-B 20-C								
20				20-II		20-II					
21								20-A 20-B 20-C			
22											
23			20-A 20-B 20-C	20-I		20-I					
24											
25								20-A 20-B 20-C			
26	20-A 20-B 20-C	20-A 20-B 20-C							20-A 20-B 20-C		20-A 20-B 20-C
27			20-A 20-B 20-C	20-II		20-II					
28											
29								20-A 20-B 20-C			
30											
31											
Total	1.0	2.0	7.0	15.0	25.0	17.0	23.0	8.0	3.5	3.5	2.0

Note: Total= days to be irrigated with full capacity per month for each tertiary block
20-A consists of FWUGs of 20-1~3 (6 tertiary blocks, 199.6ha in total)
20-B consists of FWUGs of 20-4~7 (6 tertiary blocks, 203.2ha in total)
20-C consists of FWUGs of 20-8~12 (8 tertiary blocks, 216.2ha in total)
20-I consists of FWUGs of 20-1~5 (8 tertiary blocks, 296.5ha in total)
20-II consists of FWUGs of 20-6~12 (12 tertiary blocks, 322.5ha in total)

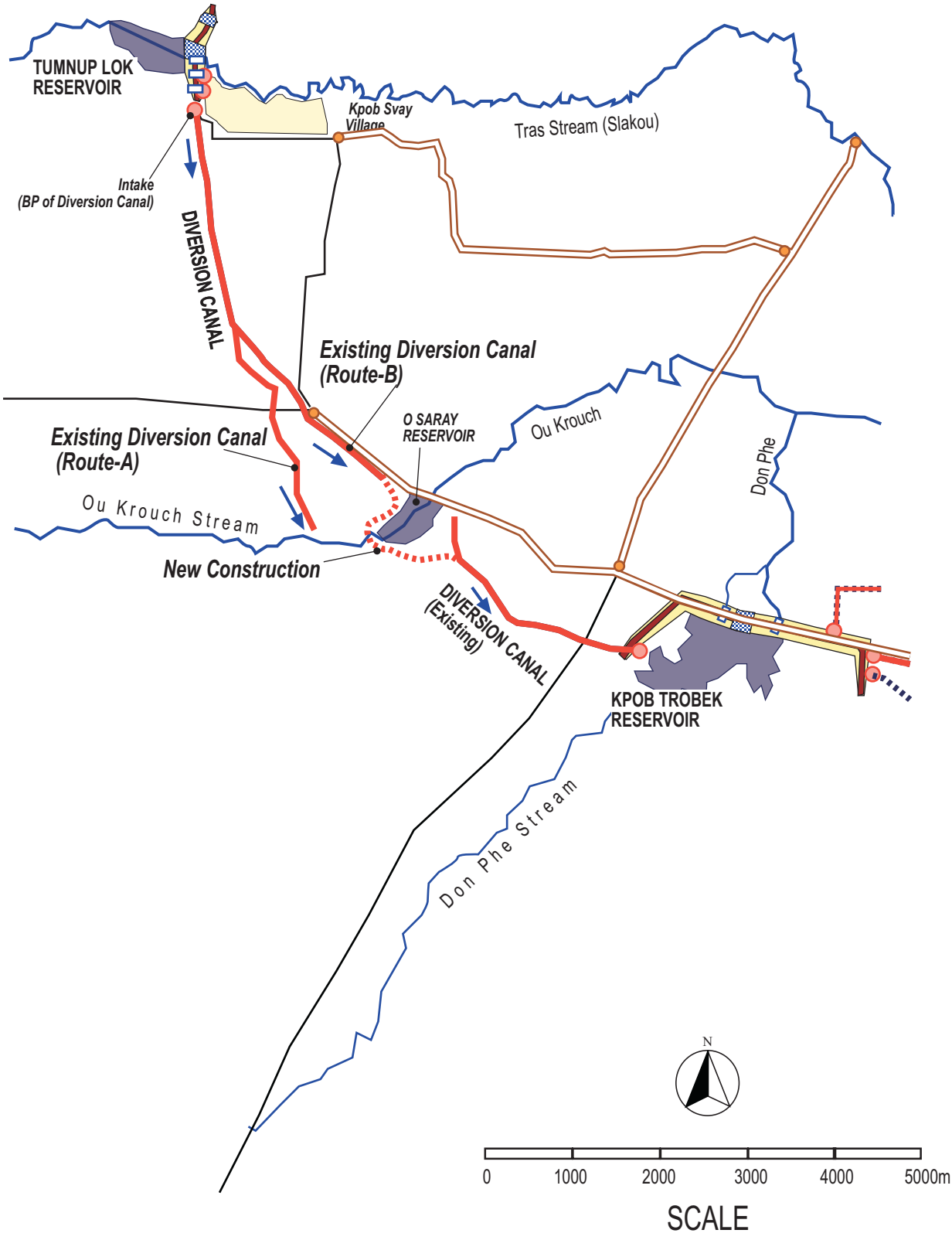
Table G-15 Water Distribution Schedule by Tertiray Block (4/4)

1. Canal 3D

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1		3D-A	3D-A	3D-A		3D-A		3D-A		3D-A	3D-A
2		3D-B	3D-B	3D-B				3D-B		3D-B	3D-B
3		3D-C	3D-C			3D-B		3D-C	3D-A	3D-C	3D-C
4		3D-A							3D-B		3D-A
5		3D-B	3D-A			3D-C		3D-A	3D-C	3D-A	3D-B
6		3D-C	3D-B	3D-C				3D-B		3D-B	3D-C
7		3D-A	3D-C	3D-B				3D-C	3D-A	3D-C	3D-A
8		3D-B				3D-A			3D-B		3D-B
9		3D-C	3D-A					3D-A	3D-C	3D-A	3D-C
10		3D-A	3D-B			3D-B		3D-B		3D-B	3D-A
11		3D-B	3D-C	3D-A	3D-all		3D-all	3D-C	3D-A	3D-C	3D-B
12		3D-C		3D-C		3D-C			3D-B		3D-C
13		3D-A	3D-A		Open		Open	3D-A	3D-C	3D-A	3D-A
14		3D-B	3D-B		4 days		4 days	3D-B		3D-B	3D-B
15		3D-C				3D-A			3D-A		3D-C
16		3D-A	3D-C	3D-B	Close		Close	3D-C	3D-B	3D-C	3D-A
17		3D-B		3D-C	1 day	3D-B	1 day	3D-A		3D-A	3D-B
18	3D-A	3D-C	3D-A		in		in	3D-B	3D-C	3D-B	3D-C
19	3D-B	3D-A	3D-B		turn		turn	3D-C		3D-C	3D-A
20	3D-C	3D-B	3D-C			3D-C			3D-A		3D-B
21		3D-C						3D-A	3D-B	3D-A	3D-C
22		3D-A	3D-A	3D-A		3D-A		3D-B	3D-C	3D-B	3D-A
23		3D-B	3D-B					3D-C		3D-C	3D-B
24		3D-C	3D-C			3D-B			3D-A		3D-C
25		3D-A		3D-B				3D-A	3D-B	3D-A	3D-A
26	3D-A	3D-B	3D-A			3D-C		3D-B	3D-C	3D-B	3D-B
27	3D-B	3D-C	3D-B					3D-C		3D-C	3D-C
28	3D-C	3D-A	3D-C	3D-C					3D-A		3D-A
29		3D-B						3D-A	3D-B		3D-B
30		3D-C						3D-B	3D-C		3D-C
31								3D-C			
Total	1.0	2.0	7.0	15.0	25.0	17.0	23.0	8.0	3.5	3.5	2.0

Note: Total= days to be irrigated with full capacity per month for each tertiary block
3D-A consists of FWUGs of 3D-1~3 (5 tertiary blocks, 127.2ha in total)
3D-B consists of FWUGs of 3D-4~5 (3 tertiary blocks, 94.8ha in total)
3D-C consists of FWUG of 3D-6 (2 tertiary blocks, 73.4ha in total)

Figures



The Study on The Rehabilitation and Reconstruction of Agricultural Production System in The Slakou River Basin, The Kingdom of Cambodia	Figure G-1 Existing Diversion Canals
Japan International Cooperation Agency	

The Study on The Rehabilitation and Reconstruction of Agricultural Production System in The Slakou River Basin, The Kingdom of Cambodia

Japan International Cooperation Agency

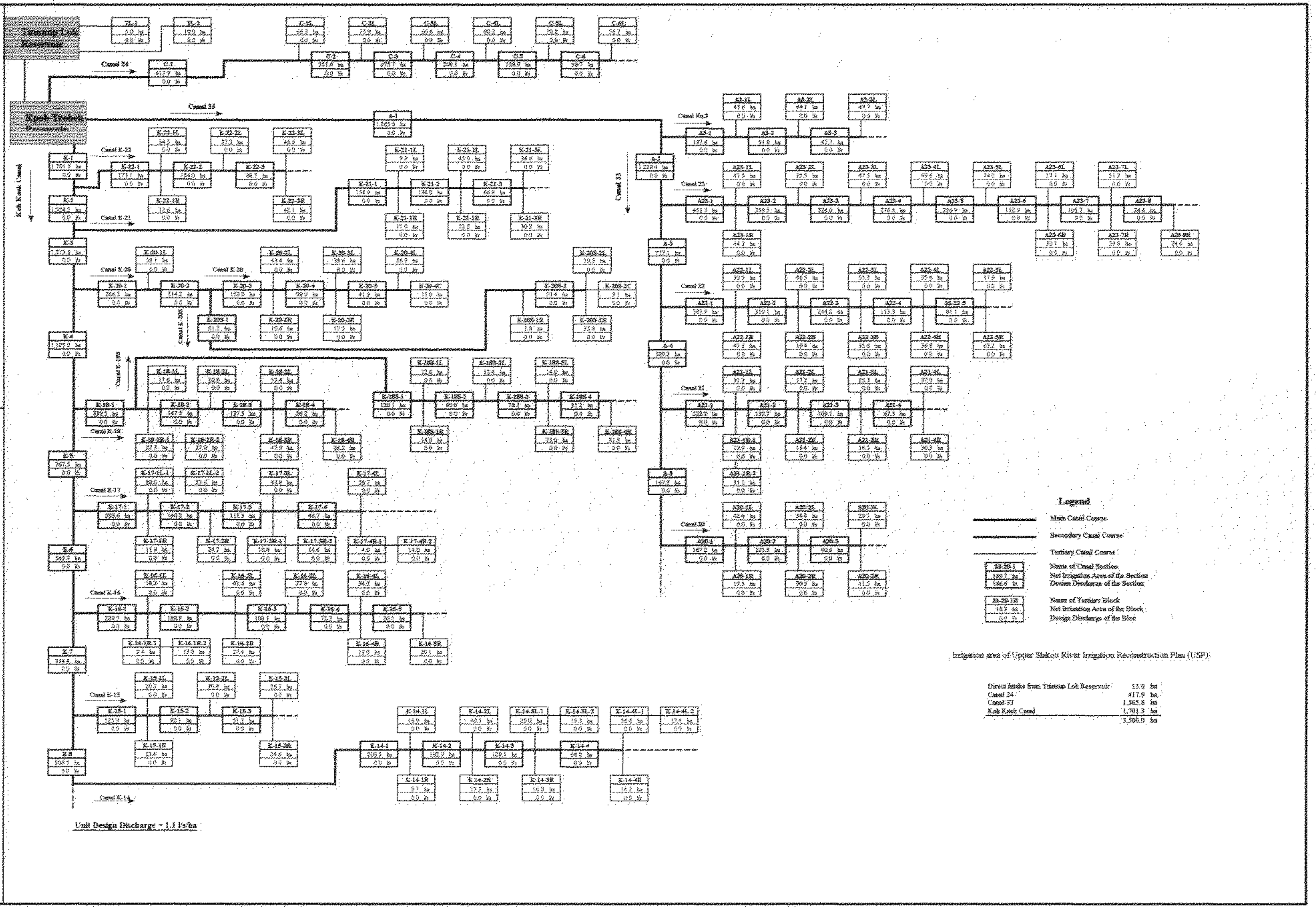


Figure G-2
Irrigation Diagram of Revised Master Plan

G-F2