

THE GOVERNMENT OF MALAYSIA
MINISTRY OF AGRICULTURE
DEPARTMENT OF IRRIGATION
AND DRAINAGE (DID)

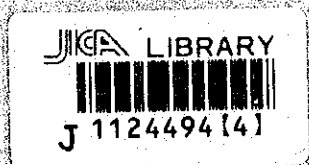
JAPAN INTERNATIONAL
COOPERATION AGENCY
(JICA)

THE FEASIBILITY STUDY
ON
SMALL RESERVOIR DEVELOPMENT
IN
PENINSULAR MALAYSIA

VOLUME II

ANNEXES

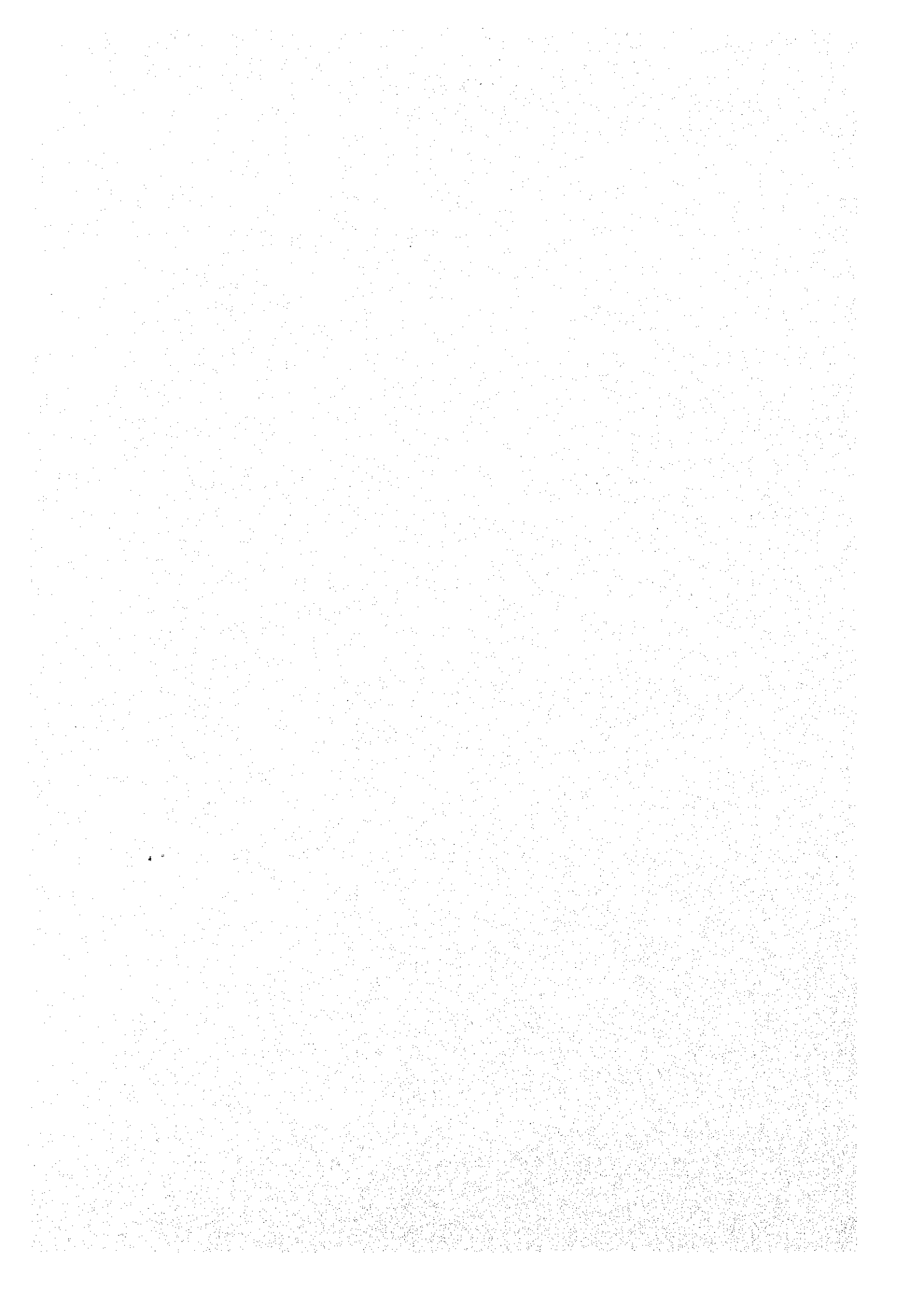
March 1995



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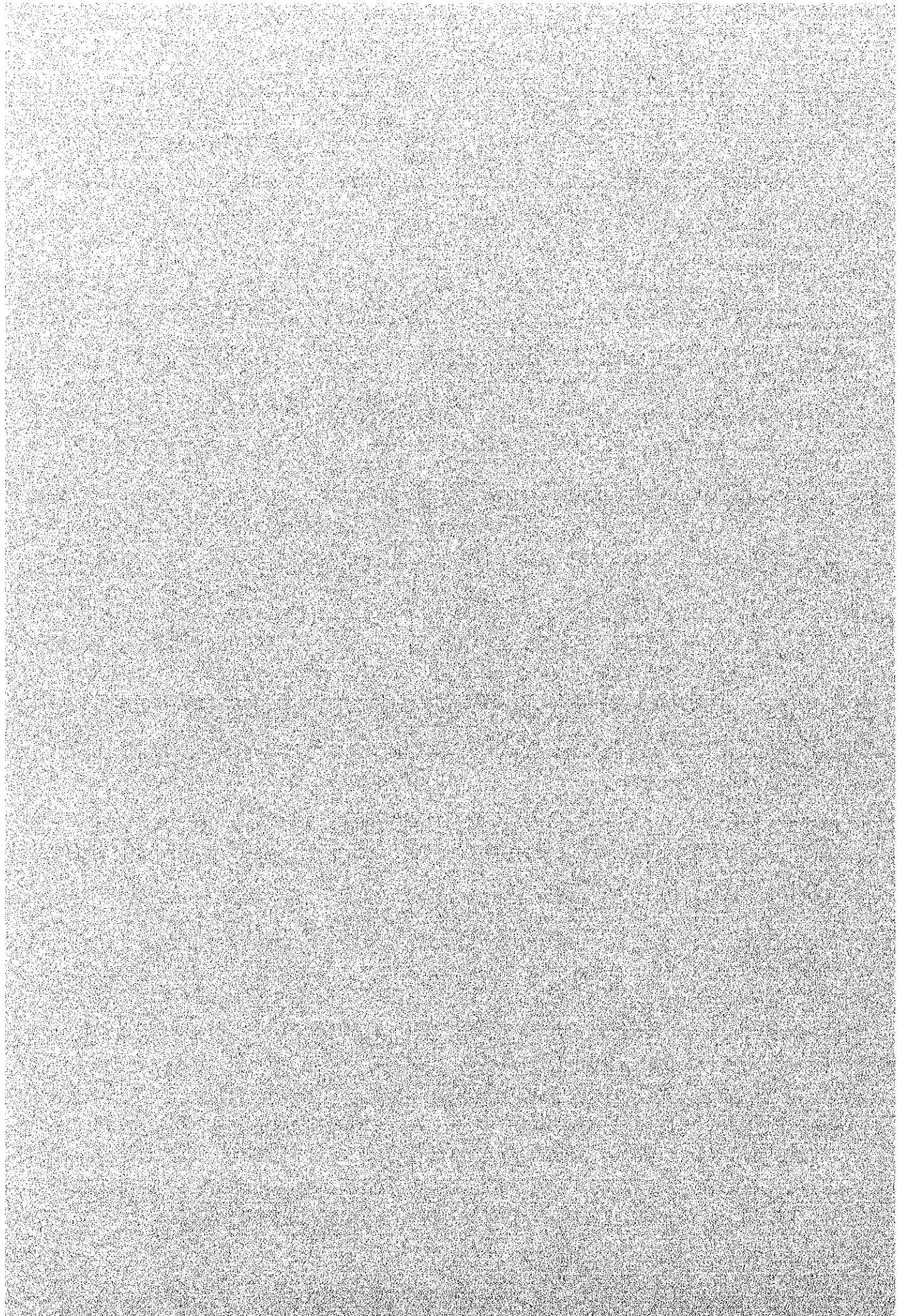


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ANNEX I
IDENTIFICATION SURVEY OF SMALL RESERVOIR
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I IDENTIFICATION OF SMALL RESERVOIR DEVELOPMENT

1.1 General

Identification survey of small reservoir development in the Peninsular Malaysia, including preparation of identification criteria and survey form (Questionnaire land II) has been carried out for 6 months. One and a half months was required for JICA Study Team to prepare the identification criteria and survey forms. Then, State DID and Local Consultant conducted field survey for four and a half months from October 15, 1993 to the end of February 1994.

A total of 266 small reservoirs were identified in the first stage survey conducted from October 15 to November 20 using Questionnaire I. All projects were registered in long list. Out of this, 141 project were selected and registered in short list for further detailed survey using Questionnaire II, which was carried out from November 20, 1993 to the end of February 1994. The number of short-listed projects fluctuated in the course of survey. It was 141 at the start and eventually settled to be 114.

1.2 Identification Criteria and Survey Form for Small Reservoir Development

At the beginning of the Study, JICA Study Team prepared the identification criteria and survey forms for small reservoir development. The identification criteria describes the objectives of the Study, study area, background of the Study, basic concepts for small reservoir planning, type of small reservoir and so forth. The survey forms include Questionnaire I and II. The identification criteria and Questionnaires are attached in Appendix I.

A workshop was held on October 14 to discuss the identification criteria and survey forms among JICA Study Team, DID official, State Coordinators, staff of other Government agencies, JICA Advisory Team, and representative of Local Consultant.

1.3 Progress of Identification Survey

The identification survey is designed to implement in two stages. The first stage survey by Questionnaire I is to produce a long list of small reservoir. And the second stage survey using Questionnaire II is to furnish more information on a limited number of short listed projects.

The first stage survey was started immediately after the workshop of October 14, 1993 and completed around November 20, 1993. Since the number of small reservoir continued to

increase later on, it finally reached 266. The long list including 266 small reservoirs is shown in Table I-1.

Screening projects in the long list, a short list was formed. Screening criteria were water shortage, purpose and State's priority. Applied criteria were slightly different by State due to the number of projects of the State and local condition. The screening criteria are shown in Table I-2.

Thus, a total of 141 projects were short-listed and the second stage survey was started around November 20, 1993. In the course of survey, however, the number of project was fluctuated and finally settled to 114. The short listed projects are also shown in Table I-1.

1.4 Difficulties and Problems Encountered in the Identification Survey

Difficulties and problems encountered in the identification survey will be enumerated here so that they should be taken into consideration when guidelines for small reservoir development are established at the end of this Study.

In January 1994 when JICA Study Team came back to Malaysia, the number of completed Questionnaire II was only one. In the meeting of State Coordinators on January 18, 1994, DID strongly requested the State Coordinators to expedite the survey. Local Consultant also visited States. But it was February 23 when all survey results reached Local Consultant.

Checking the data base delivered from Local Consultant, JICA Study Team found that many Questionnaires contained many blanks.

The question is why so much time is needed for the survey and why the quality of data is not so good. JICA Study Team reviewed the identification survey and examined its adequacy from three aspects: project formulation, survey schedule, and contents of Questionnaire.

1.4.1 Project formulation

There is misunderstanding in project formulation because certain projects were formed without beneficiaries or consent of beneficiaries. During the field visit, JICA Study Team found projects which claim to aim at improvement of idle paddy fields, but most farmers already left village and remaining farmers have no intention to cultivate paddy earning wage at nearby Felcra farm.

One of the essentials of project is to have beneficiary. In project formulation, existence of enthusiastic beneficiary should be the first check point before going to technical and economic aspects.

1.4.2 Survey schedule

It is likely that the survey period was too short for the survey volume.

The identification survey was started with a very short notice. JICA Study Team explained the identification survey to the State Coordinators two times: one was at the State Coordinator meeting held on September 16, 1993 and the other was at the workshop held on October 14, 1993 when the identification criteria and survey forms were discussed. Actual survey was started immediately after the workshop.

There might be no time to conceive new projects; that may be the reason that many on-going projects were listed up and not so many new projects came out.

State Coordinators have to collect information from various government agencies such as State DOA, LPP/PPK, FELCRA, FELDA, DOW , etc. It may be difficult and time consuming to collect information from other government agencies, because naturally other agencies may have lesser interest in DID's project than their own project.

1.4.3 Contents of Questionnaire

Questions ranged wide disciplinary fields and number of questions was many. Questionnaire includes questions on hydrology, irrigation, geology agriculture and environment. The wide range of question might have caused difficulty in finding answerers and the large number of questions might have required much time to answer. When JICA Study Team prepares guidelines, attempt will be made to minimize questions and limit them to absolutely necessary ones so that the survey period could be shortened and the man power input could also be minimized.

II CATEGORIZATION OF SMALL RESERVOIR BY ANALYSIS OF IDENTIFICATION SURVEY RESULTS

2.1 Categorization of Small Reservoir on the Long List

The first step survey by Questionnaire I identified 266 small reservoirs in Peninsular Malaysia. The 266 small reservoirs were registered in the long list of small reservoir. Questionnaire I has only 13 questions including routine items such as the name of project, code number, location of project.

Summary of survey result by State is presented in Table I-3. Main statistics are shown below.

a) Type of Small Reservoir;

Type A (small dam on stream)	112	(42%)
Type B (pond in depression or swamp)	95	(36%)
Type C (abolished river)	8	(3%)
Type D (upstream of existing weir)	35	(13%)
Type E (tin mine pond or lake)	13	(5%)
(blank)	3	(1%)
Total	266	(100%)

b) Purpose of Reservoir

Irrigation	240	
Paddy	128	(24%)
Vegetables	141	(27%)
Fruits	89	(17%)
Others	30	(6%)
Domestic Supply	30	(6%)
Industrial Use	12	(2%)
Fisheries	46	(8%)
Agro-tourism	54	(10%)
Others	1	
Total	531	(100%)

c) Benefits

Irrigation	Area (ha)	37,678
	Family (No.)	40,259
Domestic Supply	Family (no.)	151,170
Industry	Factory (no.)	5,566
Fishery	Pond (ha)	1,147.72

d) Land Ownership

Government	(no. of projects)	109
Private	(no. of projects)	127
Mixed and others		30
Total		266

e) Environmental Problems

Water quality	(no. of projects)	41
Soil erosion	(no. of projects)	17
Flooding	(no. of projects)	4
Drought	(no. of projects)	4
Water logging	(no. of projects)	10
River erosion	(no. of projects)	3

f) Priority of Project in State's View

Priority 5 (highest)	(no. of projects)	123
Priority 4	(no. of projects)	66
Priority 3	(no. of projects)	34
Priority 2	(no. of projects)	13
Priority 1 (lowest)	(no. of projects)	6
blank	(no. of projects)	24
total		266

2.2 Meteorology and Hydrology

(1) Hydrological information - questionnaire survey

Questionnaires (Questionnaire II.B) were prepared and delivered for short-listed projects to get information on meteorology and hydrology. The questions include: i) meteo-hydrological observations, ii) related rivers and their conditions, iii) recent droughts and floods, iv) seasons, and v) rainfall and surface water resources. Some questions related to hydrological conditions such as water shortage, proposed cropping area, catchment area, etc. are included in other questionnaires. The answers have been compiled into a database for: i) categorization and selection of projects for the feasibility study, and ii) providing basic information on each area. The database was formed by Lotus 123 and all the data are available in output forms (tables).

(2) Hydrological evaluation

Based on the above-mentioned information, hydrological conditions were evaluated. Factors selected and procedures of evaluation are explained in the following.

a. Depth of rainfall

When we consider the potential of regional water resources without a certain location of project, water availability is expressed by depth of water. The depth of available water is determined by quantity of rainfall, evaporation and percolation. Out of these, the dominant factor for the water availability is rainfall which varies quite a lot depending on location and season. Thus, the rainfall distribution was evaluated in terms of yearly total of monthly reliable rainfall and its variance in a year. The procedures of evaluation are mentioned in the following.

i) Yearly total of monthly rainfall of 80 % reliability

A quantitative evaluation of rainfall was done by estimating monthly rainfall of 80 % reliability which is generally used for an irrigation planning. The reliable rainfall was calculated by Iwai method for 37 basin rainfall by month. The rainfall records were provided by DID and their observation periods are long enough.

According to the estimated yearly total of monthly reliable rainfall, scores (Re) from 1 (lowest) to 5 (highest) were determined by basin (37 basins). The criterion was as follows:

<u>Score (Re)</u>	<u>Range</u>
1	less than 1000 mm
2	1000 to 1200 mm
3	1200 to 1400 mm
4	1400 to 1600 mm
5	more than 1600 mm

ii) Standard deviation of monthly rainfalls

A standard deviation explains the variance of data. The lower a value is, the smaller the variance is. The standard deviation of monthly rainfalls through a year also shows their variation in a year.

According to the standard deviation, scores (Rd) from 1 (lowest) to 5 (highest) were determined by basin (37 basins). The criterion was as follows:

<u>Score (Rd)</u>	<u>Range of Standard Deviation</u>
1	more than 80
2	65 to 80
3	50 to 65
4	35 to 50
5	less than 35

Based on the scores Re and Rd, an integrated evaluation was done. Considering crop cultivation, absolute quantity of available water in a year or seasons should be prior to its consistency. In this meaning, some weight was put to the quantitative score (Re). After some trials for the weight, scores on hydrological condition (lowest 1 to highest 10) were determined following the formula as below:

$$\text{Total Score} = (3 \times \text{Re} + \text{Rd}) / 2$$

The scores are shown in Table I-4.

b. Run-off to the proposed reservoirs

According to the hydrological evaluation by Basin, general conditions can be known for certain regions. Even though a project is located in a preferable hydrological conditions with abundant and consistent rainfall, it might not get enough water because of unbalance in its catchment and irrigation area. Considering these, water balance of the estimated run-off and the water demand should be examined for each project.

Here, the run-off to the proposed reservoir was estimated by multiplying: i) depth of reliable rainfall to the catchment, ii) catchment area, and iii) run-off coefficient. In this study, the run-off coefficient was assumed at 0.70.

(3) Categorization of projects

The purposes of the categorization of projects are: i) to clarify a potential of a project for small reservoir development, ii) to select pilot projects for the feasibility study, and iii) to provide an idea that what is to be analyzed and how to find and evaluate the candidate projects.

Following factors were examined for the categorization of the short-listed projects.

- i) Water shortage
- ii) General hydrological condition (Basin-wise rainfall depth)
- iii) Estimated run-off
- iv) Estimated gross irrigation requirement
- v) Proposed area

a. Water shortage

Water shortage condition was investigated by questionnaire survey. The seriousness of the water shortage was evaluated subjectively by owners of the projects by scores of 1 (no water shortage) to 5 (the severest). This factor was also used for the screening

of projects from the long-list to the short-list. Here, the projects with its score of 3 or more were categorized as "projects which require water source development". In Table I-5, these projects have "O" in the column of "Water shortage" and others have "X".

b. General hydrological condition

According to the score for the depth of reliable rainfall in a certain Basin (Table I-4), the projects were categorized. The projects with higher scores are considered to be in a preferable hydrological condition. In this study, the projects with their scores of less than 7 were categorized as "projects with more necessity for water source development". In Table I-5, these projects have "O" in the column of "General hydrological condition" and others have "X".

c. Water availability

Scale of a water source development is determined by the quantity of available water from the source and the proposed area. The concept of small reservoirs is considered to be temporary and supplemental water source without storing water for full dry season. At the initial stage of planning when dimensions of a reservoir are not fixed, it is difficult to estimate the irrigable area by detail water balance study.

Here, as a simplified measure, the run-off to the reservoir was compared with the gross irrigation requirement which was estimated using some assumptions of: i) crop water requirement, ii) irrigation efficiency, and iii) effective rainfall.

Crop water requirement was assumed at 1500 mm based on the average evapotranspiration in Kuala Lumpur (1200 mm/year) estimated in "Estimating Potential Evaporation Using the Penman Procedure, *Hydrological Procedure No. 1, DID*" and crop coefficient of 1.2. Irrigation efficiency was assumed at 70 % considering a small irrigation area. Effective rainfall was assumed at 60 % of reliable rainfall.

Example : PR1, Simpang Geti (Perlis)

Catchment area	: 3 km ²
Proposed area	: 70 ha
Net water requirement	: 1500 mm
Yearly total reliable rainfall	: 922 mm (BASIN I, Table I-6)

$$\begin{aligned} \text{Estimated run-off} &= 3 \text{ km}^2 \times 922 \text{ mm} \times 0.70 \\ &= \underline{194 \text{ ha m}} \end{aligned}$$

$$\begin{aligned} \text{Gross water requirement} &= (1500 \text{ mm} - 922 \text{ mm} \times 0.6) \times 70 \text{ ha} / 0.70 \\ &= \underline{94.7 \text{ ha m}} < 194 \text{ ha m [OK]} \end{aligned}$$

If the estimated run-off was bigger than gross irrigation water requirement, "O" was given in the column of the "water availability". Detail water balance study will be done in the next stage with optimization studies of proposed reservoirs.

(4) Selection of projects from hydrological viewpoints

According to the above-mentioned three factors (hydrological condition, water shortage, water availability) and size of proposed area, recommendable projects for further study were selected. The range of the proposed area selected is 30 ha to 400 ha.

If a project had four "O"s, it was automatically selected. If some special conditions are found for the project, it was also selected with some "X"s. The special conditions considered were: island, a good example of each type of reservoir, priority by States, and the government policy.

2.3 Irrigation and Drainage

As the result of the second questionnaires, a majority numbers of projects give the answers, but some discrepancy and ambiguity are found out among the of the answers on the same projects. In this description, taking account these discrepancy and ambiguity, the general components on the projects are roughly summarized based on the categorization and analysis.

(1) Present condition of the short listed projects

(a) Existing irrigation facilities in the project areas

Out of the short listed projects of 114 number, 76 projects have some of the existing irrigation facilities such as dam, head work, pond, pump station, pipe line and canals.

Water resources of the projects area river water in a majority of projects and shallow ground water and / spring in a few projects.

A majority of existing dam are earth fill type with a total storage capacities ranging 4,200 m³ to 1.8 million m³, and dam height ranges from 2 m to 9 m. The irrigation areas range from about 13 ha to 490 ha.

In case of pond which the clear information is gotten only one (1) case through the questionnaire, the storage capacity is 21,000 m³, and the irrigation area is 220 ha. However, in cases of Pahang State's proposal case, a majority of inundation projects are seemed to ponds which are banding depression and / or swamp located in the river mouth of Pahang river's small tributaries by river levee for flood control. The storage capacity of these ponds range from 90,000 m³ to 1.6 million m³. The irrigation areas range from about 50 ha to 210 ha.

In case of head work and / or intake weir, the height of head works range from 2 m to 5 m, and the effective storage capacities are estimated at the range from 2,000 m³ to 240,000 m³. The irrigation areas range from about 50 ha to 3,660 ha.

Detailed information are summarized in Appendix III.

(b) Flood condition of the projects

In accordance with the answers on the flood record for the 4-year from 1990 to 1993, the flood occurrence and its' affection to the project area are found out. The occurrence period and affection of flood are slightly different case by case, but a majority of flood condition to the projects can be summarized as follows.

Flood occurrence

Except for the projects in Perlis State, Lankawi and P' Penang State, flood continuously occur in the main season from October to January. the irrigation area of the Projects are always suffered from the flood, and affected areas by the flood range from 100 % to about 10 % of the respective project areas. Inundation periods of water are less one (1) week in the a majority project areas, except the projects in Pahang.

Inundation of the projects in Pahang State continues about 3 months after flood attacking, and nearly 100 % of the project areas are damaged because of the locations of the Project areas.

Detailed information are described in Appendix III.

(c) Water shortage condition of the projects

In accordance with the answers of the questionnaires on water shortage record for the 4-year from 1990 to 1991, about 40 projects with existing irrigation facilities face this problem, and 2 projects such as PK-5 & PK-20 have absolutely water shortage through all crop season. Main reason of the water shortage problem are the loss of river water resources for irrigation during the off-season from February to May, but in case of projects in Perlis State, water shortage problem is caused by regional water manage problem.

Water shortage areas of the projects, depending to the irrigation water demand crops and planting schedule, range 100 % to 10 % of the project area.

Detailed information are described in Appendix III.

(d) O & M work of the projects

As for current water use in the projects, 15 projects share same water resources with other type of projects located the adjacent area to the project.

Other type of projects are the other irrigation projects, hydro-power dam and fish pond. Aerial overlapping with the other projects occurs in 3 project cases, and overlapping area of the projects range from about 59 % to 8 % of the project area.

Maintenance work of the project facilities is mainly carried out at the force account base and subletting is made at rate of about 30 % of the numbers of the projects.

Detailed information are summarized in Appendix III.

(2) Small reservoir development of the short listed projects

(a) Mini dam & reservoir and / or heightening of existing dam (Type-A)

Proposed mini-dams have dam height ranging 1 m to 12.8 m and total storage capacity ranging 600 m³ to 1.0 million m³. Land to be submerged by the storage water are estimated at the range from about 1 ha to 20 ha at the respective projects, and present land use are rubber plantation area, paddy field, swamp, bushes and forest.

Expecting cropping pattern in the respective projects are double paddy planting, orchard and vegetable.

Proposed mini-dam is new water resources development projects, but 16 projects have water shortage problem under the current operation of existing water resources and irrigation facilities.

Detailed information of the proposal on the mini-dam and reservoir are described in Appendix III.

In case of heightening dam and bank, additional height of dam and band of the projects range 1 m to 2 m, and total height of dam and band reach the range from 4 m to 7 m. Total storage capacity of dam and band range from about 4,000 m³ to 600,000 m³. Total irrigation area including the increased irrigation area by the heightening dam will range about 80 ha to more 560 ha.

Water shortage problem are found out 6 projects under the current operation of water resources and existing irrigation facilities, based on the answers of the second questionnaires on water shortage record for the 4-year from 1990 to 1993.

Expecting cropping pattern are proposed double paddy planting or paddy - upland crop.

Detailed information of the proposal on heightening dam and band are described in Appendix III.

(b) Pond in the depressed area, swamp and abandoned paddy field (Type -B)

The proposed area for pond development are covered by sandy clay to clayey soils, and proposed depth of pond of the projects range from 1.5 m to 4.5 m. Total storage capacity range from about 1,000 m³ to 1.2 million m³. Total irrigation area of the projects range from 40 ha to more 490 ha.

Proposed water supply to the irrigation areas are mainly pumping up system, but in a few cases, gravity method is also proposed.

Expecting cropping pattern of the projects are double or single paddy planting.

Water shortage problem are found out in the 14 projects under the operation of existing irrigation facilities, based on the results of questionnaires.

Detailed information of the proposal on pond development are described in Appendix III.

(c) Abolished river course (Type-C)

In case of development on abolished river course, only 4 projects area proposed.

Excavation of ponds are proposed the range from 4 m to 5 m, except for PP-1. Total storage capacities of the projects range from about 2,300 m³ to 90,000 m³, and water will be used for irrigation of double paddy planting or paddy - upland crop. Proposed irrigation areas range 10 ha to about 200 ha.

Brackish water intrusion to these abolished river courses are not found out.

But water shortage problem in the 2 project areas are found out under the operation of existing irrigation facilities, in accordance with the result of questionnaires on water shortage record for the 4-year.

Detailed information of the proposal on abolished river courses development are described in Appendix III.

(d) Heightening of existing weir (Type-D)

Proposed heightening of weir range 0.3 m to 1.0 m, and effective storage capacities are estimated at the range from 6,000 m³ to 60,000 m³.

Submerged land due to the heightening of weir are swamp, rubber and oil palm plantation areas and paddy field.

Expecting cropping pattern are double paddy planting, orchard and paddy - upland crop.

In accordance with the result of the questionnaires on water shortage record for the 4-year, the 4 projects faced under the current irrigation operation.

Detailed information of the proposal on heightening of existing weir are described in Appendix III.

(e) Disused tin mine pond (Type-E)

In case of the disused tin mine pond development, 5 projects are proposed, and main water use is irrigation for paddy and orchard planting.

Total storage capacities of disused tin mine ponds range about 140,000 m³ to 300,000 m³, irrigation areas of the projects range from 14 ha to 200 ha.

Water shortage problem of one (1) project is found out in agriculture land located near the pond, and in other project cases, it seems new development project.

Detailed information of the proposal on the disused tin mine pond area described in Appendix III.

(3) Screening conditions for advantageous project

In accordance with review result of the answers of questionnaires, much discrepancy and ambiguity on answers are found out, and furthermore no answers items are much found out, specially planing on reservoirs and construction cost.

As for the discrepancy and ambiguity on answers, re-filling and adjustment of data are carried out as much as possible.

However, since the prompt discussion on the appreciated reservoir capacity and construction cost in this moment because of no filling of questionnaires, screening condition of advantageous projects are adopted as follows.

(a) Water shortage

In accordance with answers on water shortage record for the 4-year, if real water shortage condition area confirmed and existing irrigation area is over 20 ha, the project will be nominated as primarily advantageous one.

(b) Storage capacity, irrigation area and expecting cropping pattern

Review and evaluation on reservoir capacity is roughly made based on proposed irrigation area of more than 20 ha and expecting cropping pattern. In case of the proposal on double and single paddy planting, irrigation demand is assumed at 1.5 m/ha/season, and the required storage capacity is assumed at 0.75 m/ha/season. And other 0.75 m/ha/season is assumed to supply from continuous river water flow.

In case of vegetable and orchard, the irrigation demands are assumed at 0.25 m/ha/season for vegetable and 300 l/no/day for orchard. the required storage capacity for vegetable is assumed at the irrigation demand for dry period of one (1) month, and that for orchard is assumed at the irrigation demand for dry period of 2 months.

If the proposed storage capacity of the project is more than the rough estimated , the project will be nominated as the primarily advantageous.

(c) Confirmation of definition on type of reservoir

The following defined conditions on type of reservoir which are adopted in the identification criteria for small reservoirs development, are confirmed, and in case of no objection on the project conditions, the project is nominated as the primarily advantageous one.

- (i) designed dam height (< 15 m)
- (ii) dam reservoir area (< 50 ha)
- (iii) excavation depth of pond (< 2 m) and embankment height (< 5 m)
- (iv) heightening of weir (< 1 m)

(d) Insufficient information case through answer of questionnaires

In case of insufficient information case through answer of questionnaires, the possibility of further investigation will be given, and the projects are temporally nominated.

(4) Selected projects in view point from irrigation development

Trough screening procedure mentioned above, the following numbers of projects are selected in view point from irrigation development.

Development	Description	Number of Project
Type of Projects		
TYPE-A	Mini-dam & Reservoir	27
TYPE-A	Heightening of dam & band	21
TYPE-B	Pond	15
TYPE-C	Abolished river course	2
TYPE-D	Heightening of weir	6
TYPE-E	Disused tin mine pond	4

2.4 Geology

Generally, geological conditions would not be primary, but be incidental in the priority ranking for the potential sites in a agricultural development plan. For example, if the other all conditions are the same, the difference of the geological conditions would decide the project economic or not, and in the other case, the geological conditions would make the project impossible, because of, for example, shortage of the bearing capacity for the large facilities planned in the project.

Any project in the short list, however, did not through the geological procedure in the priority ranking for the potential sites. Because, the priority of all potential sites were ranked with the other primary selection criteria and there was no project including such a large facilities plan as the geological judgment will be required.

The main points of the results are as follows.

- i) Answers of one hundred fifteen(115) projects of 145 were collected(79.3 %), as of Feb. 19, 1994.
- ii) The map with a scale of 1 to 63,360(1 inch to 1 mile) or 1 to 50,000 is not prepared in thirty nine(39) projects, 33.9% of 115 answered projects. The 39 projects include 30 no answered. Many projects in which the map, described above, does not prepared or did not answer, are in Perak, Selangor, Melaka and Trengganu.

The above result means that those four State DID do not prepare the map but partially. Because, according to the collected information, the map of 1 to 1 mile covers all of Peninsular Malaysia.(G_MAP:Existing topographic map)

- iii) Aerial photograph does not prepared in any project. (G_PSCALE:Scale of aerial photographs)
- iv) The maps, except for the map described in "b)", are prepared in 23(20%) projects. Scale of the maps is mostly 1 to 25,000 and the others are 1 to 6,336 or 1 to 3,168. The maps are prepared in many projects in Pulau Pinang, Melaka and Trengganu. (G_MSCALE:Scale of other maps)
- v) Answers to "Geologic condition" are collected in almost all projects. The answers, "Unknown", are only 4.(G_COND:Geologic condition in the scheme area)

- vi) Some geological data are prepared in 5 projects. Four(4) of the them are in Pulau Pinang and the other is in Kelantan. The kinds of the geological data of the former 4 are " Geological Map or Profile", and the latter 1 is "Geological Survey Report".

According to the collected information, the geological map with a scale of 1 to 500,000 covers the all of Malaysia and a scale of 1 to 63,360 covers almost all Peninsular Malaysia. Furthermore, the other many kinds of geological data are published by the Geological Survey of Malaysia.(G_DATA:Existing geological data in the vicinity)

- vii) Answers of "Yes" to " Damage" including the answers indicating "Place of Damage", nevertheless "No" are 18(15.7%). The kinds and places of damage are as follows.(G_DAMG:Damage in the vicinity, G_PDAMG:Place of the damage, G_SDAMG:Scale of the damage, G_MDAMAG:Countermeasures against the damage)

<u>Slope Failure</u>	<u>10</u>
Natural Slope	5
Cut Slope	4
Slope of Embankment	1
2	7
Foundation of Facilities	7
<u>Others</u>	<u>1</u>
River Bank Washed Away by Flood	1

The measures are taken against the only 3 slope failure damages. In case of the damages of the foundation facilities, kinds and scale of the damages and measures against them are not mentioned. Therefore, they are presumed to be not serious.

2.5 Agriculture and Agro Economy

2.5.1 Categorization by Agriculture Aspects

(1) Land Use and Suitable Crops

DOA has 240 extension area, holding 3 extension workers each in the Peninsular Malaysia. One extension worker is in-charge for 800 farm households, and the suitable crops were instructed by state DOA and MARDI station in each area.

As for suitable crops, as already mentioned, there are fruits maps by MARDI and the list of vegetable production areas by DOA. The characteristics on agriculture in each state is summarized as follows :

- States of paddy production	PR, KH, KN
- States of fruit production	JR, PK
- States of vegetables production	JR, PH, PK, KN
- States of plantation	JR, PH, PK
- States of flower production	PH, SG, JR
- States of fishery production	SG, PH, PK, NS
- States of agro-tourism	PP, MA
	PH (Cameron highland)
	KH (Langkawi)

(2) Soil Texture

In the second questionnaire, five types of soil, clay, loam, sand, silt and peat were chosen in each site. Out of 96 answer sheets, around 70% sites answered as "clay".

Generally speaking, the soil in Peninsular Malaysia scarcely has organic matter and when there is shortage of water, the surface of the soil hardens like an iron-clad. The soil has poor grainy texture, and the leveling of crop beds in upland is very difficult.

(3) Owner of Project

Similar projects have been programmed by various agencies of plantation crop authorities or state development authorities as well as Governmental Organizations such as DOA, FOA, FELCRA etc. Some projects have basic constraints on water or soil problems in land use.

In our field reconnaissance survey it was found out that for some cases, the previous discussion had been not enough to solve the basic problems. For example in PR state, failure of fruits diversified paddy land was noticed where the soil was heavy clay using drip irrigation in spite of very high ground water. An another example is a peat soil area in PK, where they dug the drainage canals. The water in the canal was decayed and smelled so bad due to stagnant water.

On-going projects by DOA, FOA, FELCRA and MARDI are included in the F/S candidate sites, some of which were reviewed in our field reconnaissance survey. It is expected that some of those will be selected as model cases in collaboration between DID and other Government agencies.

(4) Beneficiary of Project

The types of beneficiaries in the project are divided into (1) individual farmers, (2) group farming (3) mini-estate (4) private sector and (5) public management.

In the second questionnaire, it was asked which type of the project beneficiary they propose. This means the farmers' intention in the project or the labour balance in the village at present. Out of the 96 answers, 14 sites answered for "individual farmers" and 45 sites answered for " group farming " for the project implementation.

(5) Purpose of Project

The frame of the projected production are mainly restricted by the labour balance in the project area. That is to say that the labour shortage will be an inevitable constraint for a large scale farming with intensive technology like vegetable cultivation.

Therefore, categorization by purpose of the project area considering social and economical conditions is necessary. Then the small reservoir development shall be classified according to the following types of farming :

- a) Poverty Alleviation type (Type PA)
Generally all the paddy area and full time farmers are included in this type. Annual family income, including off-farming income, remains in the level of RM. 4,000 - RM. 5,000. For this type of the project, RM. 10,000 of annual family income will be set up as a target.
- b) Labour Saving type (Type LS)
When a main labour (a husband) is fixed to engage in off-farm work outside, the future farming have to programmed to save labours or to make it easy for women and old men to fulfill the project. The labour saving farming will need much capital intensive methods with high technological facilities. Then, floriculture or vegetable cultivation will be suitable for this purpose.
- c) Advance Farming Type (Type AF)
In the area where the family income is around RM. 10,000/year on the average, the highly motivated farmers want to extend their farming to fruits production, fishery or cash crops for agri - business. For this type of the project, RM. 20,000 of annual family income will be programmed as a target with high technology.
- d) Agro-Tourism Type (Type AT)
On the tourism area with lots of tourists, service and profit oriented farming will be programmed for the areal development combining the tourism with farming exhibitions, orchards, farm processing factories etc.

e) Water Resource Type (Type WR)

These cases are some cases of strategic development for future water resource by DID, even though the reservoir and canal construction is over investment for the farmers request at present. Another case, which urgently needs to improve the water management system (O&M), will be also included in this category. Some agricultural development plans in this type will be more or less temporary.

2.5.2 Selection from the Short List

(1) Enumeration results of answer sheets

Short list survey by questionnaire-2 was conducted by a local consultant (SSP) on 142 sites, which were chosen by questionnaire-1. The enumeration was done for 114 answer sheets as of Feb. 25, 1994. However the numbers of effective answer-sheets on Agriculture Questionnaire were only 96, that is 15% of the answers were blank in all.

Answers were areal extension workers (Pembantu Pertanian) in case of DOA project. However, in case of DID project or other agency project, there are so many blanks without monitoring from farmers.

(2) First Selection and Priority Ranking in Agriculture

As potential conditions for agriculture development, the five questions shown below were picked out and the ranking was made by five points evaluation :

1)	Size of the participant farmers (Q 24)		
	30 < P < 200		38/96
2)	Managing system (Q 26)		
	Individual or group farming		59/96
3)	Rate of farmers successors (Q13)		
	Over 50%		30/96
4)	Experience of group farming (Q17)		
	Yes		43/96
5)	Main upland crops and/or fruits (Q18&Q19)		
	Names are written		31/96
	- 5 points	Rank A	4 sites
	- 4 points	Rank B	13 sites
	- 3 & 2 points	Rank C	41 sites
	- 1 point	Rank D	24 sites
	- 0 point	Rank E	14 sites
	Total		96 sites

(3) Recommendation by DID and DOA

DID and DOA have recommended several potential sites apart from the above ranking. The recommended 5 sites; NS 1 (MARDI), MA 16(FELCRA), KH 4 (Langkawi, DID & DOA), PP 3 (DOA) and PH 20 (DID); and Rank A, B, C, totaled into 63 sites are tabulated in Table I-7.

(4) Recommendation by the Consultants with Field Reconnaissance Survey

The consultant carried out field reconnaissance survey on 31 sites, which was recommended by DID or DOA in each state, for 11 days from Jan 22, 1994 (Table I-8).

With this survey the consultants have finally recommended the most potential nine sites, one site in each state, as the first priority except SG and PK.

(5) Decision of F/S Project Sites and Priority Ranking by DID

DID proposed (1) some areal expansion at project sites in PR and KH, and (2) additional TR project (TR3). And DID decided the priority ranking of all the 10 project sites as follows :

F/S Priority Sites and Priority Ranking

Priority Ranking	Farm Land	Farm Houses	Development Items	Project Owner	Remarks	Purpose Type
1. PR 1	52 ha	171	O & M system	DID	Tasik Melati incl.	WR
2. KH 4	(200 ha)	(150)	Paddy, Agro-tourism	DID/DOA	KH5 included	AT
3. NS 1	(200 ha)	-	Fruits Research	MARDI	No farmers	AF, AT
4. PH 20	137 ha	50	Veg. Fishery	DID	Inundation	PA, WR
5. TR 44	62 ha	22	Vegetables	DOA	Group farming	PA, LS
6. TR 3	420 ha	400	Paddy, Veg.	DID	Tin mine pond	WR, PA
7. KN 16	32 ha	55	Paddy, Veg. Domestic W.	DOA	Multi-purpose reservoir	LS, PA
8. JR 10	82 ha	25	Fruits	DOA	Irrigation	AF
9. MA 16	409 ha	119	Fruits, Fishery, Flower	FELCRA	Multi-crop Agro-tourism	LS, AT
10. PP 3	68 ha	34	Paddy, Veg, Fruits	DID	Multi-crop, Paddy	PA, WR

2.5.3 Site Information on Agriculture and Agro Economy

(1) Present Condition and Agricultural Plan

As for a site information on agriculture, the out-put programme from database on agriculture was instructed to Local Consultants in Nov. 1993. (Table I-9) They followed

our instructions and gave us around 100 out-put data on Feb.25, 1994, although it was too late, and the figures were needed some modification.

Most questions on present condition were answered in answer-sheets, however, the answers on agricultural plan could not be written with new ideas or with farmers requests because answerers could not understand on the basic concept on "Small Reservoir Development".

In this point of view, some sites recommended by DOA showed a good response because some agricultural extension workers were eagerly requesting a budget for the introduction of new technology such as pumping, drip or sprinkler irrigation.

(2) Some Subjects on Selected F/S Project Sites

a) Acreage and Participant of Project

In some cases, the figures on project acreage or project participants are not confirmed because the answerer could not meet the farmer. In case of DID project, there are no farmers leaders who can organize the village and the farmers remaining in the village can not answer other farmers intentions.

b) Role of village women of project

From the questionnaire we could not get any information on women's role in village life. In the field survey in MA 16 they said that around 25 women are working outside, and in PH 20 we could interview a women working in the field for the first time of our survey. She said that she cultivate the upland crops only with hoe and earn about RM 50-100 per month.

c) Farmers Organization

Most of the F/S selected sites answered that there is a farmers organization, however, the activities are not enough functioning due to labour shortage. Especially in case of PR1, TR3, PH 20 and PP3 we have to review and encourage farmers to organize the grouping activity in water management (system O&M) as well as in farming cooperation.

(3) Confirmation of Farmers' Intention on the Project

In order to confirm (1) basal figure on the proposed acreage and participants in F/S project sites, and (2) farmers' intention (proposal) on development plan, the consultants asked DOA to get additional information by a simple questionnaire with agriculture extension net work through the state DOA.

2.6 Environmental Issues

The following environmental issues were surveyed for the short-listed projects using the questionnaire.

- 1) Major environmental problems, remedial measures and monitoring facilities for environmental protection
- 2) Prescribed activities carried out in the project
- 3) Environmental Impact Assessment of the project using a preliminary assessment matrix

During this II stage of the Study the results of the above survey were analyzed. A field visit was conducted to verify the environmental problems in the selected projects which have high priority in the state. The results of the analysis and the field survey are discussed in this section.

2.6.1 Environmental Problems of the Long-listed and Short-listed Projects

The environmental problems of the 266 long-listed projects were surveyed by using the general questionnaire and the summary is shown in Table I-10. As shown in Table I-10, 149 of the 266 projects surveyed have no major environmental problem in the area. The major environmental problem is water quality caused by domestic effluent, industrial effluent, farm effluent, salinity, brackish water, sediment, mineral and weeds. In Melaka state water quality is the main problem for 9 projects caused by the different factors mentioned above. Other major environmental problems are water logging, flooding, and soil erosion. Especially 10 projects in Pahang state are affected by water logging and flooding in 8 of those projects. In Perak state soil erosion is the major problem for 7 projects caused by land clearing and land logging.

Since there is no major environmental problem in most of the projects, no remedial measures have been followed for these projects. It was reported that the remedial measures are improving for 7 projects in Perak. Silt trapping and bunding are carried out for one project (in Perak) and two projects (one in Perak and one in Pulau Pinang) respectively.

The environmental problems of the 134 short-listed projects were surveyed using questionnaire-2 and the summary is shown in Table I-10. A detailed list of all the environmental problems for all the projects is shown in Table I-11.

As shown in Table I-10, 76 of the 134 projects surveyed have no major environmental problem in the area. The major environmental problem is water quality caused by domestic effluent, industrial effluent, farm effluent, salinity, brackish water, sediment, mineral and weeds. Water quality is the major problem in 4 of the 5 short listed projects in Melaka State. Other major environmental problems in the short-listed projects are flooding, soil erosion and water logging. Especially in the Pahang state, flooding and water logging are the major problems in 9 of the inundation schemes. Small reservoir development is expected to have a significant effect in mitigating the flood problem. Soil erosion because of land clearing and logging is an important problem in 8 projects in Perak State. In Kelantan river erosion and flooding are the major problems in 3 of the projects.

2.6.2 Remedial Measures and Monitoring Facilities

Since there are no major environmental problems caused by the small reservoir development projects, there are almost no remedial measures were followed in the projects surveyed except for desilting basin and bunding which were reported for two projects.

Regarding the monitoring facilities for environmental protection, DID carries out water quality sampling in the major rivers. As shown in Table I-12, DID has 43 principal water quality stations and 28 secondary water quality stations for monitoring the water quality in the major rivers. Besides suspended sediment sampling is carried out at 43 principal stations and 37 secondary stations. DOE is also monitoring the 87 major rivers and the water quality samples were carried out in 555 sites in 1991.

2.6.3 Prescribed Activities of the Short-listed Projects

The Environmental Impact Assessment (EIA) which was made a mandatory requirement under section 34A of the Environmental Quality Act, 1974 requires anyone who intends to carry out a prescribed activity to first conduct a study to assess the environmental impact that will arise from the prescribed activity as well as the mitigating measures to overcome them. The Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 specifies 19 broad categories of activities requiring EIA prior to project approval or implementation.

The proposed project activities in the project area were verified against the prescribed activities through the questionnaire survey. Based on the analysis of the results, it was found out that the proposed project areas for most of the projects are small compared to the limits of the Prescribed activities. Therefore in most of the cases, EIA shall not be necessary. Among the short listed projects, the following projects which are bound by the limits of the prescribed

activities need a detailed EIA and approval from DOE before their implementation. The projects and the prescribed activities which bound the respective projects are given below :

1. KH 3 - Ampangan Pdg Saga - Conversion of forest land to other land use covering an area of 50 ha or more.
2. PP6 - Sg Jarak Irrigation Area - Construction of dams or impounding reservoirs of 200 ha or more.
3. PP9 - Sg Burung - Conversion of forest land to other land use covering an area of 50 ha or more.
4. PP 13 - Skim Pengairan Tasek Selatan - Development of tourist facilities in national parks.
5. PK 3 - Industri Buah-Buahan - Conversion of forest land to other land use covering an area of 50 ha or more.
6. SG 8 - Kuang - Land development of agricultural estates covering an area of 500 ha or more involving changes in type of agriculture use.
7. NS 7 - Kg Bk Tembok & Sg Raya - Construction of dams or impounding reservoirs of 200 ha or more.
8. KN 5 - Lubok Selehong - Agriculture programs necessitating the resettlement of 100 families or more.
9. KN 24 - Ranc Taliair Enggong - Construction of dams or impounding reservoirs of 200 ha or more.
10. TR1 - Telabak Irrigation Scheme - Conversion of forest land to other land use covering an area of 50 ha or more.
11. TR 3 - Skim Tanaman Padi Maras - Conversion of forest land to other land use covering an area of 50 ha or more.
12. TR 50 - Kolam Abang - Construction of dams or impounding reservoirs of 200 ha or more.

In most of the projects where there is a potential for small reservoir development, the area of the proposed reservoir is not clear at present. Therefore, it is not possible to decide on the necessity of EIA for those projects. Once a complete and suitable plan is made for those projects, the necessity of EIA can be verified against the prescribed activities.

2.6.4 Environmental Impacts of the Short-listed Projects

The environmental impacts of the short-listed projects were studied using a preliminary assessment matrix through questionnaire survey. The summary of the environmental impacts of the short-listed projects based on the Questionnaire survey is shown in Table I-13. The

environmental impacts of the projects in each of the 11 state of Peninsular Malaysia is shown in Table I-14.

Among the 114 projects, around 100 projects have no impact with regard to most of the environmental components. Since the size of the project considered in most of the cases for the small reservoir development is less than 200 ha, the environmental impacts are relatively small.

The main environmental component which has a significant effect on 10-15 small reservoir development projects is surface water, which includes flooding, water quality, drainage and water balance etc. The socio economic conditions of the area is also expected to have a significant impact. The other environmental components like groundwater, land, species and populations and aesthetic and cultural aspects also have significant impact on some of the projects.

The environmental enhancement is also significant for around 20 projects. Especially the surface water conditions, socio economic conditions and impacts on the community is expected to improve by these small reservoir development projects. Water balance of 5 projects in Perlis State and 17 projects in Kedah State is expected to improve by small reservoir development. The community shall also be benefited from these 22 projects. In Pahang state small reservoir development is expected to have a significant effect in improving the flooding and drainage problem of the projects.

2.6.5 Environmental Criteria for the Selection of Projects

With regard to environmental aspect, the selection of the projects for small reservoir development shall be made considering the following three factors :

- 1) The projects which may cause no or less environmental problems which can be solved by suitable remedial measures shall be selected.
- 2) The project areas which do not include environmentally sensitive areas shall be selected. The environmentally sensitive areas are as follows ;
(Reference : A Handbook of Environmental Impact Assessment Guidelines Appendix 13, page 117)
 - i) Historic, religious, cultural or archeological sites
 - ii) Existing Reserves and Parks
 - iii) Any area gazetted as a forest reserve or protective forest reserve (including mangrove areas)

- iv) Existing Hydro-project and irrigation schemes
- v) Water Supply Intakes
- vi) Coral reefs and major fishing grounds
- vii) Any area with tourism potential

3) Areas which include the prescribed activities mentioned in the Questionnaire (Part-2 of the Environment) shall be avoided. However if necessary, some highly potential areas which also include prescribed activities shall be selected. If development need to be carried in these areas, a detailed Environmental Impact Assessment and approval from the Department of Environment will be necessary which may take a considerable amount of time (more than a year).

2.6.6 Results of the Field Survey

After arriving at Malaysia on February 1, 1994, Perak and Pahang States were visited on Feb 3 to 4 and Feb 7 to 8 respectively. The field visits were carried out with the main aim of identifying the suitable projects for the Feasibility Study to be carried out in the next stage of the Study. The project sites were surveyed to identify the major environmental problems and factors which may limit the selection of the project for the Feasibility Study. The project sites visited in these states and the major environmental problems identified in the project sites with regard to the small reservoir development are as follows :

(1) Environmental Problems of the Projects Visited

Perak State :

1) PK 3 - Industri Buah-Buahan (Selama District) - In a forestry area of 57 ha, Farmers Organization Association (FOA) is planning to convert the forest area to grow Durian trees. According to Environmental Quality Act 1974, if a forest area of more than 50 ha need to be developed, a detailed EIA and the DOE approval is necessary for developing this area. Besides, the possibility of small reservoir development is also less in this area since FOA is planning to install 3 tanks for irrigating Durian trees. Therefore, this area shall not be considered as a favorable project site for small reservoir development.

2) PK 8 - Kelompok Buah Buahan (Larut Matang District) -The major environmental problems identified in this area are as follows :

- i) The soil in this area is acidic peat soil
- ii) Drainage facilities are poor in this area.

iii) Water quality is not good because of the industrial effluents from the adjacent areas

iv) All the area belongs to farmers and if small reservoir need to be developed in this area then farmers land need to be converted for small reservoir development which may create social problems.

Because of the above mentioned problems, this area shall not be considered as a favorable project site for small reservoir development.

Pahang State :

1) PH 9 - Paya Pagar Sasak (Lipis District) - Water quality because of sediments is a major environmental problem in the project area. This area already has irrigation facilities which only require proper maintenance. Hence this area shall not be considered as a favorable project site for small reservoir development.

2) PH 20 - Paya Lanting (Maran District) - In this abandoned inundation scheme of 187 ha area, the major environmental problems are water logging and water quality because of water logging and sediments accumulation. Besides drainage is also poor in this area. Flooding occurs during heavy rainfall. However it was informed that the farmers are interested in developing this area for fish farming and vegetable cultivation. At present, no cultivation is practiced in this area and small reservoir development may be helpful for the development of this area. Because of the above mentioned environmental problems, this site shall be considered as a partially favorable site for the small reservoir development.

3) PH 23 - Paya Pesagi (Maran District) - Similar to PH 20, this area is also an abandoned inundation scheme of 93 ha. The major environmental problems are water logging and water quality because of water logging and sediments accumulation. Besides the drainage is also poor in this area. Flooding occurs during heavy rainfall. In this area small reservoir development was proposed for fish farming. Because of the above mentioned problems, this site shall be considered as a partially favorable site for the small reservoir development.

(2) Major Environmental Problems in the Project Sites of Other States

The Study team members except Geologist and Environmental Specialist came to Malaysia on January 9, 1994 and visited the following sites in the other states. The major environmental problems in these sites are as follows :

Perlis State : In this State the following three project sites were visited.

1. PR1 - Simpang Geti 2. PR4 - Tasek Melati

3. PR6 - Hutan Lembah Mango

Among the above sites PR1, PR4 have the water quality problem by industrial effluents and weed respectively and there is no major environmental problem in PR6. In this state there are many small ponds owned by Federal and State government agencies. Conflict of interest in water use between these different agencies is a major environmental problem in the State. Because of this conflict of interest, the farmers at the downstream side faces water shortage problem at the dry season and flooding problem during the rainy season. An efficient water management system incorporating all these ponds is necessary for this state.

Kedah State : In this State the following project sites were visited.

1. KH 2 - Kabun Badak
2. KH 3 - Padang Saga
3. KH 4 - Kawasan Padi
4. KH 5 - Kedawang
5. KH 35 BK Perak
6. Kg. Kubang Yoi
7. Sik Durian

No major environmental problem was reported in the above project sites except KH 35, which has the drought problem.

Pulau Pinang State : The following project sites were visited in Paula Pinang State.

1. PP 3 - Tok Bedu
2. PP 9 - Sg. Burung

The major environmental problem in PP3 is water quality problem by farm effluents. Water quality and flooding are the major problems in PP9.

Selangor State : The following project sites were visited in Selangor State.

1. SG 13 - Jalan Enam Kaki
2. SG 14 - Sesapan BT Minangkabau
3. SG 15 - Bukit Kepong

This area is paddy mini estate growing paddy. Flooding problem was reported in SG 15 and no environmental problem was reported in the other projects.

Negeri Sembilan State : In this State NS 1 - Stesen Mardi Jelebu was visited. This is the driest region in the country. The experimental commercial research farm managed by MARDI is affected by the drought.

Melaka State : The following project sites were visited in Melaka State.

1. MA 14 - Kandang
2. MA 15 - Solok BK Meta
3. MA 16 - Felcra BK. Sedanan

Water quality is the major environmental problem reported from the above project sites. Water quality by salinity, brackish water and sediment transportation were reported from MA 14, MA 15 and MA 16 respectively.

Johor State : The following project sites were visited in Johor State.

1. JR 3 - sawah Kebun Baru 2. JR 10 - Ldg. Kelompok Kangar

No major environmental problem was reported in these two sites.

Kelantan State : The following project sites were visited in Kelantan State

1. KN 13 - Tasik Putera 2. KN 16 - Bendang Pmtg. Sungkai

Water quality is the major problem in KN13 and no major environmental problem was reported in KN 16.

Trengganu : The following project sites were visited in Trengganu State.

1. TR 3 Tanaman Padi Mas 2. TR12 Begual Katong

3. TR 34 Lembah Marang II 4. TR 44 Pasir Nering

Water shortage is the major problem in TR 34 and no major problem was reported in the other project sites.

(3) Prescribed Activities in the Projects Visited

The prescribed activities carried out in the Projects visited are shown in Table I-15. Among the projects visited, a detailed EIA and the DOE approval is necessary for developing PK 3 since a forest land of more than 50 ha area need to be developed. For some of the potential small reservoir development areas, the proposed area of the small reservoir is not clear now. This will be clear only after developing a detailed plan for these project areas. The activities to be carried out in most of the other projects are less than the limit of EQA, 1974. Therefore a detailed EIA and DOE approval may not be necessary for implementing these projects.

(4) Environmental Impacts of the Selected Projects

The summary of environmental impacts of the selected projects as analyzed from the preliminary assessment matrix is shown in Table I-16. Most of the environmental elements has no impact on the selected projects. Especially there is no unsolvable impact for any of the project.

It is obvious that the small reservoir development project will have significant effect on the surface water. PR1, PR4, and PH 20 are expected to have a positive impact with regard to surface water. Development of PR1 and PR4 will have a significant positive impact on the water management of the surrounding area and the surrounding small reservoirs. In PH 20, the inundation scheme, the flooding problem can be mitigated by small reservoir development.

The socio economic conditions of PR 1, KH4 and PH 20 is also expected to improve by small reservoir development, which would have a good impact on the community.

III. SELECTION OF PILOT PROJECTS

3.1 General

In the meeting of January 18, 1994, State Coordinators presented priority projects of respective State. Total number of priority projects was 33. JICA Study Team made a field reconnaissance survey on the 33 project sites and selected 18 projects as candidate pilot projects. Out of the 18 candidate projects, DID finally decided 12 pilot projects with priority ranking. JICA Study Team has conducted feasibility study on five number of pilot projects in the Phase II Study.

3.2 Field Reconnaissance Survey

JICA Study Team conducted the field reconnaissance survey from January 22, 1994 to February 8, 1994 on the 33 project sites. Features of the 33 projects are derived from Questionnaire I and shown in Table I-17. JICA Study Team's findings in the site inspection and evaluation of projects are shown in Table I-18. In the evaluation, existence of beneficiary party and enthusiasm of the beneficiary party for development are deemed most important judgement criteria, followed by technical and economic soundness.

3.3 Selection of Pilot Projects

Out of the 33 projects, JICA Study Team selected 18 candidate pilot projects and forwarded to DID. They are shown in Table I-19. DID and JICA Study Team discussed basic concepts for selection of pilot projects and themes of the feasibility study. Major points are enumerated as follows;

- a) Pilot projects should have different characters each other, otherwise there is no point to undertake plural number of pilot project ;
- b) Pilot projects should represent specific local conditions and include local problems to be solved;
- c) Pilot projects should include not only DID owned projects but also those owned by other government agencies such as DOA, MARDI, FELCRA, etc.
- d) The feasibility study should cover themes such as:
 - i) irrigated vegetables or fruits cultivation;
 - ii) paddy and diversified crops irrigation;

- iii) water management of small reservoirs along a river system in Perlis State;
- iv) strategic land use study of inundation schemes in Pahang State;
- v) utilization of tin mine ponds and surrounding areas in Perak State; and
- vi) cooperation to national tourism programme in Langkawi.

DID finally decided 12 pilot projects. Main gists are shown in Table I-20.

3.4 Description of Pilot Projects

Pilot projects decided by DID are briefed in this section. More detailed data and information derived from Questionnaires are summarized in Table I-16.

Priority No.1 Simpang Geti (PR1) and Tasek Melati (PR4) - Perlis State

Both are existing DID projects irrigating paddy and diversified crops, particularly tobacco. They belong to the same river basin which include hundreds of small tanks. There are water management problems concerning river system as well as on farm. The lack of river-basin-wide water management aggravates flood damages in the rainy season and drought and water quality degradation in the dry season. Moreover, scattered tobacco cultivation is causing very low irrigation efficiencies.

The theme of the feasibility study is to clarify the present condition of water management and to work out O/M improvement plans for the river as well as irrigation system. To improve the on-farm irrigation efficiency, possibility of group farming will be examined.

Priority No.2 Kedawang (KH4 and KH5) - Langkawi, Keda State

Projects are proposed by DID (KH4) and DOA(KH5) for the same objective area. The area is rainfed paddy fields cultivating single crop a year. Langkawi is an island where tourism development programmes are going on by public and private sectors. The government designated the Kedawang area to be used for agriculture in future. Particularly, there is a plan to demonstrate traditional harvesting scene of paddy as an attraction show to tourists.

The theme of the feasibility study is to produce a physical plan of small reservoirs, irrigation and drainage system and other necessary infrastructures which will enable an year round paddy cultivation at least in part of the project area. In addition, possibility to introduce vegetable cultivation under sprinkler irrigation will be examined.

Priority No.3 MARDI Fruit Farm (NS1) - Jelebu, Negeri Sembilan State

The MARDI farm is a large scale commercial orchard. Various fruit trees including durian were planted, but trees are still young. Jelebu is the driest district in Peninsular

Malaysia. There is drip irrigation system taking water from two small ponds. But the storage capacities are so small to cover the whole area of 200 ha that some plants already died.

The feasibility study is to design appropriate size of small reservoirs to irrigate the entire area. It will offer a model irrigation facility for fruit culture in the dry area.

Priority No.4 Paya Lanting (PH20) - Maran, Pahang State

The project area is a former inundation scheme and has been abandoned since 1981. The proposed project is to construct a small reservoir in the middle stream of the valley for fish culture and to grow vegetables in the downstream area with drainage improvement.

Since almost 90 % of inundation schemes have been abandoned in Pahang State, it would be necessary to revitalize the area from viewpoint of efficient use of resources. The feasibility study is to survey the existing condition and constraints and to work out strategic measures for future land use and water resources development. The inundation scheme has development potential, if adequate infrastructure is provided.

Priority No.5a Pasir Nering (TR44) - H.Tgganu, Trengganu

The project area is one of the poverty areas. Farmers group already started vegetable cultivation with drip irrigation under the guidance of DOA district office, though scale is very small. They have plan to extend the area in future to grow more vegetables and fruit trees.

The feasibility study is to demonstrate a model of vegetable and fruit cultivation with small reservoir and irrigation and to examine its effectiveness for poverty eradication.

Priority No.5b Skim Maras (TR3) - K.Tgganu, Trengganu State

The project aims at utilization of tin mine ponds in mountainous area to irrigate paddy fields at downstream.

The feasibility study is to design facilities to regulate the ponds, work out O/M plan of the facilities and examine economic viability of the project. Vegetable cultivation is conceived as future cropping plan.

Priority No.6 Bdg. Permatung Sunkai (KN16) - Pasir Puteh, Kelantan

The project is already started by group of farmers aiming at vegetable cultivation and domestic water supply. Water is taken from a small stream. A well and overhead tank are under construction. Farmers intend to expand the area and get water from a small reservoir proposed upstream of the present intake.

The feasibility study is to design the small reservoir and connecting channel and to examine economic viability of the project.

Priority No.7 Kelompok Kangkar (JR10) - Batu Pahat, Johor State

The project is going on with guidance of DOA aiming at fruits cultivation with irrigation. The area is rather hilly. A small pond exists and another pond is proposed.

The feasibility study is to form an improvement plan of irrigation system by constructing another small reservoir and tank on the hill. Economic viability of the project is examined.

Priority No.8 Bld. Sedanan (MA16) - Jasin, Melaka State

This is a Felcra project for settlement. The area was reclaimed, and planted to fruits, vegetables and tree crops. Settlers already settled. A small reservoir was constructed and another one is planned for fishery and agro tourism. Floriculture is also practiced.

The feasibility study is to examine viability of the multi-crop settlement project and to design the small reservoir. Particular attention will be paid on the floriculture, which has possibility to serve the women development through providing them with income.

Priority No.9 Skim Tok Bedu (PP3) - SP Utara, P. Pinang State

This project utilize an abolished river course, which is Type C of Small Reservoir. Using it as reservoir, multi-crop cultivation is planned.

The feasibility study is to work out the Type C reservoir and irrigation and drainage system and to examine the viability of the project.

Tables

Table I-1 LONG LIST AND SHORT LIST OF SMALL RESERVOIR

LONG LIST		
COD	NO	NAME OF PROJECT
PR	1	SIMPANG GETI
PR	2	PANGGAS - SMALL DAM PROJECT
PR	3	FELDA CHUPING
PR	4	TASEK MELATI
PR	5	PAYA KELUBI MANGO PROJECT
PR	6	HUTAN LEMBAH MANGO PROJECT
PR	7	TASEK MELATI II
Sub Total	7	

SHORT LIST		
COD	NO	NAMA OF PROJECT
PR	1	SIMPANG GETI
PR	2	PANGGAS - SMALL DAM PROJECT
PR	4	TASEK MELATI
PR	5	PAYA KELUBI MANGO PROJECT
PR	6	HUTAN LEMBAH MANGO PROJECT
PR	7	TASEK MELATI II
Sub Total	6	

KH	1	DURIAN PERAGIN
KH	2	AIR HANGAT
KH	3	AMPANGAN PDG SAGA
KH	4	KAWASAN PADI KEDAWANG
KH	5	KEDAWANG
KH	6	P LIBALI BERKELOMPOK
KH	7	KG PAYA PAHLAWAN
KH	8	KG JERANGAN
KH	9	ALOR PAYA PAHLAWAN
KH	10	KG BINJAL
KH	11	P KELOMPOK BUAH - BUAHAN
KH	12	P KELOMPOK BUAH - BUAHAN
KH	13	KG. PDG. GELANGGANG
KH	14	SKIM JANING
KH	15	LUBUK MERBAU
KH	16	SEKIM TANDOP BESAR
KH	17	TANDOP BESAR
KH	18	KG JANING
KH	19	KURONG HITAM IRRIGATION SCHEME
KH	20	P PADI
KH	21	P PADI KG DURIAN BURUNG
KH	22	P DESA JAYA
KH	23	P KG LANGGOK
KH	24	P KG BETONG
KH	25	P LUBUK BESAR
KH	26	P BT LIMA
KH	27	P KG SELAMAT
KH	28	DUSUN KELOMPOK TELUK ENGGANG
KH	29	SAYURAN
KH	30	DUSUN DURIAN JABI
KH	31	KUBUR PANJANG
KH	32	KG KAYU TIGA
KH	33	PDG KERBAU
KH	34	KG SAWA KECIK
KH	35	BK PERAK
KH	36	TOK SADAQ
KH	37	P KELOMPOK BUAH - BUAHAN
KH	38	P KELOMPOK BUAH - BUAHAN
KH	39	YAN
KH	40	SG AIR JERNIH
KH	41	SG BARU
KH	42	SIMPANG 3 BUJANG
KH	43	BENDANG DALAM
KH	44	KG TELOK TEMELAH
KH	45	PADI SEKIM SIDAM
KH	46	DUSUN KELOMPOK SEDIM
KH	47	PMTG KERAT TELUNJUT
Sub Total	47	

KH	1	DURIAN PERAGIN
KH	2	AIR HANGAT
KH	3	AMPANGAN PDG SAGA
KH	4	KAWASAN PADI KEDAWANG
KH	5	KEDAWANG
KH	6	P LIBALI BERKELOMPOK
KH	13	KG. PDG. GELANGGANG
KH	14	SKIM JANING
KH	15	LUBUK MERBAU
KH	16	SEKIM TANDOP BESAR
KH	19	KURONG HITAM IRRIGATION SCHEME
KH	31	KUBUR PANJANG
KH	32	KG KAYU TIGA
KH	34	KG SAWA KECIK
KH	35	BK PERAK
KH	40	SG AIR JERNIH
KH	41	SG BARU
KH	43	BENDANG DALAM
Sub Total	18	

PP	1	LUAR BAN PINANG TUNGGAL
PP	2	TOK BEDU IRRIGATION AREA
PP	3	KG TOK BEDU, AIR MELINTAS, PMTG BERANGAN
PP	4	PINANG TUNGGAL IRRIGATION AREA (PIA)
PP	5	SG JARAK IRRIGATION AREA
PP	6	BK TOH ALLANG
PP	7	SG BURUNG
PP	8	SG BURUNG
PP	9	MAK SULONG
PP	10	SG KULIM IRRIGATION SCHEME
PP	11	SKIM PENGALIRAN SG KULIM
PP	12	SKIM PENGALIRAN TASEK SELATAN
Sub Total	13	

PP	1	LUAR BAN PINANG TUNGGAL
PP	2	TOK BEDU IRRIGATION AREA
PP	3	KG TOK BEDU, AIR MELINTAS, PMTG BERANGAN
PP	4	PINANG TUNGGAL IRRIGATION AREA (PIA)
PP	5	SG JARAK IRRIGATION AREA
PP	6	BK TOH ALLANG
PP	7	SG BURUNG
PP	8	SG BURUNG
PP	9	MAK SULONG
PP	10	SG KULIM IRRIGATION SCHEME
PP	11	SKIM PENGALIRAN SG KULIM
PP	12	SKIM PENGALIRAN TASEK SELATAN
Sub Total	13	

LONG LIST		
COD	NO	NAME OF PROJECT
PK	1	KG TASEK
PK	2	PUSAT PERTANAH TINGGI BK BARING
PK	3	INDUSTRI BUAH-BUAHAN
PK	4	BENDANG TEMELONG
PK	5	P KELOMPOK BUAH-BUAHAN
PK	6	P KELOMPOK BUAH-BUAHAN/SAYURAN
PK	7	SENOUK CHANGKAT NING
PK	8	P KELOMPOK BUAH-BUAHAN AIR PUTIH
PK	9	BENDANG JENALIK
PK	10	BENDANG KG LANEH
PK	11	RANC TALIAIR BENDANG SENGGANG
PK	12	RANC TALIAIR BENDANG LEMPOR
PK	13	RANC TALIAIR PDG RENGAS
PK	14	SG RAJA
PK	15	DENDANG A
PK	16	DENDANG B
PK	17	BRUAS & TAMBAHAN
PK	18	SG CHENDERLIANG
PK	19	KG LALAT BATU 7
PK	20	SG BATANG PDG MATI
PK	21	SG MANIK, IRRIG SCHEME
Sub Total		21

SG	1	TEBUK BERIHUN
SG	2	
SG	3	SG JANG
SG	4	BK TAMU
SG	5	KG KALONG TENGAH
SG	6	P SAYURAN SG YU
SG	7	BERJUNTAI TIN MINING
SG	8	KUANG
SG	9	REKREASI SG CHONGKAK
SG	10	KG KANTAN
SG	11	KG PASIR
SG	12	MINANG KABAU
SG	13	JLN ENAM KAKI 1
SG	14	SAPAN BT MINANGKABAU
SG	15	SG JAI BK KEPONG
SG	16	MARDI RESEARCH STATION
SG	17	PAYA JARAS HILIR
SG	18	TAMAN PERT MALAYSIA
SG	19	TAMAN PERT MALAYSIA
SG	20	TAMAN PERT MALAYSIA
SG	21	TAMAN PERT MALAYSIA
SG	22	TAMAN PERT MALAYSIA
SG	23	RANC SUNGAI KELAMBU
SG	24	P KELOMPOK SAYURAN KG ENDAH
SG	25	P KELOMPOK KONTAN KG KUNDANG
Sub Total		25

NS	1	STESAN MARDI JELEBU
NS	2	BUAH-BUAHAN LANJUT MANIS
NS	3	SRI MENANTI
NS	4	PEMBANGUNAN SAWAH KG. LONDAH
NS	5	REMBAU
NS	6	KELOMPOK KG CHENGAU ULU
NS	7	KG BK TEMBOK & SG RAYA
NS	8	P TERNAKAN UDANG GALAH
Sub Total		8

MA	1	TEBONG
MA	2	ULU SG BULOH
MA	3	SOLOK BT ALANG
MA	4	FELCRA RAMUAN CINA
MA	5	MERIAM PATAH
MA	6	SOLOK PUNGGAI
MA	7	PUSAT LAT PERT SG UDANG
MA	8	BEJIMBING DALAM
MA	9	PDG KELADI
MA	10	BUNDED STORAGE, SG MELAKA
MA	11	SG UDANG
MA	12	FELDA BK KATIL
MA	13	AYER KEROH DAM
MA	14	KANDANG
MA	15	SOLOK BK META
MA	16	FELCRA BK SEDANAN
MA	17	CINCIN LAKE
MA	18	KG PULAI/SERKAM
Sub Total		18

SHORT LIST		
COD	NO	NAMA OF PROJCT
PK	1	KG TASEK
PK	3	INDUSTRI BUAH-BUAHAN
PK	4	BENDANG TEMELONG
PK	5	P KELOMPOK BUAH-BUAHAN
PK	6	P KELOMPOK BUAH-BUAHAN/SAYURAN
PK	7	SENOUK CHANGKAT NING
PK	8	P KELOMPOK BUAH-BUAHAN AIR PUTIH
PK	9	BENDANG JENALIK
PK	10	BENDANG KG LANEH
PK	11	RANC TALIAIR BENDANG SENGGANG
PK	12	RANC TALIAIR BENDANG LEMPOR
PK	13	RANC TALIAIR PDG RENGAS
PK	15	DENDANG A
PK	16	DENDANG B
PK	17	BRUAS & TAMBAHAN
PK	19	KG LALAT BATU 7
PK	20	SG BATANG PDG MATI
PK	21	SG MANIK, IRRIG SCHEME
Sub Total		19

SG	1	TEBUK BERIHUN
SG	3	SG JANG
SG	4	BK TAMU
SG	5	KG KALONG TENGAH
SG	6	P SAYURAN SG YU
SG	8	KUANG
SG	9	REKREASI SG CHONGKAK
SG	10	KG KANTAN
SG	11	KG PASIR
SG	12	MINANG KABAU
SG	13	JLN ENAM KAKI 1
SG	14	SAPAN BT MINANGKABAU
SG	15	SG JAI BK KEPONG
SG	16	MARDI RESEARCH STATION
SG	18	TAMAN PERT MALAYSIA
SG	24	P KELOMPOK SAYURAN KG ENDAH
SG	25	P KELOMPOK KONTAN KG KUNDANG
Sub Total		17

NS	1	STESAN MARDI JELEBU
NS	2	BUAH-BUAHAN LANJUT MANIS
NS	3	SRI MENANTI
NS	4	PEMBANGUNAN SAWAH KG. LONDAH
NS	5	REMBAU
NS	6	KELOMPOK KG CHENGAU ULU
NS	7	KG BK TEMBOK & SG RAYA
NS	8	P TERNAKAN UDANG GALAH
Sub Total		8

MA	1	TEBONG
MA	2	ULU SG BULOH
MA	3	SOLOK BT ALANG
MA	4	FELCRA RAMUAN CINA
MA	5	MERIAM PATAH
MA	6	SOLOK PUNGGAI
MA	9	PDG KELADI
MA	11	SG UDANG
MA	12	FELDA BK KATIL
MA	14	KANDANG
MA	15	SOLOK BK META
MA	16	FELCRA BK SEDANAN
MA	17	CINCIN LAKE
MA	18	KG PULAI/SERKAM
Sub Total		14

LONG LIST		
COD	NO	NAME OF PROJECT
JR	1	SAWAH KURNIA SAKTI
JR	2	SAWAH RING
JR	3	SAWAH KEBUN BARU
JR	4	SAWAH PULAU PENARIK
JR	5	SAWAH KESANG TASEK
JR	6	SAWAH KESANG GATE
JR	7	SAWAH SG BALANG
JR	8	LDG KELOMPOK KG SRI TIMOR
JR	9	LDG KELOMPOK BT SAMBULAN, YONG PENG
JR	10	LDG KELOMPOK KANGKAR MERLIMAU
JR	11	LDG COLCRO SG KAYU
JR	12	TUNJOK LAUT
JR	13	SG LEBAK KANAN
JR	14	SG CHEMARAN
Sub Total	14	

SHORT LIST		
COD	NO	NAMA OF PROJECT
JR	8	LDG KELOMPOK KG SRI TIMOR
JR	9	LDG KELOMPOK BT SAMBULAN, YONG PENG
JR	10	LDG KELOMPOK KANGKAR MERLIMAU
JR	12	TUNJOK LAUT
JR	14	SG CHEMARAN
Sub Total	5	

KN	1	JUBAKAR PANTAI
KN	2	BENDANG KELABORAN HULU
KN	3	BENDANG DAUH BUNIHAN
KN	4	KG BELLAN
KN	5	LUBOK SELEHONG
KN	6	BENDANG KUANG
KN	7	BENDANG BELUKAR
KN	8	BENDANG JELUTONG, KOK LANAS
KN	9	BENDANG BT TINGGI, BK CHINA
KN	10	BENDANG SOKOR, BK CHINA
KN	11	KUBANG TEBAKANG
KN	12	BENDANG TASEK BERANGAN
KN	13	TASIK PUTERA
KN	14	BENDANG PERIGI
KN	15	TASEK CHINA
KN	16	BENDANG PMTG SUNGKAI
KN	17	RANC PENGAIRAN JERAM 1
KN	18	RANC PENGAIRAN TELOSAN 1
KN	19	RANC PENGAIRAN SG YONG
KN	20	RANC PENGAIRAN TELOSAN 2
KN	21	RANC TALLAIR BAGAN 2
KN	22	RANC TALLAIR BAGAN 3
KN	23	RANC TALLAIR BELUKAR
KN	24	RANC TALLAIR HILIR SAT 1
KN	25	HILIR SAT II
KN	26	RANC PENGAIRAN TERASIL
KN	27	RANC PENGAIRAN GUAL IPOH
KN	28	RANC PENGAIRAN LUBUK BERANGAN
KN	29	RANC PENGAIRAN BECAH LAUT
KN	30	RANC PENGAIRAN AIR LANAS
KN	31	RANC TALLAIR SG KENOR
KN	32	RANC TALLAIR KELUAT
KN	33	RANC TALLAIR BEDAL
KN	34	RANC TALLAIR ENGGONG
KN	35	RANC TALLAIR LEPAN AGOR
Sub Total	35	

KN	1	JUBAKAR PANTAI
KN	2	BENDANG KELABORAN HULU
KN	3	BENDANG DAUH BUNIHAN
KN	4	KG BELLAN
KN	5	LUBOK SELEHONG
KN	6	BENDANG KUANG
KN	8	BENDANG JELUTONG, KOK LANAS
KN	9	BENDANG BT TINGGI, BK CHINA
KN	10	BENDANG SOKOR, BK CHINA
KN	11	KUBANG TEBAKANG
KN	13	TASIK PUTERA
KN	14	BENDANG PERIGI
KN	35	RANC TALLAIR LEPAN AGOR
Sub Total	14	

LONG LIST		
COD	NO	NAME OF PROJECT
TR	1	TELABAK IRRIGATION SCHEME
TR	2	AGRICULTURAL - KETARA
TR	3	SKIM TANAMAN PADI MARAS
TR	4	P KELOMPOK SAYURAN
TR	5	P KELOMPOK SAYURAN
TR	6	SKIM TANAM PADI TEPOH
TR	7	SALIRAN TOK JIRING
TR	8	P KELOMPOK SAYURAN
TR	9	P KELOMPOK SAYURAN
TR	10	SKIM TALIAIR SG IKAN
TR	11	P KELOMPOK SAYURAN
TR	12	P KELOMPOK SAYURAN
TR	13	P KELOMPOK SAYURAN
TR	14	P KELOMPOK SAYURAN
TR	15	P KELOMPOK SAYURAN
TR	16	P KELOMPOK SAYURAN
TR	17	P KELOMPOK SAYURAN
TR	18	P KELOMPOK SAYURAN
TR	19	P KELOMPOK SAYURAN
TR	20	SKIM TANAM PADI DURIAN HAJI
TR	21	P KELOMPOK SAYURAN
TR	22	P KELOMPOK SAYURAN
TR	23	P KELOMPOK SAYURAN (BELJA)
TR	24	P KELOMPOK SAYURAN
TR	25	P KELOMPOK SAYURAN
TR	26	RANC TANAMAN PADI KATONG
TR	27	P KELOMPOK SAYURAN
TR	28	P KELOMPOK SAYURAN
TR	29	P KELOMPOK SAYURAN
TR	30	P KELOMPOK SAYURAN
TR	31	P KELOMPOK SAYURAN
TR	32	P KELOMPOK SAYURAN
TR	33	P KELOMPOK SAYURAN
TR	34	LEMBAH MARANG II
TR	35	LEMBAH MARANG I
TR	36	SKIM TANAM PADI JERONG
TR	37	TRG
TR	38	P KELOMPOK SAYURAN
TR	39	P KELOMPOK SAYURAN AJIL
TR	40	P KELOMPOK SAYURAN
TR	41	P KELOMPOK SAYURAN
TR	42	P KELOMPOK SAYURAN
TR	43	P KELOMPOK SAYURAN
TR	44	P KELOMPOK SAYURAN
TR	45	P KELOMPOK SAYURAN
TR	46	P KELOMPOK SAYURAN
TR	47	P KELOMPOK SAYURAN
TR	48	KOLAM SIMPANG 3 JLN BT BESI
TR	49	TAMAN TASIK BT BESI
TR	50	KOLAM ABANG
TR	51	KOLAM RANTAU PANJANG
TR	52	TASEK TEMBESU
TR	53	RANC PENGAIRAN AIR PUTIH
Sub Total	53	

PH	1	PAYA KANGSAR
PH	2	PAYA KUBANG KARAH
PH	3	PAYA ANGUT
PH	4	PAYA LUAS
PH	5	PAYA KEPONG
PH	6	PAYA TRIANG HILIR
PH	7	PAYA PELAK
PH	8	PAYA LALOH SALAK
PH	9	PAYA PAGAR SASAK
PH	10	PAYA KUALA KELOI
PH	11	P.WAU, BETONG & GEMAYAI
PH	12	PAYA JELUTUNG
PH	13	PAYA NYAK BESAR
PH	14	PAYA TING & BESAR KERTAU
PH	15	PAYA SENTANG
PH	16	PAYA NYAK KECIL
PH	17	PAYA PDG TENGGALA
PH	18	PAYA GUMAI
PH	19	PAYA SG LING
PH	20	PAYA LANTING
PH	21	PAYA NAKOH
PH	22	PAYA BAHRU
PH	23	PAYA PESAGI
PH	24	PAYA KROT
PH	25	PAYA LDG
Sub Total	25	

Total	266
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SHORT LIST		
COD	NO	NAMA OF PROJECT
TR	1	TELABAK IRRIGATION SCHEME
TR	3	SKIM TANAMAN PADI MARAS
TR	4	P KELOMPOK SAYURAN
TR	7	SALIRAN TOK JIRING
TR	12	P KELOMPOK SAYURAN
TR	14	P KELOMPOK SAYURAN
TR	20	SKIM TANAM PADI DURIAN HAJI
TR	24	P KELOMPOK SAYURAN
TR	28	P KELOMPOK SAYURAN
TR	34	LEMBAH MARANG II
TR	38	P KELOMPOK SAYURAN
TR	42	P KELOMPOK SAYURAN
TR	44	P KELOMPOK SAYURAN
TR	45	P KELOMPOK SAYURAN
TR	50	KOLAM ABANG
Sub Total	15	

PH	9	PAYA PAGAR SASAK
PH	11	P.WAU, BETONG & GEMAYAI
PH	12	PAYA JELUTUNG
PH	13	PAYA NYAK BESAR
PH	14	PAYA TING & BESAR KERTAU
PH	16	PAYA NYAK KECIL
PH	17	PAYA PDG TENGGALA
PH	19	PAYA SG LING
PH	20	PAYA LANTING
PH	23	PAYA PESAGI
PH	24	PAYA KROT
PH	25	PAYA LDG
Sub Total	12	

Total	141
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Table I-2 SCREENING CRITERIA FOR SHORT LISTING

SHORT LISTED CRITERIA FOR THE STATES

1. Q7, future water shortage more than 2
2. Q7, future water shortage more than 3
3. Q9, benefit not for industrial alone
4. Q13, priority of project more than 2
5. Q13, priority of project more than 3
6. Q13, priority of project more than 4
7. Q9, mixed purposes, ie for vegetable, paddy, fisheries, and agro-tourism
8. 3 sites are short listed only for the district of Kuala Terengganu, Marang and Hulu Terengganu based on the different mukim and most benefit in term of irrigation acrege
9. All sites are considered due to small number

STATE	CRITERIA
Perlis	1,3,4
Kedah	2,3,5
P. Pinang	1,3,4
Perak	1,3,4
Selangor	1,3,4
N. Sembilan	9
Melaka	1,3,4
Johor	1,3,4
Kelantan	2,3,6
Terengganu	2,3,5,7,8
Pahang	1,3,4

Table I-3 CATEGORIZATION OF PROJECT ON THE LONG LIST

	REH				AREA													TOTAL				
	E	S	P	c	TOTAL	G	N	R	U	P	C/N	GR	GU	NR	NRU	NU	RU		U/P	BLANK	c	
PERLIS	6		1		7		3	1	1	2												7
KEDAH	24	3	20		47	8	3	19	13			2					2					47
PULAU PINANG	7	1	5		13	1	4	4	1		2									1		13
PERAK	15	5	1		21	1	16	1	1						1					1		21
SELANGOR	8	11	5	1	25		11	1	5	1										6	1	25
N SEMBILAN	3	1	4		8		2	1	2	1										2		8
MELAKA	3	13	2		18		2	5	2	1								1		7		18
JOHOR	10	3	1		14	5	1		2	4	1									1		14
KELANTAN	24	3	8		35		19		2					7	5	1	1					35
TERENGGANU	43	3	7		53	1	36	7	3								1			4	1	53
PAHANG	8	16	1		25	2	4	12												5	1	25
TOTAL	151	59	55	1	266	18	101	51	32	9	3	2	2	0	12	5	2	4	1	23	3	266

Notes for REH:

- E = Existing
- R = to be Rehabilitated
- P = Potential
- c = blank, to be filled

Notes for AREA:

- G = Granary Area
- N = Non-granary Area
- R = Rainfed paddy area
- U = Upland area (small holder)
- P = Plantation (large scale)

		WATER SHORTAGE - PRESENT																																									
		IRRIGATION					DOMESTIC					INDUSTRY					FISHERIES					AGRO-TOURISM					OTHERS																
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5							
PERLIS						3																																					
KEDAH		2	5	16	12	12	2	1			1																																
PULAU PINANG			1	5	1	1	1	1	1																																		
PERAK		2	3	3	8	4	1	2			1																																
SELANGOR		1	4	5	1	7	3	1			1																																
N SEMBILAN			3	2	1																																						
MELAKA		2		2	5	2					2	1																															
JOHOR		7	3			2																																					
KELANTAN		5	16	10	4		3				2																																
TERENGGANU		35	7	2	5																																						
PAHANG		8	4	9	1																																						
TOTAL		62	46	57	38	32	10	5	5	4	1	3	0	3	3	1	12	6	12	5	3	8	4	12	11	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

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		WATER SHORTAGE - FUTURE																																						
		IRRIGATION					DOMESTIC					INDUSTRY					FISHERIES					AGRO--TOURISM					OTHERS													
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5									
PERLIS						4																																		
KEDAH		8	7	18	14						3	1																												
PULAU PINANG		1				7					2		1																											
PERAK		1		2	11	5	1				2	2		1																										
SELANGOR		3	3	3	3	9					3	1		1	1																									
N'SEMBILAN		1	3	2									1																											
MELAKA		2	1	4	4						1	1	1																											
JOHOR		7	2			2																																		
KELANTAN		1	4	8	10	6					1	1	3																											
TERENGGANU		6	3	3	5	5																																		
PAHANG		7	4	10	1																																			
TOTAL		19	30	40	82	56	1	4	10	7	4	2	0	3	1	4	8	4	14	8	5	5	5	8	17	9	1	0	0	0	0	0	0							

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	TYPE OF SMALL RESERVOIR										PURPOSE OF RESERVOIR										BENEFITS								
	A	AB	AD	AE	B	C	CD	D	E	e	TOTAL	IR	IP	IV	IF	IO	D	IN	F	A	O	FAMILY (Nos)	AREA (Ha)	FAMILY (Nos)	FISHERIES (Nos)	INDUSTRIAL KIND	NO (Nos)	OTHERS ITEM	NO (Nos)
PERLIS	1				6					7	7	4	3	2	5				2			385	457						
KEDAH	25	1	1	1	12		7			47	47	32	17	23	2	5	1	5				6,429	5,118	6,330	0.25	M	1		
PULAU PINANG	5				2	2	4			13	10	9	8	6		5	3	4				2,767	6,029	80,300	18.97	M,L	5,000		
PERAK	14				4		2	1		21	20	11	11	13	2	5	2	4	4			6,873	8,869	200	220.70	M	104		
SELANGOR	14				7		2	2		25	19	5	8	11	2	6	2	7	16			7,426	6,456	310	225.50	M	4		
N SEMBILAN	3				2		1	1	1	8	6	3	3	5		1	1	2	2			2,908	1,321	2,800	3.20	M	50		
MELAKA	4				11		2	1		18	11	1	10	10	1	3	3	11	14			558	1,522	60,200	85.60	M,L	405		
JOHOR	1				6		5		2	14	13	6	3	7				1	1			1,848	1,109						
KELANTAN	12				6	3	10	4		35	35	33	27	9	8	5	1	1	4			5,911	5,028	1,030	4.50	M	2		
TERENGGANU	7				39	1	1	5		53	49	11	46	1				3	2	1		1,265	1,836		37.00			AGI	1
PAHANG	23						1			25	23	13	5	2	10				13			1,308	2,514		552.00				
TOTAL	109	1	1	1	95	7	1	35	13	3	266	240	128	141	89	30	30	12	46	54	1	37,678	40,259	151,170	1,147.72	M,L	5,566	AGI	1

Notes for TYPE OF SMALL RESERVOIR:
A = Type A (dam on small reservoir)
B = Type B (pond in lowland, swamp and idle land)
C = Type C (abandoned river)
D = Type D (upstream of present intake)
E = Type E (tin mine pond or lake)

Notes for PURPOSE OF RESERVOIR:
IR = Irrigation
IP = Irrigation - Paddy
IV = Irrigation - Vegetables
IF = Irrigation - Fruits
IO = Irrigation - Others

Notes for INDUSTRIAL:
L = Light
M = Medium
M = Heavy

Table I-4 WATER SOURCE EVALUATION

BN	Location	Station No.	Station Name	80 % Reliable Monthly Rainfall in mm												Total	SD	Ann	Re	Rd	
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
5	Kedah south, Perai	5305091	Kulim	43	40	109	180	159	87	119	123	155	271	201	73	1600	70	2440	5	2	9
24	Johor south	1537114	Johor Bahru	78	87	119	156	142	106	95	102	114	156	171	137	1482	31	2152	4	5	9
8	Perak northwest	4807031	Taipin	195	186	296	348	188	98	113	125	205	310	324	195	2583	85	3761	5	1	8
14	Selangor central	3117070	Kuala Lumpur	62	131	133	233	151	85	80	97	139	140	164	90	1505	47	2216	4	4	8
9	Perak central east	4311001	Kampar	98	36	235	202	161	77	75	55	161	155	173	154	1582	62	2577	4	3	8
33	Pahang north coast	3833004	Kuantan	106	42	47	46	114	82	88	119	155	160	210	113	1480	78	2342	4	2	7
4	Kedah central	5807067	Sik	14	16	61	146	165	100	135	138	210	251	151	56	1443	74	2070	4	2	7
27	Kelantan central	5521050	Kuala Krai	50	22	35	43	101	96	129	135	207	191	213	294	1516	85	2217	4	1	7
21	Johor northeast	2438185	Mersing	76	27	45	49	91	93	119	123	123	143	226	112	1427	80	2334	4	1	7
2	Lankawi	6398121	Sg. Penghulu	9	8	31	74	180	153	153	173	257	232	126	20	1416	88	2077	4	1	7
32	Pahang Lipis	4120064	Kuala Lipis	77	58	71	105	139	91	81	85	155	157	197	130	1374	45	2094	3	4	7
23	Johor southeast	1839196	Simpang Mawai	88	23	68	47	160	132	129	103	139	118	163	157	1346	48	2006	3	4	7
11	Perak south	3711160	Ulu Bernam	85	61	114	127	118	52	45	73	126	153	183	146	1283	44	1912	3	4	7
7	Perak northeast	4811078	Elphill	45	67	87	132	142	73	88	71	150	179	144	85	1263	42	1856	3	4	7
12	Perak southeast	3717051	Bukit Frazer	106	54	88	100	135	69	47	46	89	202	186	166	1289	54	1937	3	3	6
15	Selangor southwest	2615131	Batu Untong	37	26	48	77	118	86	118	130	145	194	191	96	1268	55	1898	3	3	6
30	Pahang north, Kelan	4620045	Merapoh	19	14	53	64	147	105	110	72	173	205	173	132	1267	63	2072	3	3	6
3	Kedah north	6105037	Gajah Mati	12	12	64	114	155	100	115	127	228	244	122	25	1318	76	2024	3	2	6
25	Johor southwest	1829001	Batu Pahat	52	44	82	116	96	75	119	88	122	133	147	69	1143	32	1849	2	5	6
10	Perak central west	4307041	Sitiawan	80	82	89	114	98	45	49	69	103	75	158	146	1107	34	1976	2	5	6
26	Kelantan north	6021061	Pasir Mas	44	14	21	17	51	83	129	137	173	175	246	272	1384	93	2166	3	1	5
6	Pulau Pinang	5402002	Pulau Pinang	12	16	35	102	194	80	126	131	261	230	129	20	1334	84	1916	3	1	5
29	Terengganu south	4734079	Dungun	67	29	35	26	60	75	78	98	99	159	248	334	1306	94	2166	3	1	5
28	Terengganu north	5331048	Kuala Terenggan	47	23	27	20	47	65	69	98	96	179	329	291	1291	105	2284	3	1	5
37	Pahang south coast	2834180	Chondong	106	25	43	39	67	49	82	90	106	122	242	304	1274	85	2309	3	1	5
22	Johor central	2033152	Kluang	33	43	78	146	123	77	86	80	119	125	129	92	1130	35	1817	2	4	5
31	Pahang northeast	4324113	Kuala Tahan	27	16	36	99	153	86	105	82	163	183	133	75	1157	54	1836	2	3	5
34	Pahang central coast	3533102	Pekan	52	28	49	52	96	56	49	79	77	133	150	260	1081	65	2045	2	3	5
19	Melaka	2222020	Melaka	24	21	77	108	87	96	107	116	137	149	162	68	1144	44	1773	2	3	5
18	N.Sembiran east	2724082	Jeram Padang	46	44	96	92	116	52	60	60	94	104	160	74	996	34	1557	1	5	4
20	Johor north	2330009	Melville	23	27	50	98	80	47	47	68	72	90	144	66	811	34	1530	1	5	4
13	Selangor west	3313043	Kuala Selangor	68	56	57	79	63	45	40	67	98	162	138	63	937	37	1577	1	4	4
17	N.Sembiran west	2719001	Seremban	36	40	89	65	89	24	75	39	98	128	150	66	904	39	1269	1	4	4
36	Pahang south	2929001	Ldg. Sg. Mengah	49	19	30	77	114	45	58	48	74	75	145	114	847	38	1477	1	4	4
35	Pahang central	3424081	Temerloh	20	13	44	100	80	25	40	17	115	112	130	106	800	44	1356	1	4	4
1	Perlis	6502003	Tasoh	8	9	29	43	110	80	86	106	157	170	92	33	922	54	1544	1	3	3
16	N.Sembiran north	2920012	Kuala Klawang	22	20	45	26	36	13	33	16	74	59	91	32	467	24	974	0	5	3

Remarks : Probability analysis was done by Iwai Method using monthly rainfall records provided by DID.

Note Total : Yearly total of monthly rainfall of 80 % reliability
 SD : Standard deviation for monthly rainfall in a year
 Ann : Annual rainfall of 80 % reliability

Total Score is...
 $(3 \times Re + Rd) / 2$

103	Main rainy season
67	Other rainy season
36	Main dry season
55	Other dry season

Re : Scores for total monthly 80% reliable rainfall

1	500 - 999 mm/year
2	1000 - 1199 mm/year
3	1200 - 1399 mm/year
4	1400 - 1599 mm/year
5	1600 mm/year <

Rd : Scores for monthly rainfall distribution

1	Standard deviation (SD) over 80
2	Standard deviation (SD) 65 - 80
3	Standard deviation (SD) 50 - 65
4	Standard deviation (SD) 35 - 50
5	Standard deviation (SD) less than 35