


**THE REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS**

**THE MASTER PLAN STUDY
ON
THE SMALL WATER IMPOUNDING
MANAGEMENT (SWIM) PROJECTS**

MAIN REPORT

MARCH 1990

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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PREFACE

In response to a request from the Government of the Republic of the Philippines, the Japanese Government decided to conduct a survey on the Master Plan Study on Small Water Impounding Management Projects and entrusted the survey to the Japan International Cooperation Agency.

JICA sent to the Republic of the Philippines a survey team headed by Mr. Tadashi Sakamoto from August, 1988 to February, 1990.

The team held discussions with the officials concerned of the Government of the Republic of the Philippines and conducted field surveys in the country. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

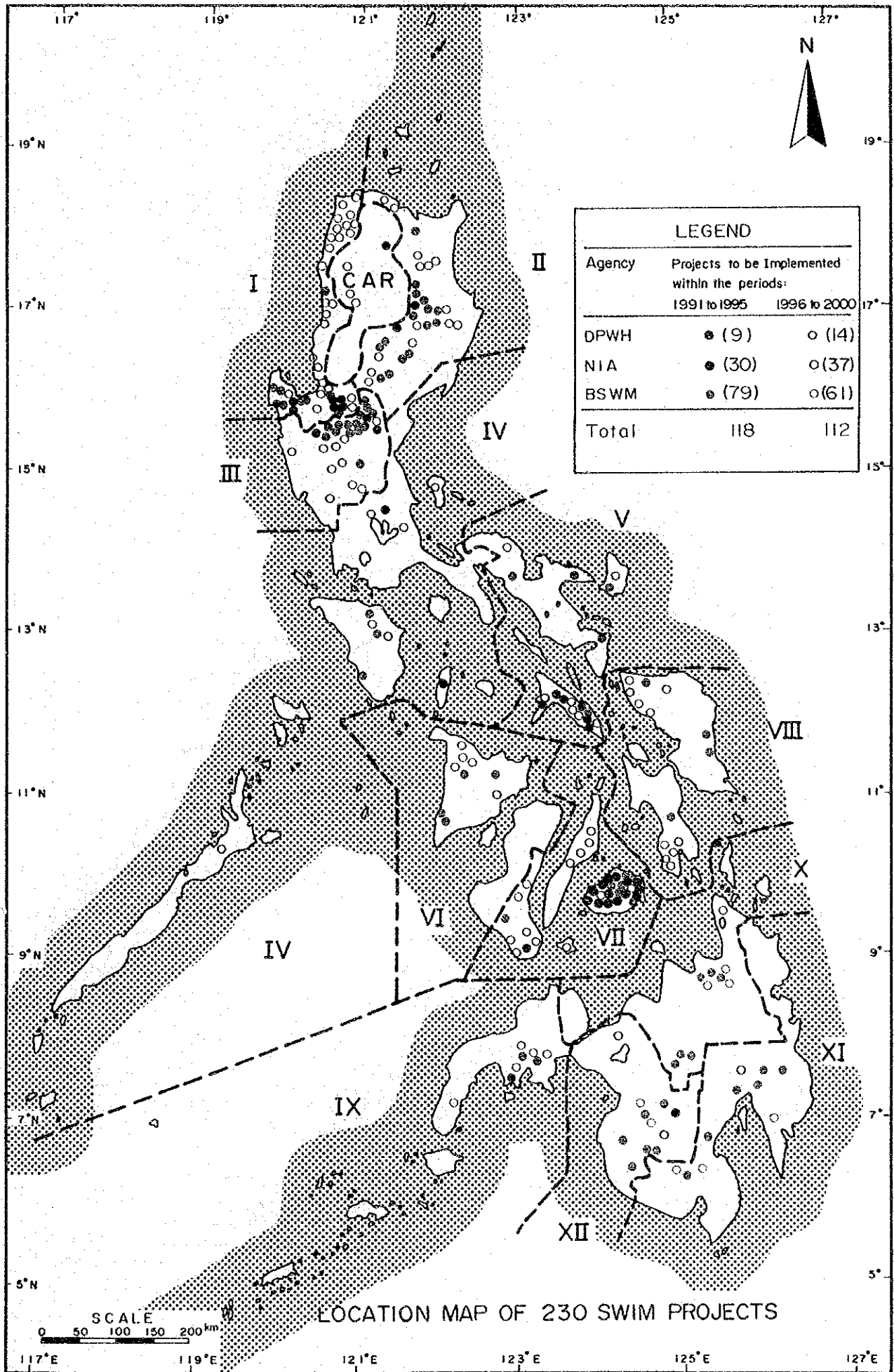
March, 1990



Kensuke Yanagiya

President

Japan International Cooperation Agency



SUMMARY

INTRODUCTION

01 This is the Master Plan Study Report on the Small Water Impounding Management (SWIM) Projects (hereinafter referred to as "the Projects"). The report presents the comprehensive results of the master plan study on the Projects which was executed by the Japan International Cooperation Agency (JICA) in close cooperation with the Department of Public Works and Highways (DPWH) and the Technical Working Group (SWIM-TWG)

02 The "Implementing Arrangement (I/A)" was concluded between JICA and DPWH on December 9, 1987. It gives the framework of the "Master Plan Study on the Projects" (hereinafter referred to as "the Study"), and describes:

- (1) objective of the Study is to formulate a master plan for the SWIM Projects, aiming at orderly utilization of nation's water and land resources,
- (2) the Study area widely covers all the regions of the Republic of the Philippines, and
- (3) the Study is carried out in the following three (3) Phases:

Phase-I	:	Review of the SWIM Projects
Phase-II	:	Preparation of criteria and guidelines
Phase-III	:	Formulation of the master plan

BACKGROUND

03 The Philippines has a total land area of about 300,000 km². The total population as of 1989 was estimated to be about 60.1 million. The population density is about 200 persons per km². The population growth rate has been about 2.5% per annum on average during the last decade. The Philippines economy deteriorated during the period 1978 - 82 and economic growth in 1983 was the lowest for over two decades. Over the next two years the economy went into sharp decline, to the point that by March 1986 it was officially estimated that two-thirds of the population were living below the poverty line, 15% of the potential labour force was unemployed and 45% underemployed, and that the outstanding external debt was US\$ 26.4 billion.

04 In December 1986, the Aquino Government set out the Medium-Term Philippines Development Plan 1987 - 1992. This Development Plan is directed towards (a) alleviation of poverty, (b) generation of more productive employment, (c) promotion of equity and social justice, and (d) attainment of sustainable economic growth.

05 The prime strategy of the Government is to enhance agricultural productivity, as the basis for self-sustaining economic growth. Agriculture is the most important sector, providing about 30% of GDP, generating more than 60% of total export earnings and directly employing about 50% of the total actual labour force. However, the farmers in rural areas continue to suffer from poverty. In recent years, more than 80% of farming families has been classified as belonging the lower 30% income bracket. Accordingly, the following objectives are emphasized in the Medium-Term Philippines Development Plan (1987 - 1992):

- (a) To enhance small farmers' income,
- (b) To sustain the increase in productivity,
- (c) To effect an equitable distribution of income,
- (d) To attain food self-sufficiency/self-reliance,
- (e) To create/increase employment opportunities in rural areas,
- (f) To institutionalize the expanded participation of farmers.

06 The country is endowed with a favorable climate, soils and labor force for agricultural production. However, the country is susceptible to seasonal variation of rainfall. Water supplies are insufficient in the dry season and frequent floods cause serious damage to agricultural crops in the wet season. Mitigation of such natural disasters is essential for economic growth of the country as well as for enhancement of living standards of rural people. The SWIM Projects are expected to mitigate such damage and thereby to improve the rural income.

07 In July 1979, the SWIM Committee was established as an autonomous body to ensure effective implementation of the SWIM Projects. The Committee is constituted by four (4) Departments with the Department of Public Works and Highways (DPWH) as Chairman, the Department of Environment and Natural Resources (DENR), the Department of Agriculture (DA), and the Department of Budget and Management (DBM).

08 The Technical Working Group (SWIM-TWG) is the technical and executive arm of the SWIM Committee. The SWIM-TWG comprises technical representatives from eight (8) agencies: PMO-MFC/SWIM as the chairman; the National Water Resources Board (NWRB) as the co-chairman; the National Irrigation Administration (NIA); the Bureau of Soils and Water

Management (BSWM); the National Electrification Administration (NEA); the Forest Management Bureau (FMB); the Bureau of Fisheries and Aquatic Resources (BFAR); and PMO-SWIM of DA (formerly FSDC).

09 The SWIM Projects are generally defined by the SWIM Committee as those small scale water impounding dams which have structural heights of not more than 30 m and/or a volume of storage not exceeding 50 million m³. The development of the SWIM Projects deserves attention because of their potentially quick yielding effects with relatively low capital investment needed for construction of small reservoirs compared to the much larger national projects and of their potential for multi-oriented uses. The SWIM Projects are thus expected to play an important role in ensuring an accelerated rural development.

CURRENT STATUS OF SWIM PROJECTS

10 A total of 550 SWIM projects were identified throughout the country in Phase-I, out of which 32 projects have already been constructed and 17 projects are now under construction. The remaining 501 projects are presently under various stages of project preparation and are recognized as the candidate projects for the Study:

(unit: No of Projects)

Implementing Agency	Present Status			Total
	Before F/S	F/S	D/D	
PMO-SWIM	15	4	14	33
NIA	198	-	15	213
FMB	56	-	-	56
NEA	14	22	11	47
BSWM	-	-	152	152
Total	283	26	192	501

11 General features of the candidate projects are outlined as follows:

DPWH projects aim to enhance the public welfare in rural areas, centering on the construction of small water impounding reservoirs. The DPWH projects are generally of a multi-purposes nature, for such purposes as irrigation, mini-hydropower, inland fishery, rural water supply, etc., as suitable to particular areas, and will accelerate grow of the rural economy. The proposed dams and development of irrigation and mini-hydropower are of

medium scale. Inland fishery is proposed in most of the projects. The main features of the DPWH projects may be summarized as follows:

Item	Unit	Range	Average
Dam Type	Zoned Earthfill of reservoir type		
Dam Height	m	10 - 29	20
Storage Capacity	MCM	0.2 - 11	2.2
Irrigation Area	ha	21 - 1,000	370
Installed Capacity	kW	90 - 900	260
Inland Fishery	ton/year	10 - 1,470	460

NIA projects are mainly formulated for irrigation purposes to supply dependable water to the existing communal irrigation systems (CIS). Although NIA has implemented a number of CIS with their own funds, due to lack of dams and reservoirs, most CIS suffer from shortage of irrigation water especially in the dry season. The SWIM projects are expected to improve the present water shortage problems. The NIA projects are of comparatively large-scale and may be summarized as follows:

Item	Unit	Range	Average
Dam Type	Zoned Earthfill of reservoir type		
Dam Height	m	2 - 33	24
Storage Capacity	MCM	0.01 - 33	3.2
Irrigation Area	ha	5 - 3,000	410
Installed Capacity	kW	165 - 520	310

BSWM projects are conceived as small scale agricultural developments, directly to serve farmers who live in small river basins, without the benefit of large scale irrigation development and left behind economically. The projects are multi-purpose oriented, centering the small scale irrigation development together with soil erosion control in watersheds. The main features of BSWM projects may be summarized as follows:

Item	Unit	Range	Average
Dam Type	Homogeneous earthfill of reservoir type		
Dam Height	m	0.5 - 19	10
Storage Capacity	MCM	0.01 - 1.1	0.2
Irrigation Area	ha	10 - 530	80
Inland Fisheries	ton/year	0.6 - 32	7
Watershed Development	ha	12 - 690	100

FMB projects aim at watershed management accompanied by incidental purpose of flood control. The project components consist of (1) engineering measures, (2) vegetative measures, and (3) a combination of these two measures (called vengineering measures). Engineering measures comprise construction of infrastructures such as check dams, terraces and ripraps, aiming at conserving soil, water, and forest resources. Vegetative measures cover the reforestation of denuded areas in the watersheds.

NEA projects are formulated with the single purpose of mini-hydropower generation. All of these projects are run-of-river type, not regulating the natural river flow by dams and reservoirs. The main components of the project facilities are (1) concrete weirs and intake structures, (2) power tunnels and forebays, (3) surge-tanks and penstocks, (4) power houses and power plants, (5) tailraces. Substations and transmission lines are not included in the project components. The main features of the NEA projects may be summarized as follows:

Item	Unit	Range	Average
Dam Type	Concrete weir of run-of-river type		
Install Capacity	kW	not more than 5,000kW	1,800
Gross Head	m	3 - 280	103

12 A post-evaluation study was made in Phase-I, in order to review the techniques employed in the implementation as well as in O&M of completed projects and to assess the benefits and socio-economic impacts derived from realization of these projects. The following projects were subjects of post-evaluation study:

No.	Name	Agency	Region	Present Condition
1.	Ilihan SWIP	NIA	VII	functioning
2.	Darapidap SWIP	BSWM	II	functioning
3.	Malinao SWIP	BSWM	VIII	functioning
4.	Pasig Timbu Watershed	FMB	III	functioning
5.	Mantayupan Falls SWIP	NEA	VII	functioning
6.	Bacnotan SWIP	FSDC	I	functioning
7.	Porac Dam	DPWH	III	damaged
8.	Kirong Dam	DPWH	III	damaged
9.	San Ramon Dam	DPWH	III	functioning
10.	Calanggaman SWIP	DPWH	VII	functioning

1.3 The main findings of this post-evaluation study may be summarized as follows:

- (1) Hydrological studies on water resources were generally inadequate due to the difficulties involved in data collection; socio-economic aspects of the projects had not been properly surveyed/documentated; and development plans had been neither explained to nor confirmed with the people to be influenced before construction.
- (2) The appurtenant structures of dams had been designed without detailed topographic survey and geological investigations. In general, project facilities other than dams and their appurtenant structures, had not been included in the detailed engineering designs. Insufficient technical guidance at the construction stage coupled with faults in design have resulted in some dams being damaged or washed out after construction.
- (3) In general, however completed projects have contributed to the beneficiaries in rural areas through increased crop and fish production, a stable supply of electricity, creation of employment opportunities and increased rural incomes. In most cases, however, the expected project returns have not been realized yet, due to lack of proper O&M. Insufficient numbers of technical staff often make proper O&M difficult, and shortage of annual budgets for proper O&M was observed in many cases.

CONCEPT AND DEFINITION OF SWIM PROJECTS

1.4 The technical review under Phase-I indicated that the listed projects have a wide variety of functions and scales of development and do not always conform to the present basic definition of SWIM Projects. As a result, a meeting was held between the JICA Study Team and SWIM-TWG to consider whether the present definition should be strictly applied to the listed projects with of these projects being disqualified or whether the present definition should be modified to qualify all of the listed projects as SWIM. As a result of the discussions, the following were decided:

Definition of SWIM Projects:

The present definition of SWIM should not be changed. Therefore, only one type should be considered as SWIM, adhering to the basic definition of SWIM Projects given by the SWIM Committee. Projects without storage dams which are proposed by FMB and NEA, would

therefore be disqualified as SWIM and would be withdrawn from the candidate projects for the Study.

Implementing Guidelines

In addition to the definition of SWIM Projects, the following implementing guidelines shall be considered for qualifying the proposed projects:

- (1) The project shall preferably be a multi-purpose water resources development on a small scale and at the same time providing a first line of defense against floods.
- (2) The project shall include a small scale water-impounding dam which generally have a structural height of not more than 30 m and/or a volume of storage not exceeding 50MCM.
- (3) The project shall include both engineering and vegetative protection works in the watershed area of the prospective reservoir.
- (4) The watershed area to be protected shall not be more than 100 km².
- (5) The irrigation development area shall not be more than 500 ha.
- (6) The installed capacity of hydropower generation shall not be more than 5,000 KW.
- (7) The construction cost of the dam and its appurtenant structures shall not exceed 50 million pesos (at 1989 constant prices).

15 Only projects that conformed to the above guidelines, were qualified as the candidate projects for the Study. After reviewing all the proposed projects, 230 out of the proposed 501 projects, were qualified as SWIM. As a result, the proposed projects were classified under Phase-II study as follows:

(1) Projects with studies	331
(a) Qualified projects	230
(b) Disqualified projects	101
(2) Projects without studies	170
Total	501

16 These 230 projects were classified by implementing agencies and their present status of project preparation was as shown below:

(Unit: Nos. of Projects)

Implementing Agency	Present Status of Projects			Total
	Pre F/S	F/S	D/D	
DPWH	10	4	9	23
NIA	59	0	8	67
BSWM	0	0	140	140
TOTAL	69	4	157	230

In these projects, FMB will be responsible for watershed protection component, and NEA will cooperate with implementing agencies on the projects which have mini-hydropower development component.

CRITERIA FOR PRIORITY RANKING

17 The criteria for prioritization of the 230 qualified projects were prepared in Phase-II, considering the technical, economic/financial and social/environmental factors. The scoring formula for project rating was finalized through discussions with SWIM-TWG as follows:

Formula for Project Rating

$$(1) \quad PR = 30\%TS + 40\%EV + 30\%SE$$

PR = Project Rating
TS = Merit Points of Technical Soundness
EV = Merit Points of Economic/Financial Viability
SE = Merit Points of Social/Environmental Impacts

$$(2) \quad TS = 20\%RF + 20\%SE + 10\%CD + 10\%CW + 20\%FC + 20\%TD$$

RF = Water Resources Reliability Factor
SE = Storage Efficiency
CD = Unit Cost of Dam Construction
CW = Unit Cost of Reservoir Water
FC = Effect of Flood Control
TD = Degree of Technical Difficulties for Construction

$$(3) \quad EV = 40\%IR + 10\%EO + 10\%PB + 30\%RB + 10\%FR$$

IR = Economic Internal Rate of Return (EIRR)
EO = Increase of Employment Opportunity
PB = Number of Project Beneficiaries
RB = Repayment Capability of Beneficiaries
FR = Annual Fund Requirement

(4) $SE = 33\%DI + 33\%RC + 17\%LA + 17\%EP$

DI = Economic condition of the area
RC = Relation with CARP
LA = Degree of Land Acquisition Problem
EP = Environmental Impacts

BASIC PLANNING CRITERIA

18 "Basic Planning Criteria" were prepared in Phase-II, as the technical tools for review and evaluation of the 230 qualified projects in Phase-III. The Criteria cover the basic items for the feasibility studies on SWIM projects and consist of guidelines for (1) survey and investigation, (2) project planning, (3) design of major structures, (4) O&M of major structures.

19 The guidelines for survey and investigation, and those for project planning covered most of the main technical and socio-economic items relating to the SWIM Projects. The guidelines for design and O&M of major structures dealt only with dams and their appurtenant structures. The procedures, methods and parameters given in the Criteria basically followed the existing studies had been reviewed in Phase-I. Since all of the proposed dams are of a fill type, the Criteria dealt only with fill type dams. The guidelines provided different criteria for projects with dam heights of more than 15 m and those less than 15 m.

20 The guideline for survey and investigation showed the basic data to be collected, and survey and investigation methods for the feasibility study on meteorological and hydrological conditions, river system, water rights, topography, geology, construction material, right of way, land acquisition and compensation. The guideline also indicates the standard methods and requirement of the studies for irrigation, mini-hydropower, water supply, inland fisheries, watershed management and environmental conservation.

21 The guideline for project planning showed the basic methods and procedures for project planning at feasibility study level. In particular, safety of dams and effective use of water resources were emphasized in the guideline. For planning of dams and reservoirs, standard methods and procedures are given for run-off analysis, flood analysis, sediment analysis, determination of storage capacity, and selection of dam site and dam type. The guideline also gave standard methods and requirements for analysis and planning of irrigation, mini-hydropower, water supply, inland fisheries, watershed management and environmental conservation. The guideline included standard methods for construction planning, cost estimates and economic evaluation.

22 The guideline for designs of major structures dealt with the basic design concepts for preliminary design of dams and its appurtenant structures. A glossary relating to design of dams and reservoirs is given in order to avoid misunderstandings. Considering the safety of dams, the guideline puts stress on the design of dam foundation and gave standard methods and requirements for dam foundation and foundation treatment. A fill type dam should have the necessary water tightness and strength, and be sufficiently safe against sliding failure or seepage failure. The guideline therefore gave standard methods and requirements for design of dam embankments and for stability analysis against sliding failure and for choice of seismic coefficients. The guideline also dealt with designs of spillways, outlet works, diversion works during construction and O&M facilities.

23 The guideline for O&M of major structures gave basic concepts for O&M works of fill type dams and their appurtenant structures. The guideline dealt with standard requirement for organizational set-up for O&M and responsibilities of implementing agencies, details of O&M works, establishment of beneficiaries' cooperatives, setting-up and collection method of O&M cost.

PRIORITY RANKING OF SWIM PROJECTS

24 The priority ranking studies on the 230 qualified projects were made under Phase-III. The costs and benefits of 230 qualified projects were reviewed/updated and the economic internal rates of return (EIRR) were re-calculated on the basis of updated cost and benefits. The 230 qualified projects were provisionally scored in accordance with the agreed "Criteria of Priority Ranking", and categorized into two priority groups: "A" (those projects which will be implemented in the first 5 years under 10 Year Action Program); and "B" (those projects implemented in the second 5 years under 10 Year Action Program) with the following basic considerations:

- (1) The 39 OECF-SWIM candidate projects shall be included in priority group "A".
- (2) The 34 projects showing less than 10% of EIRR shall be placed in priority group "B", irrespective of the total scores.
- (3) The remaining 157 projects showing more than 10% of EIRR shall be divided into two (2) groups, "A" and "B", according to the total scores; half of the higher scored projects shall be grouped as "A" and other half be grouped as "B". Grouping shall be made agency by agency.

25 The final results of priority ranking studies are shown below:

(Unit: Nos.of Projects)

Implementing Agency	Priority Groups				Total
	Group "A"		Group "B"		
DPWH	9	(3)	14	(8)	23
NIA	30	(5)	37	(12)	67
BSWM	79	(31)	61	(14)	140
Total	118	(39)	112	(34)	230

Remark: Parenthesized figures in "A" group indicate the number of OECF-SWIM projects, and those in "B" group indicate the number of projects with less than 10% of EIRR.

26 Regional distribution of the 230 qualified projects are as follows:

(Unit: No.of Projects)

Region	Group "A"				Group "B"				Total
	DPWH	NIA	BSWM	Total	DPWH	NIA	BSWM	Total	
I	4	2	9	15	2	8	15	25	40
II	2	0	15	17	1	0	13	14	31
CAR	1	0	0	1	0	0	3	3	4
III	0	3	14	17	1	6	3	10	27
IV	1	1	3	5	4	1	1	6	11
V	0	8	3	11	1	6	2	9	20
VI	0	0	4	4	1	0	4	5	9
VII	0	15	7	22	0	11	2	13	35
VIII	0	0	4	4	1	5	4	10	14
IX	0	1	2	3	0	0	5	5	8
X	0	0	6	6	0	0	4	4	10
XI	0	0	6	6	1	0	3	4	10
XII	1	0	6	7	2	0	2	4	11
Total	9	30	79	118	14	37	61	112	230

INSTITUTIONAL DEVELOPMENT FOR SWIM PROJECTS

27 The institutional development plan is conceived in the light of the present condition of the SWIM Projects. Basically, it is founded on the idea of:

- (1) simplicity and clarity of institutional procedures,

- (2) faith in the capability of the participating agencies for implementation of their respective areas such as irrigation, watershed protection, mini-hydropower and inland fisheries,
- (3) conformity to the existing policies issued by the SWIM Committee,
- (4) necessity of the participative approach to project implementation by beneficiaries' organization for ensuring smooth implementation of the projects, and
- (5) establishment of a monitoring system which provides a suitable feedback mechanism for future improvement of planning, implementation, operation and maintenance

28 The authorities and responsibilities of each organization involved in implementing the SWIM Projects shall be as follows:

(1) SWIM Committee:

- (a) to formulate operational policies and targets,
- (b) to designate the implementing and cooperating agencies,
- (c) to decide on the implementation of projects, and
- (c) to examine and adopt annual programs and budget.

(2) SWIM-TWG:

- (a) to evaluate the technical reports submitted by respective implementing agencies,
- (b) to recommend the implementing/cooperating agencies for each project,
- (c) to conduct the prioritization of projects according to the criteria,
- (d) to review the annual SWIM Program prepared by PMO-MFC/SWIM, and
- (e) to review and evaluate the completion and O&M reports on technical aspects.

(3) PMO-MFC/SWIM

- (a) to conduct preliminary selection of the proposed projects (reconnaissance level)
- (b) to evaluate the proposed projects (F/S level),
- (c) to prepare the annual SWIM Program,
- (d) to evaluate the D/D and confirm conditions for commencement of construction,
- (e) to coordinate the implementation of the SWIM projects,
- (f) to evaluate the progress, completion and O&M reports, and
- (g) to develop standards, criteria and guidelines for all technical activities of SWIM.

(4) Implementing Agencies

- (a) to identify the proposed projects through reconnaissance,
- (b) to submit project proposals for possible funding under the SWIM Program,
- (c) to obtain beneficiaries' consent for project implementation,
- (d) to prepare feasibility studies and detailed designs,
- (e) to provide the funds for the works which are not funded by SWIM Program,
- (f) to implement the projects either contract or force account, and
- (g) to submit periodic progress reports to PMO-MFC/SWIM.

(5) Cooperating Agencies

- (a) to participate in reconnaissance,
- (b) to participate in project identification, feasibility studies and detailed designs,
- (c) to assist the O&M of beneficiaries' associations,
- (d) to implement non-infrastructure components of the projects, and
- (e) to submit periodic progress reports to the lead implementing agencies.

29 The SWIM fund shall be released in the following cost items:

Items	Dams & Reservoir	Irrigation	Mini-hydropower	Water Supply	Watershed Protection
I. Direct Costs	SWIM	Non	Non	Non	SWIM
II. Indirect Costs					
1. Land Acquisition	SWIM	Non	Non	Non	Non
2. General Administration	SWIM	Non	Non	Non	SWIM
3. Engineering Services					
(1) Feasibility Study	SWIM	SWIM	SWIM	SWIM	SWIM
(2) Detailed Design	SWIM	SWIM	SWIM	SWIM	SWIM
(3) Construction Supervision	SWIM	Non	Non	Non	SWIM
4. Contingencies	SWIM	Non	Non	Non	SWIM

The watershed protection portion of the SWIM fund will be administered through FMB, and the fund for planning and design of the mini-hydropower portion through NEA.

30 The participative approach to project implementation is a milestone in the realization of rural development goals. The beneficiaries' organizations will be effective channels for information dissemination; for gathering beneficiaries' consensus; for easement of right of way problems and land acquisition; for supply of labor during construction. Recognizing this,

implementation of SWIM projects shall utilize these organizations as partners of goal achievement.

FRAMEWORK OF 10 YEAR ACTION PROGRAM

31 All of the 230 qualified projects will be implemented and completed within the 10 year period of 1991 - 2000. A total of 118 projects, including 39 candidate projects for OECF-SWIM, which has been categorized into the priority group of "A", will be implemented during the first 5 years. Projects with the completed detailed designs and without any deficiencies for faults in their studies and designs, will be implemented first.

32 The implementation schedule for the second 5 year period will be revised in the fourth year of the 10 Year Action Program, to take into account the results of review work on projects with less than 10% of EIRR and of feasibility studies for projects without existing data. That is: Re-studies of 34 projects which show less than 10% of EIRR, will be made during the first 3 years of the 10 Year Action Program and only economically viable projects will be included in the second 5 year program. Besides, since some feasibility studies on new projects shall be made during the first 5 years, some of such new projects which are economically viable shall be included in the implementation schedule of the second 5 year program.

33 Feasibility studies of approximately 300 candidate projects for next 10 year action program (2001-2010), including 170 projects which are categorized as "projects without studies" under Phase-I study, are included in the 10 Year Action Program. The next 10 year action program is scheduled to be prepared in the 9th year, based on the results of feasibility studies on approximately 300 projects.

34 Considering the above framework of the 10 Year Action Program, the overall implementation schedule for 230 qualified projects has been prepared on the basis of estimated periods for pre-construction activities and construction works for each project, and will be finalized through a trial and error process in order to achieve (1) a balanced regional distribution of projects over the country and (2) equitable or gradually increased annual fund requirements for implementation under the Program.

PROJECT COST ESTIMATES

35 The cost estimates are given at 1989 current prices in pesos on a local competitive bidding (LCB) basis. The costs required for implementation of the 10 Year Action Program comprise:

- (1) construction costs of the 230 qualified projects, which comprise
 - (a) dam and appurtenant structures to be financed from the SWIM fund, and
 - (b) other works to be funded by the respective implementing agencies.
- (2) costs of watershed protection works for the 230 projects, which shall be financed from the SWIM fund and executed through FMB.
- (3) costs for review and re-studies of the projects with less than 10% of EIRR, which will be borne by the respective implementing agencies.
- (4) costs for feasibility studies of the candidate projects for next 10 year program to be financed from the SWIM fund

36 For updating the costs, the financial construction costs estimated in existing studies are converted to those at 1989 current prices, by applying the average price escalation. The cost of dam construction is revised by reference to the latest bid prices and average unit cost of embankment works for the SWIM projects; for DPWH and NIA projects, costs in the range of US\$3.0 - 5.0/m³ are appropriate, if not, US\$4.0/m³ is applied; for BSWM projects, costs of more than US\$2.5/m³ are appropriate, if less than that, US\$3.0/m³ is applied. where additional foundation treatment is required, its cost is added to the original cost estimate. Where the freeboard is not enough, dam height is raised and the cost of the additional embankment is added to the original cost estimate.

37 The costs for irrigation facilities are revised in accordance with the unit cost per ha applied by NIA for communal irrigation projects. Where the unit cost of irrigation facilities per ha in the existing studies is in the range of ₱17,000 to ₱25,000/ha, the cost is not revised. Where the unit cost is lower than ₱17,000/ha, the cost for irrigation facilities is revised on the basis of unit cost of ₱17,000/ha. Where the unit cost is higher than ₱25,000/ha, the cost is revised on the basis of ₱25,000/ha.

38 Cost for mini-hydropower generation is revised in accordance with the average unit cost per kW applied by NEA for the SWIM projects. Where the unit cost of power facilities per kW is in the range of US\$900 to US\$1,100/kW, the cost is not revised. If the unit cost is out of the above range, the cost is revised based on the unit cost of US\$1,000/kW. The cost of rural water supply facilities is updated by applying price escalation rates.

39 Land acquisition and compensation costs are revised by multiplying reservoir area by the average unit price of ₱15,000/ha. The general administration cost is assumed to be 3% of direct costs. Cost for engineering service is estimated at 3% of the direct cost for feasibility studies, 6% for detailed designs and 10% for construction supervision. Physical contingency is estimated, to take account of present status of project preparation, at the following percentages to the total cost; 20% for Pre-F/S project, 15% for F/S project and 10% for D/D project.

40 In the existing studies, no information is available on the present condition of the watersheds of the 230 projects. FMB estimated the costs of watershed protection works for the 230 projects, on the basis of their resources such as nationwide forest/vegetation maps and standard unit costs per ha for watershed rehabilitation and protection works.

41 Price contingencies are not estimated in the existing studies. In order to estimate the total fund requirements for implementation of 10 Year Action Program, the price contingencies are estimated, by applying the following rates:

Currency	Proportion	Escalation Rate
Local portion (pesos)	: 60%	7% per annum
Foreign portion	: 40%	3% per annum

42 The total fund requirements for implementation of the 10 Year Action Program are estimated at approximately ₱6.1 billion in total, comprising ₱2.3 billion for the first five years (118 projects) and ₱3.8 billion for the second five years (112 projects).

Items	Total Fund (₱ million)				Total	
	1st Five Years		2nd Five Years			
DPWH	250	(149)	596	(0)	846	(149)
NIA	977	(275)	1,264	(0)	2,241	(275)
BSWM	569	(209)	393	(0)	962	(209)
Sub-total	1,796	(633)	2,253	(0)	4,049	(633)
F/S for 300 projects	85	(0)	50	(0)	135	(0)
Price Contingency	483	(153)	1,466	(0)	1,949	(153)
Total	2,364	(786)	3,769	(0)	6,133	(786)

Remark: Figures in parentheses show the costs for OECF-SWIM projects.

43 The total SWIM fund requirement amounts to approximately ₱4.9 billion, of which about ₱1.8 billion is scheduled to be disbursed in the first 5 years and the remaining about ₱3.1 billion in the second 5 years as shown below:

Items	SWIM Fund (₱ million)				Total	
	1st Five Years		2nd Five Years			
DPWH	192	(113)	477	(0)	669	(113)
NIA	768	(200)	1,066	(0)	1,834	(200)
BSWM	412	(149)	307	(0)	719	(149)
<u>Sub-total</u>	<u>1,372</u>	<u>(462)</u>	<u>1,850</u>	<u>(0)</u>	<u>3,222</u>	<u>(462)</u>
F/S for 300 projects	85	(0)	50	(0)	135	(0)
Price Contingency	377	(111)	1,206	(0)	1,583	(111)
Total	1,834	(573)	3,106	(0)	4,940	(573)

Remark: Figures in parentheses show the costs for OECF-SWIM projects.

44 The costs to be borne by respective implementing agencies are estimated to be about ₱1.2 billion in total, or 20% of the total fund requirement. Out of about ₱1.2 billion, about ₱0.5 billion will be disbursed in the first 5 years and about ₱0.7 billion in the second 5 years.

Items	Specific Costs (₱ million)				Total	
	1st Five Years		2nd Five Years			
DPWH	58	(37)	119	(0)	177	(37)
NIA	208	(76)	198	(0)	406	(76)
BSWM	157	(59)	86	(0)	243	(59)
<u>Sub-total</u>	<u>423</u>	<u>(172)</u>	<u>403</u>	<u>(0)</u>	<u>826</u>	<u>(172)</u>
Price Contingency	107	(41)	260	(0)	367	(41)
Total	530	(213)	663	(0)	1,193	(213)

Remark: Figures in parentheses show the costs for OECF-SWIM projects.

45 The annual fund requirement for implementation of 10 Year Action Program is calculated, in accordance with the implementation schedule, as follows:

(Unit: ₱million)

Year	SWIM Fund						Specific Costs	Total
	Dam & Appurtenant Structures		Watershed Protection Works		Studies & Designs			
1991	129	(86)	43	(17)	31	(0)	65 (38)	268 (141)
1992	223	(91)	73	(17)	30	(0)	101 (40)	427 (148)
1993	260	(96)	94	(18)	38	(0)	113 (43)	505 (157)
1994	300	(101)	98	(19)	30	(0)	119 (45)	547 (165)
1995	311	(107)	115	(21)	59	(0)	132 (47)	617 (175)
1996	339	(0)	116	(0)	53	(0)	104 (0)	612 (0)
1997	400	(0)	135	(0)	47	(0)	119 (0)	701 (0)
1998	450	(0)	141	(0)	55	(0)	111 (0)	757 (0)
1999	485	(0)	160	(0)	8	(0)	150 (0)	803 (0)
2000	573	(0)	144	(0)	0	(0)	179 (0)	896 (0)
Total	3,470	(481)	1,119	(92)	351	(0)	1,193 (213)	6,133 (786)

Remark: Figures in the parentheses show the costs for OECF-SWIM projects.

46 The annual operation and maintenance (O&M) costs are estimated to be about ₱24 million in total for 230 projects, applying 0.5% of direct construction cost for dams and 2.5% for water utilization facilities:

(Unit: ₱ million)

Agency	Number of Project	O&M Cost
DPWH	23	5.2
NIA	67	11.8
BSWM	140	6.5
Total	230	23.5

Beneficiaries cooperatives shall shoulder all of the above O&M costs. The amount, however, accounts only for 6% of the total expected incremental revenue from beneficiaries of about ₱383 million which it is judged the beneficiaries can pay.

ECONOMIC EVALUATION

47 The 230 qualified projects are classified in terms of EIRR as follows:

(Unit: Nos. of Projects)

Range of EIRR	DPWH		NIA		BSWM		Total	
EIRR<10%	8	(0)	14	(2)	18	(4)	40	(6)
10%<=EIRR<20%	12	(3)	30	(3)	66	(15)	108	(21)
20<=EIRR	3	(0)	23	(0)	56	(12)	82	(12)
Total	23	(3)	67	(5)	140	(31)	230	(39)

Remark: Figures in parentheses show the number of OECF-SWIM projects.

48 Although the SWIM Projects have manifold types of benefits, only those accrued from irrigation, mini-hydropower, domestic water supply, and inland fishery are calculated as direct benefits. Estimated production losses in the prospective reservoir areas are deducted from the project benefits. The economic benefits of 230 projects are estimated to be about ₱0.6 billion per annum as follows:

(Unit: ₱ 1,000)

Implementing Agencies	Benefit Components				Production Foregone	Total
	Irrigation	Hydropower	Fisheries	Water supply		
DPWH	70,000	16,900	6,800	2,200	- 100	95,800
NIA	249,600	5,600	71,300	0	- 900	325,600
BSWM	151,400	0	16,100	0	- 100	167,400
Total	471,000	22,500	94,200	2,200	- 1,100	588,800

49 The financial costs for implementation of 10 Year Action Program are converted to the economic costs, by deducting the costs of feasibility studies for the candidate projects for the next 10 year program, price contingencies, taxes and other transfer payments from the estimated financial costs and further by applying shadow price rates of 1.2 for the foreign currency portion, 0.6 for unskilled labor and 1.0 for other local costs. The estimated economic project costs are about ₱3.1 billion, and economic annual O&M costs are ₱21.4 million in total for 230 projects as shown below:

(Unit: ₱ 1,000)

Implementing Agencies	Economic Project Costs	Economic Annual O&M Costs
DPWH	692,900	4,700
NIA	1,689,300	10,700
BSWM	716,500	6,000
Total	3,098,700	21,400

50 The proposed 10 Year Action Program is economically viable in accordance with its implementation schedule, by consideration of EIRR calculated as follows:

<u>10 Year Action Program</u>	:	<u>17.5% (230 projects)</u>
first five (5) years	:	20.0% (118 projects)
second five (5) years	:	12.8% (112 projects)

SOCIO-ECONOMIC IMPACTS

51 The flood control effects of the SWIM projects are considered to be incidental. However, peak-cuts of 4,900 m³/sec can be expected by construction of 230 projects, according to the following calculation:

Agency	Total Catchment Area (km ²)	Total Design Flood Discharge (m ³ /s) (A)	Total Peak-cut Discharge (m ³ /s) (B)	Peak-cut Ratio (%) (B)/(A)x100
DPWH	281	2,820	510	18
NIA	715	10,630	3,600	34
BSWM	145	2,300	790	34
Total	1,141	15,750	4,900	31

52 The implementation of 230 projects will create new irrigation areas of about 28,000 ha in total, comprising about 16,000 ha for the first 5 years and 12,000 ha for the second 5 years. Double cropping will also be possible in most of these irrigated areas. With the increase of irrigation area and cropping intensity, the total annual increase of paddy production will be about 200,000 tons, which corresponds to the total annual consumption of 1.6 million persons.

53 The SWIM Projects will certainly contribute to raising of living standards in the rural areas through mitigation of flood damage and economic development by impounding of water for irrigation and mini-hydropower generation. The 230 SWIM projects will produce incremental revenue amounting to ₱383 million per annum, which is equivalent to about ₱14,000 per household . This will accelerate growth of the rural economy and will have secondary benefits for economic activities in rural areas. The SWIM Projects will also contribute to the Comprehensive Agrarian Reform Program (CARP) by providing the SWIM dams in the priority provinces of CARP support service program.

54 The 230 SWIM projects will provide new employment opportunities for 3.5 million man-days for construction. For implementation of the 230 projects, about ₱6.1 billion will be disbursed during the 10 year period over the country and most of these investments will be spent in the rural areas where the projects are located. The SWIM projects will also create new job opportunities, even after completion of the construction works, for O&M works as well as in food production in new irrigation areas.

55 With the implementation of the SWIM projects, some 45,000 ha of watershed areas will be protected by construction of check dams and reforestation. These watershed protection works will prolong the useful life of dams and reservoirs by reducing soil erosion and increasing the water holding capacity in the catchment areas. The watershed protection works will also help the national afforestation program.

ENVIRONMENTAL IMPACTS

56 The environmental impacts of the SWIM projects have not been sufficiently studied in existing reports. It is necessary for the environmental impacts assessment and the countermeasures to minimize the impacts to be carefully studied by the implementing agencies, and that plans be approved by DENR prior to commencement of construction works.

57 The environmental impacts induced by implementation of the SWIM projects may comprise (1) physical changes in river flow, groundwater levels and sedimentation loads, (2) ecological changes for living fauna and flora, (3) socio-economic changes in land use and life style and (4) resettlement problems in connection with impoundment of reservoir areas.

RECOMMENDATIONS

58 It is recommended that the 10 Year Action Program be implemented as proposed. The projects to be implemented within first five (5) years, especially, are verified to be technically sound and economically feasible with overall EIRR of 20%, and are expected to improve living standards as well as social welfare of people in rural areas.

59 In the Study, an institutional development plan was proposed within the framework of the existing system. It is also recommended that the following measures be taken for further smooth and efficient implementation and management of the SWIM Projects:

- (a) The promotion of the SWIM program by media
- (b) Strengthening of PMO-MFC/SWIM
- (c) Periodic training of the staff
- (d) Establishment of a more comprehensive system of monitoring and evaluation

60 It is recommended that the "Basic Planning Criteria" prepared under the Study be further developed and completed by adding design and O&M guidelines for water utilization facilities. It is also recommended that the following technical and management tools be prepared for effective implementation, management and operation of the SWIM projects:

- (a) Detailed design criteria for SWIM dam and appurtenant structures
- (b) An inspection manual for construction works
- (c) An operation and maintenance manual for SWIM dam and appurtenant structures
- (d) A monitoring and evaluation manual for completed projects

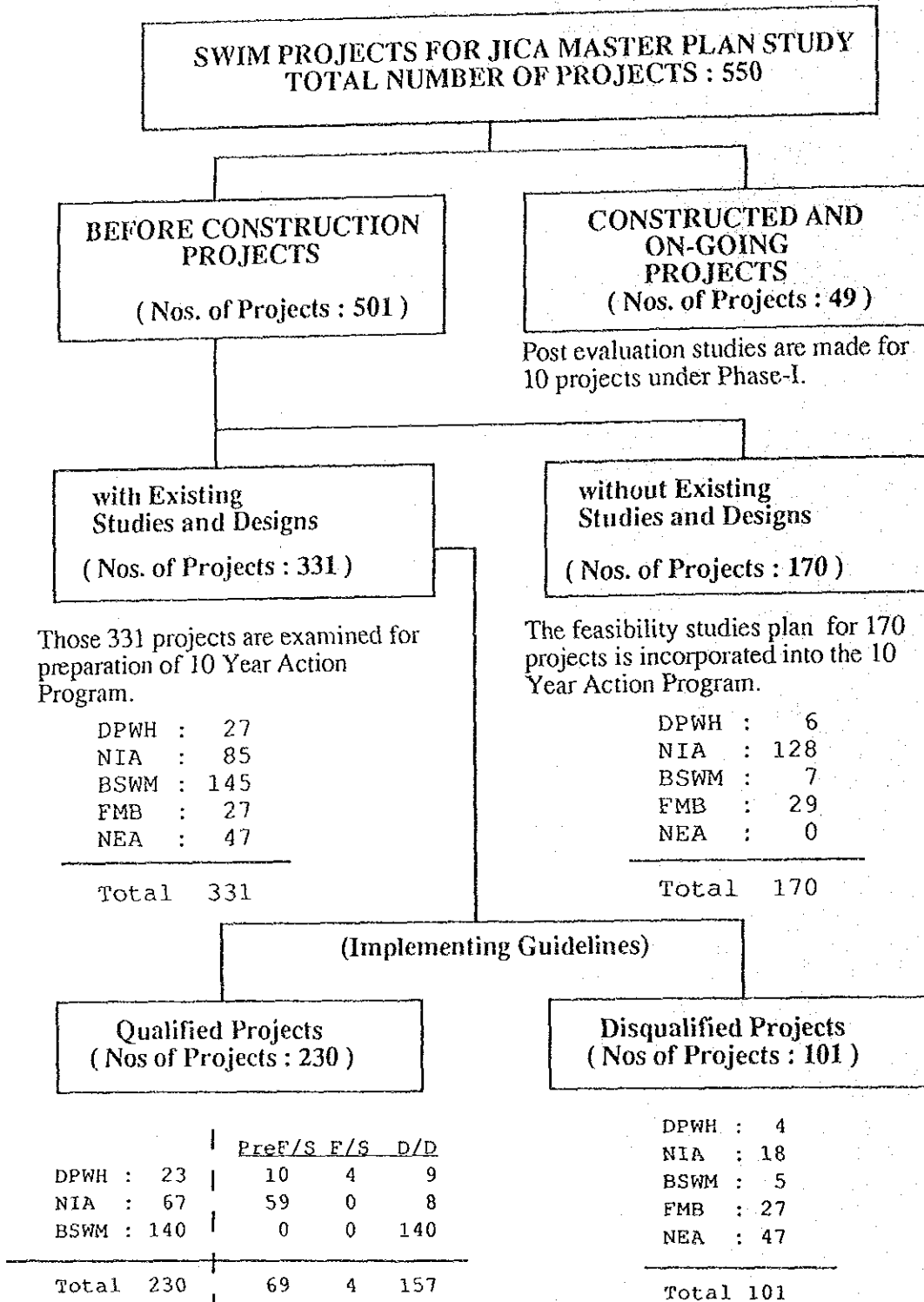
61 The post-evaluation study on completed projects, in Phase-I, indicated that most completed projects are not well-maintained due to poor O&M. It is recommended that all completed projects be investigated and necessary rehabilitation works be carried out, in parallel with implementation of the 10 Year Action Program. It is also recommended that the projects be periodically monitored after completion of rehabilitation works.

62 It is recommended that measures for environmental impacts including establishment of study procedures for environmental impact assessment and preparation of evaluation criteria for environmental assessment be investigated, since it was found during the Study that environmental aspects of implementation of the projects had hardly been examined in the existing studies.

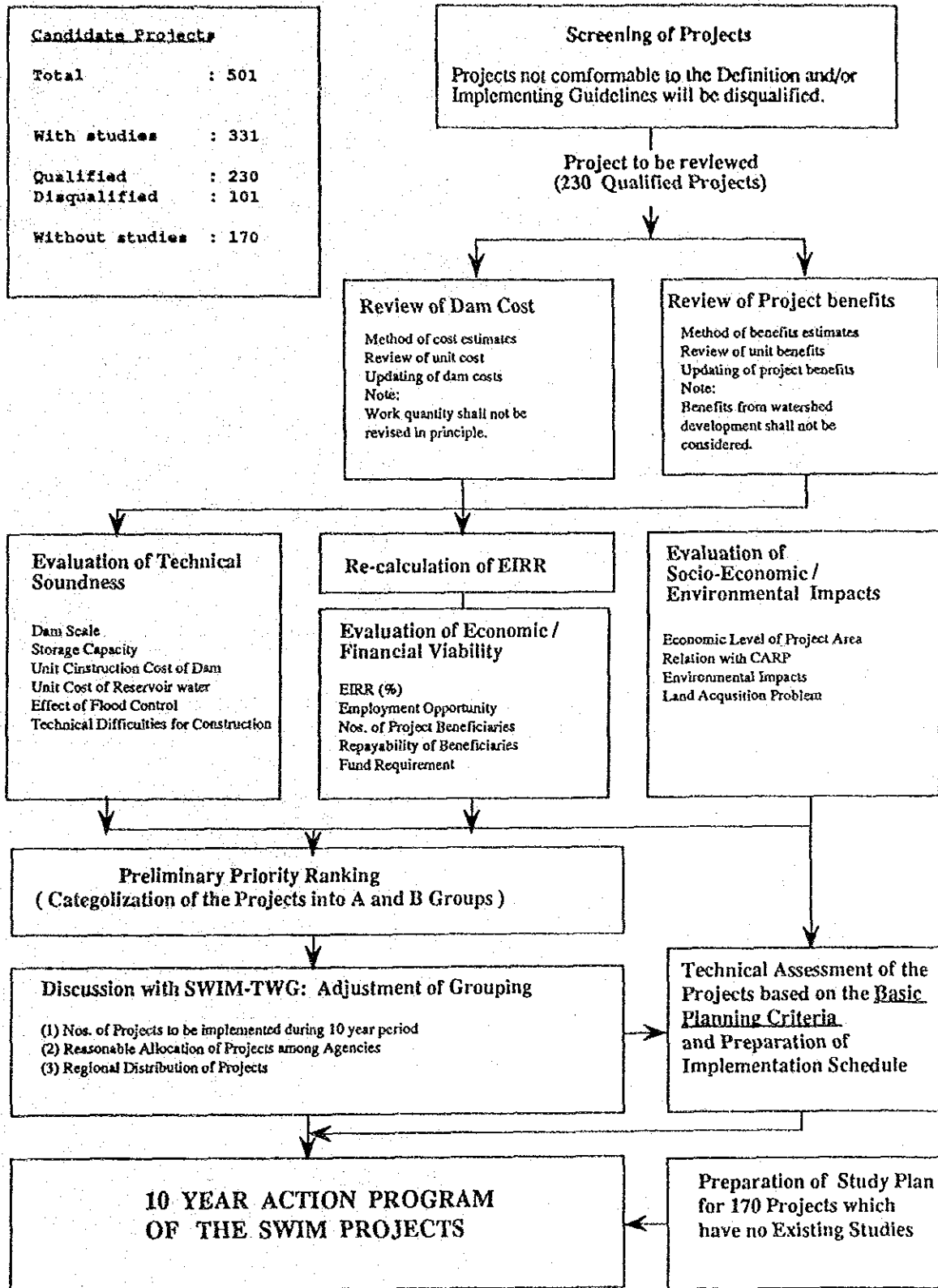
63 It is recommended that the proposed 10 Year Action Program be reviewed and modified periodically; say every 5 years, to reflect changes in water demand, hydrological conditions and the country's ability to construct and finance projects. It is also recommended that feasibility studies of 170 projects without existing data be conducted at an early stage in the 10 Year Action Program and that arrangements for revision of the implementation schedule for the second five years be made.

64 It is recommended that necessary arrangements for project implementation including establishment of beneficiaries cooperatives and solutions to the issues of land compensation, etc., be confirmed prior to commencement of the implementation.

SCREENING/QUALIFYING PROCESS OF SWIM PROJECTS



PROCEDURES OF FORMULATION OF 10 YEAR ACTION PROGRAM



FRAMEWORK OF 10-YEAR ACTION PROGRAM

Item	10-Year Period									
	1st Five Year					2nd Five Year				
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1. Implementation of Qualified Project (230 Projects) (1) Group "A" Projects (118 Projects) EIRR ≥ 10% (79 Projects) - D/D Completed Projects (49) - Ready to construction 36 - Review of D/D 13 - F/S Completed Projects (0) - Pre-F/S Completed Projects (30) - Ready to F/S 30 OECF Projects (39 Projects) *1 - Projects to be implemented - Projects to be not implemented (2) Group "B" Projects (112 Projects) EIRR ≥ 10% (78 Projects) - D/D Completed Projects (50) - Ready to construction 41 - Review of D/D 9 - F/S Completed Projects (3) - Ready to D/D 2 - Repeat from F/S 1 - Pre-F/S Completed Projects (25) - Ready to F/S 25 EIRR ≤ 10% (34 Projects) - D/D Completed Projects (19) - Review of F/S 11 - Review of F/S & D/D 8 - F/S Completed Projects (1) - Review of F/S 1 - Pre-F/S Completed Projects (14) - Review of Pre-F/S 14										
2. Preparation of Implementation Schedule for 2nd Five Year										
3. Preparation of Feasibility Study for Projects not supported with data (300 Projects) *2	F/S					F/S				
4. Preparation of Next 10 Year Action Program										

Note: *1: Subject to further review under the OECF SWIM Projects financed by 14th OECF Loan.

- *2: (1) Approximate required number of projects for Next 10 Year Action Program.
 (2) Including 170 projects categorized as "projects which have no existing data".
 (3) Some of projects will be scheduled to be implemented in the 2nd Five Year.

**THE MASTER PLAN STUDY
ON
THE SMALL WATER IMPOUNDING MANAGEMENT (SWIM)
PROJECTS**

FINAL REPORT

PREFACE
LOCATION MAP OF THE PROJECTS
SUMMARY
TABLE OF CONTENTS
LIST OF TABLES
LIST OF FIGURES
LIST OF ATTACHMENTS
LIST OF ANNEXES
LIST OF DATA BOOK
ABBREVIATIONS

TABLE OF CONTENTS

		<u>Page</u>
CHAPTER I	INTRODUCTION.....	1
1.1	Authority	1
1.2	Objectives and Scope of the Study	2
1.3	Plan of Operation for the Study.....	2
1.4	Activities during the Phase-I Period.....	2
1.5	Activities during the Phase-II Period.....	4
1.6	Activities during the Phase-III Period.....	5
CHAPTER II	BACKGROUND OF THE SWIM PROJECTS.....	7
2.1	General Economic Situations of the Philippines	7
2.2	Historical Overview of SWIM Projects	9
2.3	Purpose and Definition of SWIM Projects.....	10
2.4	Organizational Set-up of SWIM Projects.....	11
2.5	Current Activities of SWIM Projects.....	11
CHAPTER III	CURRENT STATUS OF SWIM PROJECTS.....	13
3.1	Inventory of SWIM Projects	13
3.1.1	Candidate Projects for Implementation under 10 Year Action Program.....	13
3.1.2	Candidate Projects for Post-Evaluation Study.....	14
3.2	Classification of Candidate Projects.....	15
3.2.1	Classification by Implementing Agencies	16
3.2.2	Classification by Region	16
3.2.3	Classification by Development Purposes	17
3.2.4	Classification by Catchment Area.....	18
3.2.5	Classification by Dam Height.....	18
3.2.6	Classification by Storage Capacity	19

	<u>Page</u>
3.2.7	Classification by Embankment Volume..... 19
3.2.8	Classification by Development Scale 20
3.3	General Features of Candidate Projects 21
3.3.1	SWIM Projects proposed by DPWH 21
3.3.2	SWIM Projects proposed by NIA 22
3.3.3	SWIM Projects proposed by FMB 23
3.3.4	SWIM Projects proposed by NEA 24
3.3.5	SWIM Projects proposed by BSWM 24
3.4	Post-Evaluation Study on Completed SWIM Projects..... 25
3.4.1	Method and Work Flow of Post-Evaluation Study 25
3.4.2	Completed Projects for Post-Evaluation Study 25
3.4.3	Major Findings of Post-Evaluation Study 27
3.5	Present Institutional Framework and Procedures for Implementation of SWIM Projects..... 29
3.5.1	SWIM Committee 29
3.5.2	Technical Working Group..... 30
3.5.3	Implementing Agencies..... 31
3.5.4	Cooperating Agencies 34
3.5.5	SWIM Project Fund and Its Allocation..... 35
3.6	Current Problems on SWIM Projects..... 36
CHAPTER IV	GUIDELINES AND CRITERIA FOR SCREENING AND PRIORITY RANKING OF SWIM PROJECTS 40
4.1	Concept and Definition of SWIM Projects..... 40
4.2	General Guidelines for Qualifying SWIM Projects..... 42
4.3	Qualified SWIM Projects..... 43
4.4	Criteria of Priority Ranking 45
4.4.1	Work Flow of Priority Ranking..... 45
4.4.2	Factors for Evaluation of Priority Ranking 46
4.4.2	Scoring System of Priority Ranking..... 48
CHAPTER V	BASIC PLANNING CRITERIA AND TECHNICAL ASSESSMENT OF SWIM PROJECTS 50
5.1	Objectives and Framework of "Basic Planning Criteria" 50
5.2	Outline of "Basic Planning Criteria"..... 51
5.2.1	Guideline for Survey and Investigation 51
5.2.2	Guideline for Project Planning 53
5.2.3	Guideline for Design of Major Structures 56
5.2.4	Guideline for Operation and Maintenance of Major Structures 58
5.3	Technical Assessment of Qualified Projects 60
5.3.1	Objectives..... 60
5.3.2	Overall Review of Existing Studies and Designs 60
5.3.3	Results of Technical Assessment..... 62

	<u>Page</u>
CHAPTER VI	PRIORITY RANKING OF SWIM PROJECTS..... 66
6.1	Procedures of Priority Ranking..... 66
6.2	Review of Project Costs and Benefits..... 67
6.3	Re-calculation of Economic "Internal Rate of Return (EIRR)"..... 68
6.4	Priority Ranking of Qualified SWIM Projects..... 69
CHAPTER VII	INSTITUTIONAL DEVELOPMENT FOR SWIM PROJECTS..... 72
7.1	General..... 72
7.2	Present Institutional Set-up and Financial Situations..... 72
7.3	Institutional Development Plan..... 73
7.3.1	Basic Concept of Institutional Development..... 73
7.3.2	Authorities and Responsibilities..... 74
7.3.3	Release of SWIM Fund..... 75
7.3.4	Institutional Procedures for Implementation..... 76
7.3.5	Role of Participative Approach..... 81
7.3.6	Implementation of Institutional Development Plan..... 81
CHAPTER VIII	IMPLEMENTATION SCHEDULE..... 82
8.1	Basic Concept for Preparation of Implementation Schedule..... 82
8.2	Framework of 10 Year Action Program..... 83
8.3	Implementation Schedule..... 86
8.3.1	Pre-construction Period..... 86
8.3.2	Construction Period..... 87
8.3.3	Overall Implementing Schedule of 230 Qualified Projects..... 88
CHAPTER IX	PROJECT COST ESTIMATES..... 90
9.1	Condition of Cost Estimates..... 90
9.2	Estimates of Financial Costs..... 91
9.2.1	Direct Cost..... 91
9.2.2	Indirect Cost..... 92
9.2.3	Cost for Watershed Protection Works..... 93
9.2.4	Cost for Review and Re-studies..... 93
9.2.5	Price Contingency..... 94
9.2.6	Cost for Feasibility Studies..... 94
9.3	Fund Requirement for 10 Year Action Program..... 95
9.3.1	Total Fund Requirement..... 95
9.3.2	SWIM Fund Requirement..... 95
9.3.3	Cost to be Borne by Implementing Agencies..... 97
9.4	Annual Fund Requirement..... 98
9.4.1	Total Fund Requirement..... 99
9.4.2	Annual Fund Requirement of Implementing Agencies..... 99
9.5	Regional Distribution of Fund..... 101
9.6	Operation and Maintenance Costs..... 102

	<u>Page</u>
CHAPTER X PROJECT JUSTIFICATION.....	104
10.1 General	104
10.2 Economic Evaluation	105
10.2.1 Basic Assumptions.....	105
10.2.2 Economic Benefits.....	105
10.2.3 Economic Costs.....	108
10.2.4 Economic Internal Rate of Return (EIRR).....	108
10.3 Socio-Economic Impacts.....	109
10.4 Environmental Impacts Assessment	112
CHAPTER XI RECOMMENDATIONS	115

LIST OF TABLES

		<u>Page</u>
Table 1.3.1	List of SWIM-TWG Members, Counterpart Personnel and JICA Study Team.....	119
Table 2.2.1	Historical Background of the SWIM Projects.....	120
Table 3.1.1	List of 501 Candidate Projects for Master Plan Study (1/10).....	121
Table 3.1.1	List of 501 Candidate Projects for Master Plan Study (2/10).....	122
Table 3.1.1	List of 501 Candidate Projects for Master Plan Study (3/10).....	123
Table 3.1.1	List of 501 Candidate Projects for Master Plan Study (4/10).....	124
Table 3.1.1	List of 501 Candidate Projects for Master Plan Study (5/10).....	125
Table 3.1.1	List of 501 Candidate Projects for Master Plan Study (6/10).....	126
Table 3.1.1	List of 501 Candidate Projects for Master Plan Study (7/10).....	127
Table 3.1.1	List of 501 Candidate Projects for Master Plan Study (8/10).....	128
Table 3.1.1	List of 501 Candidate Projects for Master Plan Study (9/10).....	129
Table 3.1.1	List of 501 Candidate Projects for Master Plan Study (10/10).....	130
Table 3.1.2	Major Features of Completed/On-going SWIM projects (1/2).....	131
Table 3.1.2	Major Features of Completed/On-going SWIM projects (2/2).....	132
Table 3.4.1	Major Features of 10 Completed Projects for Post-Evaluation Study.....	133
Table 3.4.2	Results of Post Evaluation Study (1/10) -- Ilihan SWIP --.....	134
Table 3.4.2	Results of Post Evaluation Study (2/10) -- Darapidap SWIP --.....	135
Table 3.4.2	Results of Post Evaluation Study (3/10) -- Malinao SWIP --.....	136
Table 3.4.2	Results of Post Evaluation Study (4/10) -- Pasig Timbu Watershed Rehabilitation Project --.....	137
Table 3.4.2	Results of Post Evaluation Study (5/10) -- Mantayupan Fall SWIP --.....	138
Table 3.4.2	Results of Post Evaluation Study (6/10) -- Bacnotan SWIP --.....	139
Table 3.4.2	Results of Post Evaluation Study (7/10) -- Porac Dam and Reservoir Project --.....	140
Table 3.4.2	Results of Post Evaluation Study (8/10) -- Kirong Dam Project--.....	141
Table 3.4.2	Results of Post Evaluation Study (9/10) -- San Ramon Dam and Reservoir Project --.....	142
Table 3.4.2	Results of Post Evaluation Study (10/10) -- Calanggaman SWIP Phase I --.....	143

	<u>Page</u>
Table 3.5.1 Annual Budget of SWIM Projects (1982 - 1988)	144
Table 3.5.2 Actual Expenditures for Construction of SWIM Projects (1982 - 1988)	144
Table 3.5.3 Actual Budgets and Expenditures of SWIM Projects by Implementing Agencies for the Period from 1982 to 1988 (1/2)	145
Table 3.5.3 Actual Budgets and Expenditures of SWIM Projects by Implementing Agencies for the Period from 1982 to 1988 (2/2)	146
Table 4.3.1 Major Features of Qualified SWIM Projects (1/6) -- DPWH --	147
Table 4.3.1 Major Features of Qualified SWIM Projects (2/6) -- NIA No.1 --	148
Table 4.3.1 Major Features of Qualified SWIM Projects (3/6) -- NIA No.2 --	149
Table 4.3.1 Major Features of Qualified SWIM Projects (4/6) -- BSWM No.1 --	150
Table 4.3.1 Major Features of Qualified SWIM Projects (5/6) -- BSWM No.2 --	151
Table 4.3.1 Major Features of Qualified SWIM Projects (6/6) -- BSWM No.3 --	152
Table 4.4.1 Criteria of Priority Ranking (1/4) -- Project Rating (PR) --	153
Table 4.4.1 Criteria of Priority Ranking (2/4) -- Merit Point of Technical Soundness (TS) --	154
Table 4.4.1 Criteria of Priority Ranking (3/4) -- Merit Point of Economic/Financial Viability (EV) --	155
Table 4.4.1 Criteria of Priority Ranking (4/4) -- Merit Point of Social/Environmental Impacts (SE) --	156
Table 5.3.1 Summary of Technical Assessment (1/4)	157
Table 5.3.1 Summary of Technical Assessment (2/4)	158
Table 5.3.1 Summary of Technical Assessment (3/4)	159
Table 5.3.1 Summary of Technical Assessment (4/4)	160
Table 8.3.1 Implementation Schedule of SWIM Projects in 10 Year Action Program (1/6)	161
Table 8.3.1 Implementation Schedule of SWIM Projects in 10 Year Action Program (2/6)	162
Table 8.3.1 Implementation Schedule of SWIM Projects in 10 Year Action Program (3/6)	163
Table 8.3.1 Implementation Schedule of SWIM Projects in 10 Year Action Program (4/6)	164
Table 8.3.1 Implementation Schedule of SWIM Projects in 10 Year Action Program (5/6)	165
Table 8.3.1 Implementation Schedule of SWIM Projects in 10 Year Action Program (6/6)	166
Table 9.2.1 Financial Cost Estimates of SWIM Projects	167

	<u>Page</u>
Table 9.2.2	Financial Cost Estimates of Each of SWIM Projects (1/5) 168
Table 9.2.2	Financial Cost Estimates of Each of SWIM Projects (2/5) 169
Table 9.2.2	Financial Cost Estimates of Each of SWIM Projects (3/5) 170
Table 9.2.2	Financial Cost Estimates of Each of SWIM Projects (4/5) 171
Table 9.2.2	Financial Cost Estimates of Each of SWIM Projects (5/5) 172
Table 9.4.1	Annual Fund Requirement of Total Project Cost 173
Table 9.4.2	Annual Fund Requirement for DPWH Portion 173
Table 9.4.3	Annual Fund Requirement for NIA Portion 174
Table 9.4.4	Annual Fund Requirement for BSWM Portion 174
Table 9.4.5	Annual Disbursement schedule of SWIM Projects (1/6) -- DPWH Projects -- 175
Table 9.4.5	Annual Disbursement schedule of SWIM Projects (2/6) -- NIA Projects No.1-- 176
Table 9.4.5	Annual Disbursement schedule of SWIM Projects (3/6) -- NIA Projects No.2-- 177
Table 9.4.5	Annual Disbursement schedule of SWIM Projects (4/6) -- BSWM Projects No.1-- 178
Table 9.4.5	Annual Disbursement schedule of SWIM Projects (5/6) -- BSWM Projects No.2-- 179
Table 9.4.5	Annual Disbursement schedule of SWIM Projects (6/6) -- BSWM Projects No.3-- 180
Table 9.5.1	Regional Distribution of Fund Requirement 181
Table 9.6.1	Repayment Capability of Beneficiaries (1/4) 182
Table 9.6.1	Repayment Capability of Beneficiaries (2/4) 183
Table 9.6.1	Repayment Capability of Beneficiaries (3/4) 184
Table 9.6.1	Repayment Capability of Beneficiaries (4/4) 185
Table 10.2.1	EIRR of SWIM Projects in the First Five Years of 10 Year Action Program 186
Table 10.2.2	EIRR of SWIM Projects in the Second Five Years of 10 Year Action Program 187
Table 10.2.3	EIRR of SWIM Projects in 10 Year Action Program 188

LIST OF FIGURES

		<u>Page</u>
Fig.1.2.1	GENERAL WORK FLOW CHART FOR MASTER PLAN STUDY.....	189
Fig.1.3.1	WORK SCHEDULE FOR MASTER PLAN STUDY	190
Fig.2.4.1	ORGANIZATIONAL SET-UP FOR SWIM PROJECTS	191
Fig.2.4.2	WORK FLOW FOR IMPLEMENTATION OF SWIM PROJECTS.....	192
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (1/15) --INDEX--	193
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (2/15) --REGION I--.....	194
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (3/15) --REGION II--.....	195
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (4/15) --REGION CAR.--.....	196
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (5/15) --REGION III--.....	197
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (6/15) --REGION IV--.....	198
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (7/15) --REGION V--.....	199
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (8/15) --REGION VI--.....	200
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (9/15) --REGION VII--.....	201
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (10/15) --BOHOL REGION VII--.....	202
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (11/15) --REGION VIII--.....	203
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (12/15) --REGION IX--.....	204
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (13/15) --REGION X--.....	205
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (14/15) --REGION XI--.....	206
Fig.3.1.1	LOCATION MAP OF CANDIDATE PROJECTS FOR MASTER PLAN STUDY (15/15) --REGION XII--.....	207
Fig.3.1.2	LOCATION MAP OF COMPLETED PROJECTS.....	208
Fig.3.2.1	PROJECT FORMAT FOR THE REVIEW OF EXISTING DATA AND REPORTS.....	209

LIST OF ATTACHMENTS

		<u>Page</u>
Attachment - 1	Implementing Arrangement for the Master Plan Study on the Small Water Impounding Management (SWIM) Projects	AT-1
Attachment - 2	Minutes of Meeting for Plan of Operation dated on August 29, 1988	AT-8
Attachment - 3	Minutes of Meeting for Inception Report dated on October 24, 1988.....	AT-12
Attachment - 4	Minutes of Meeting for Progress Report dated on March 8, 1989	AT-18
Attachment - 5	Minutes of Meeting for Plan of Operation dated on July 6, 1989.....	AT-22
Attachment - 6	Minutes of Meeting for Interim Report dated on September 20, 1989.....	AT-26
Attachment - 7	Minutes of First Monthly Progress Meeting dated on October 12, 1988.....	AT-28
Attachment - 8	Minutes of Second Monthly Progress Meeting dated on November 15, 1988	AT-43
Attachment - 9	Minutes of Third Monthly Progress Meeting dated on December 16, 1988.....	AT-46
Attachment - 10	Minutes of Fourth Monthly Progress Meeting dated on August 4, 1989.....	AT-49
Attachment - 11	Minutes of Fifth Monthly Progress Meeting dated on August 17, 1989	AT-57
Attachment - 12	Minutes of Sixth Monthly Progress Meeting dated on October 9, 1989	AT-60
Attachment - 13	Minutes of Seventh Monthly Progress Meeting dated on November 6, 1989.....	AT-64
Attachment - 14	Minutes of Eighth Monthly Progress Meeting dated on November 27, 1989	AT-69
Attachment - 15	Minutes of Meeting for Draft Final Report dated on February 22, 1990	AT-72

ANNEXES

- ANNEX A INVENTORY OF SWIM PROJECTS FOR MASTER PLAN STUDY
- ANNEX B REVIEW OF EXISTING REPORTS AND DESIGNS, AND POST-EVALUATION STUDY OF COMPLETED SWIM PROJECTS
- ANNEX C CONCEPTS AND IMPLEMENTING GUIDELINES OF SWIM PROJECTS
- ANNEX D PRIORITY RANKING OF SWIM PROJECTS
- ANNEX E BASIC PLANNING CRITERIA FOR SWIM PROJECTS
- ANNEX F INSTITUTIONAL DEVELOPMENT
- ANNEX G LOCATION AND MAJOR FEATURES OF QUALIFIED SWIM PROJECTS
- ANNEX H COSTS AND BENEFITS ESTIMATES AND RE-CALCULATION OF ECONOMIC INTERNAL RATE OF RETURN (EIRR)
- ANNEX I TECHNICAL ASSESSMENT OF QUALIFIED SWIM PROJECTS
- ANNEX J IMPLEMENTATION SCHEDULE

DATA BOOK

LOCATION MAP OF QUALIFIED SWIM PROJECTS

SWIM PROJECT PROFILE

ABBREVIATIONS

(1) Organization

DPWH	Department of Public Works and Highways
DENR	Department of Environment and Natural Resources
DA	Department of Agriculture
DBM	Department of Budget and Management
PMO-SWIM	Project Management Office for SWIM in DPWH
NIA	National Irrigation Administration
NWRB	National Water Resources Board
FMB	Forest Management Board
NEA	National Electrification Administration
BFAR	Bureau of Fisheries and Aquatic Resources
BSWM	Bureau of Soils and Water Management
FSDC	Farm Systems Development Corporation (now PMO-DA)
SWIM-TWG	Technical Working Group for SWIM
NAPOCOR	National Power Corporation
IBRD	International Bank for Reconstruction and Development
IRRI	International Rice Research Institute
JICA	Japan International Cooperation Agency

(2) Others

GDP	Gross Domestic Product
IRR	Economic Internal Rate of Return
CIP/CIS	Communal Irrigation Projects/System
O&M	Operation and Maintenance
SWIM	Small water Impounding Management Projects
SWIP	Small water Impounding Projects
F/S	Feasibility Study
D/D	Detailed Engineering Designs
₱	Philippines Peso
¥	Japanese Yen
US\$	US dollar

(3) Measurement

<u>Length</u>	<u>Weight</u>
mm = millimeter	mg = milligram
cm = centimeter	g = gram
m = meter	kg = kilogram
km = kilometer	ton = metric ton
<u>Area</u>	<u>Electrical Measures</u>
cm ² = square centimeter	V = Volt
m ² = square meter	A = Ampere
ha = hectare	Hz = Hertz (cycle)
km ² = square kilometer	W = Watt
<u>Volume</u>	kW = Kilowatt
cm ³ = cubic centimeter	MW = Megawatt
l = liter	GW = Gigawatt
kl = kiloliter	<u>Other Measures</u>
m ³ = cubic meter	% = percent
MCM = million cubic meter	m ³ /s = cubic meter per second
	kWh = Kilowatt hour
	MWh = Megawatt hour
	kVA = Kilovolt ampere

CHAPTER I INTRODUCTION

1.1 Authority

This Report is prepared in accordance with the Implementing Arrangement (I/A) for the Master Plan Study on the Small Water Impounding Management (SWIM) Projects (the Study) agreed upon between the Department of Public Works and Highways (DPWH) and the Japan International Cooperation Agency (JICA) on December 9, 1987. The I/A is incorporated in this Report as Attachment - 1.

The Study was commenced in August 1988 and completed in March 1990. The Study was carried out in the following three phases:

- (1) Phase-I : Review and study on current status of the SWIM Projects (Aug.1988 - Mar.1989)
 - (1) Inventory of the SWIM projects
 - (2) Review and evaluation of the previous studies
 - (3) Post-evaluation of the completed projects

- (2) Phase-II : Preparation of criteria and guidelines for implementation and management of the SWIM projects (Jun.1989 - Sept.1989)
 - (1) Categorization of the SWIM projects
 - (2) Preparation of guideline for screening or priority ranking of SWIM Projects
 - (3) Preparation of basic planning criteria for SWIM Projects

- (3) Phase-III : Formulation of master plan which includes preliminary evaluation of each candidate project, priority ranking for implementation, action programs for next 10 years. (Sep.1989 - March.1990)
 - (1) Priority ranking of the projects for implementation
 - (2) Preliminary estimate of project cost and benefits
 - (3) Preparation of 10 Year Action Program

This Report presents all the results of the Study covering Phase-I, Phase-II and Phase-III, consisting of the following three (3) separate volumes; (1) Main Report, (2) Annex and (3) Data Book. This volume is the Main Report giving the summary of the Study.

1.2 Objectives and Scope of the Study

The objective of the Study is to formulate a master plan of the SWIM projects, aiming at orderly utilization of the nation's water and land resources. The Study widely covers all the Regions of the Republic of the Philippines.

The general work flow of the Study is illustrated on Fig.1.2.1

1.3 Plan of Operation for the Study

The Study has been carried out in three (3) Phases with a total period of 20 months from August 1988 to March 1990. The general work schedule of the Study is given in Fig.1.3.1. The Study has been executed jointly by the JICA Study Team comprising ten (11) experts and the counterpart personnel despatched from the government agencies concerned. The personnel participated in the Study is listed in Table 1.3.1. The following reports have been prepared during the course of the Study:

- (1) Plan of Operation : at the beginning of Phase-I (Aug. 1988)
- (2) Inception Report : two (2) months after commencement of Phase-I (Oct. 1988)
- (3) Progress Report : at the end of Phase-I (Mar. 1989)
- (4) Interim Report : at the end of Phase-II (Sept. 1989)
- (5) Draft Final Report : at the end of home work of Phase-III in Japan (Feb. 1990)
- (6) Final Report : within two (2) months after receiving comments on the Draft Final Report (Mar. 1990)

1.4 Activities during the Phase-I Period

The Study was commenced on August 28,1988. The Team submitted "Plan of Operation" to the Project Management Office for SWIM Projects (PMO-SWIM) on

August 29, 1988, and discussion was made on the same date between the Technical Working Group for SWIM Projects (SWIM-TWG) and the Team. The "Plan of Operation" was mutually agreed on between both parties, and the Minutes of Meeting on the Plan of Operation was prepared as shown in Attachment - 2.

In accordance with the "Plan of Operation", the Team made the following activities, together with the counterpart personnel, during the initial two months and prepared the "Inception Report":

- (1) Finalization of an inventory of the SWIM Projects proposed by the PMO-SWIM for the master plan study,
- (2) Preparation of an inventory of the completed and under-construction projects,
- (3) Collection of data and reports relevant to the SWIM Projects,
- (4) Field reconnaissance to some of the completed projects,
- (5) Listing the candidate projects for the Study,
- (6) Examination of the detailed work plan for the Phase-I study, and
- (7) Preparation of the Inception Report.

The Team submitted the "draft Inception Report" to PMO-SWIM and discussed the same with SWIM-TWG on October 24, 1988. The Inception Report was basically accepted by SWIM-TWG. The Minutes of Meeting on the Inception Report is shown in Attachment - 3. The final version of the Inception Report was submitted to PMO-SWIM on October 28, 1988, after incorporating all the comments raised by the SWIM-TWG members.

It was noted at the meeting that the Chairman of SWIM Committee (Mr. Romulo M. del Rosario, Undersecretary of DPWH) requested the Team to undertake the technical assistance regarding the required additional survey for the "before F/S projects, since most of these projects had not been supported by adequate data and information for the master plan study. The request was conveyed to JICA office for further consideration. In early December 1988, the Team was informed from the JICA headquarters that the required additional survey for 96 projects should be included in the Phase-I study and be made under the contracts with the local consultants. The contracts were finalized on December 21, 1989. The additional survey work was executed during the period from December 21, 1989 to March 31, 1989 under supervision of the Team.

After the Inception meeting, the Team was engaged in the following activities with assistance of the counterpart personnel for the period of one and half months, and

prepared the "Field Note on Phase-I" which shows the interim results of the Phase-I study.

- (1) Further review of the existing data and reports of the SWIM projects
- (2) Field inspection and data collection of the completed projects for the post-evaluation study
- (3) Analysis of data and information collected from the above (2)

The "Field Note on Phase-I" was explained to the SWIM-TWG members at the third monthly progress meeting on December 16, 1988 (see Attachment-8). The Team completed all the field work in the Philippines on December 23, 1988. After returning back to Japan, the Team continued further study mainly on the following items:

- (1) Review and evaluation of the existing data and reports
- (2) Post-evaluation study of the completed 10 projects
- (3) Preparation of work plan for Phase-II and Phase-III

JICA Study Team prepared the Progress Report incorporating all the results obtained from the Phase-I activities mentioned above, and submitted it to PMO-SWIM on March 6, 1989. The discussion on the Progress Report was made on March 8, 1989 between SWIM-TWG and the JICA Study Team. The Progress Report was fully accepted by the SWIM-TWG members (refer to the Attachment-4).

1.5 Activities during the Phase-II Period

The Phase-II study was commenced on June 23, 1989. The Team prepared the "Plan of Operation for Phase-II and Phase-III" in Japan. The Team arrived at Manila on July 3, 1989 and submitted the "Plan of Operation" to PMO-MFC/SWIM (PMO-SWIM was merged with PMO-MFC on June 1, 1989) on July 4, 1989. The discussion was made between the SWIM-TWG and the Team on July 6, 1989. The "Plan of Operation" was mutually agreed on between both parties, and the Minutes of Meeting on the Plan of Operation was prepared as shown in Attachment - 5.

In accordance with the agreed "Plan of Operation", the JICA Study Team classified and categorized the projects listed under Phase-I, and reported the results at the 4th monthly progress meeting on August 4, 1989 (see Attachment-9). The concept and definition of SWIM projects were confirmed during the discussions; namely, only one

type of SWIM projects were qualified as the SWIM projects, adhering to the basic concept of the SWIM projects that is generally defined as those small water impounding dams with a structural height of not more than 30 m and/or a volume of storage not exceeding 50MCM. In addition, the implementing guidelines for qualifying the proposed projects were newly adopted at the meeting. The results of discussions were further approved by the SWIM Committee and JICA office.

Based on the discussion mentioned above, the JICA Study Team prepared the draft "criteria and guidelines for implementation and management" by August 20, 1989. The JICA Study Team visited all the agencies concerned during the period of August 21 - 30 to discuss the draft criteria and guidelines, and finalized them incorporating the comments and suggestions obtained through the discussions. During the same period of August 21 - 30, three (3) experts of the JICA Study Team went back to Japan in order to report the work progress to the JICA headquarters.

The JICA Study Team submitted the "Interim Report" which deals with the results of Phase-II studies, to PMO-MFC/SWIM on September 15, 1989. The discussion meeting on the "Interim Report" was held between the JICA Study Team and SWIM-TWG on September 20, 1989. The "Interim Report" was fully accepted by the SWIM-TWG members (refer to the Attachment-6).

1.6 Activities during the Phase-III Period

The Phase-III study was commenced on September 21, 1989, in continuation with Phase-II. The field work in the Philippines under Phase-III includes:

- (1) Institutional studies on implementation and management of SWIM Projects
- (2) Priority ranking of qualified projects
- (3) Technical evaluation of qualified projects

The Team reported the initial results of the institutional studies at the 6th monthly progress meeting held on October 9, 1989. The proposed framework of institutional procedures for implementation of the projects was basically accepted by the SWIM-TWG (see Attachment-12).

The initial results of the priority ranking together with framework of 10 year action program were also reported at the 7th monthly progress meeting held on November 6,

1989 and preliminary discussions were made between the JICA Study Team and SWIM-TWG. Various comments and suggestions on the initial results were given to the Team at the meeting as shown in Attachment-13.

Based on the outcomes of the 7th monthly progress meeting, the Team prepared the "Field Note on Phase-III", which deals with initial results of the Phase-III studies, and submitted it to PMO-MFC/SWIM on November 17, 1989. The "Field Note on Phase-III" was explained to SWIM-TWG at the 8th monthly progress meeting held on November 27, 1989. The Field Note was fully accepted by SWIM-TWG members (see Attachment-14). The Team completed the studies in the Philippines on November 30, 1989.

After returning back to Japan, the Team continued further studies mainly on the following items:

- (1) Technical assessment of 230 qualified projects
- (2) Preparation of implementation schedule for 230 qualified projects
- (3) Construction cost estimates for 230 qualified projects including annual fund requirements for 10 years
- (4) Finalization of institutional studies on implementation and management of SWIM projects
- (5) Preparation of 10 year action program

The JICA Study Team prepared the Draft Final Report incorporating all the results obtained from the Phase-I, Phase-II and Phase-III activities mentioned above.

The Team submitted the Draft Final Report to PMO-MFC/SWIM on February 19, 1990 and discussed on the report with the SWIM-TWG members on February 21, 1990 (refer to Attachment-15). The Team received the comments on the report dated March 8, 1990 from DPWH which was prepared by PMO-MFC/SWIM after discussion with the SWIM-TWG members. This Final Report is prepared referring to those comments.

CHAPTER II BACKGROUND OF THE SWIM PROJECT

2.1 General Economic Situations of the Philippines

The Philippines has a total land area of about 300,000 km². The total population as of 1989 is estimated to be about 60.1 million. The population density is about 200 persons per km². The population growth rate is about 2.5% per annum on an average during the last decade. The total labour force as of 1989 is estimated at about 23.7 million or 64% of working-age population. Under-employment and unemployment are serious problem. Unemployment rate is officially estimated to be about 10% of the total labour force, while under-employment is put at over 30%. Future population is projected for the year of 2000 to be 75.2 million.

The Philippines economy has not realized the potential of its abundant natural resources, and its growth rate has tended to lag behind that of other middle income countries in Asia. The Government originally projected an average annual growth of 7.6% in GNP for the period 1978 - 82, but the performance was below this target and worsen in each of these years. The economic growth in 1983 was the lowest for over two decades, and over the next two years the economy went into sharp decline, to the point that by March 1986 it was officially estimated that two-thirds of the population were living below the poverty line, 15% of the labour force was unemployed and 45% underemployed and the outstanding external debt was US\$ 26.4 billion.

In December 1986, the Aquino Government set forth the Medium-Term Philippines Development Plan 1987 - 1992. The Development Plan is directed towards the following goals:

- (a) alleviation of poverty,
- (b) generation of more productive employment,
- (c) promotion of equity and social justice, and
- (d) attainment of sustainable economic growth.

GNP has been rising after the new government established. GNP as of 1987 is ₱ 708 billion (equivalent to US\$34 million) at current prices or about ₱ 12,000 (equivalent to US\$583) per capita; however, it is still below 1983 level. The Development Plan for 1987 - 92 projects the economic recovery to 1983 level by 1991.

The strategy of the Aquino Government is to enhance agricultural productivity, as the basis for self-sustaining economic growth. Agriculture is the most important sector, sharing about 30% of GDP, generating more than 60% of total export earnings and directly employing about 50% of the labour force. However, the farmers in rural areas continue to suffer from poverty. The rural-urban inequality has worsen over time as the ratio of average family rural income to average family urban income has declined from 0.67 in 1975 to 0.46 in 1985. In recent years, more than 80% of farming families are classified as belonging to the lower 30% income bracket.

Under such situations, the following objectives are emphasized for agricultural development in the Medium-Term Philippines Development Plan (1987 - 1992):

- (a) To enhance small farmers' income,
- (b) To sustain the increase in productivity,
- (c) To effect an equitable distribution of income,
- (d) To attain food self-sufficiency/self-reliance,
- (e) To create/increase employment opportunities in rural areas,
- (f) To improve the marketing system, and
- (g) To institutionalize the expanded participation of farmers.

The country is endowed with favorable climate, soils and labor force for agricultural production. However, the country is susceptible to the seasonal variation of rainfall. Water supplies are insufficient in the dry season and sometimes prolonged drought have brought about destructive damages to the agricultural production. In the wet season, frequent floods have caused serious damages to agricultural crops as well as the infrastructure which support the agricultural activities.

Mitigation of such natural disaster is quite essential for economic growth of the country as well as for enhancement of living standards of the rural people. The SWIM Projects are expected to mitigate such damages and thereby to improve the rural income.

2.2 Historical Overview of SWIM Projects

Pursuant to Presidential LOI No.898 dated July 29, 1979, a Small Water Impounding Management (SWIM) Committee was established for ensuring the effective and coordinated implementation of the development program for small catchment basin or impounding reservoirs. The SWIM Committee was chaired by the Ministry of Public Works (MPW). The main function of the Committee was to formulate and coordinate the operational policies and targets for the development of the SWIM Projects. Along with LOI No.898, a SWIM Technical Working Group (SWIM-TWG) was also established as a technical arm of the Committee. The TWG was chaired by the Task Force for Flood Control and Related Activities (TFFCRA) and consisted of several related agencies.

With the merger of the Ministry of Public Works and the Ministry of Public Highways in 1982, a Project Management Office for Small Water Impounding Management Projects (PMO-SWIM) was established under MPWH. In place of the TFFCRA, the Project Manager of PMO-SWIM was designated as the Chairman of SWIM-TWG.

Several hundred of the SWIM projects have been identified, however only 49 projects have been constructed and/or are under construction so far. The constraints for implementation of the SWIM Projects are manifold; it is recognized, however, that the most important key factors will be (1) insufficient studies and investigation for preparation of these projects and (2) lack of guidelines for the prioritization of these candidate projects. Hence, a master plan study is required to review the existing plans and designs and also to establish the criteria or guidelines for rating the project priority. The priority rating will play a key role not only for an orderly utilization of water and land resources but also for administrative purposes including budgetary arrangement for the implementation.

Under the above situations, the Government of the Philippines (GOP) has requested the Government of Japan (GOJ) to provide technical assistance for execution of the said master plan study. In response to the request of the GOP, JICA sent a preliminary survey mission headed by Mr. Sota Iwamoto to the Philippines in December, 1987. The I/A for the Master Plan Study was agreed upon and signed on December 9, 1987 between DPWH and JICA. The master plan study was commenced in August 1988.

In June 1989, PMO-SWIM was merged with PMO-MFC (Major Flood Control), and the SWIM projects are now managed under the office of PMO-MFC/SWIM. The

Project Manager of PMO-MFC/SWIM has been designated as the Chairman of SWIM-TWG.

The historical overview of the SWIM Projects is given in Table 2.2.1.

2.3 Purpose and Definition of SWIM Projects

The SWIM Projects are generally defined by the SWIM Committee as those small scale water impounding dams which have structural heights of not more than 30 m and/or a volume of storage not exceeding 50 million m³. The development of the SWIM Projects deserves attention because of quick yielding effects with relatively low capital investment needed for construction of small reservoirs compared to the much larger national projects and of its potential multi-oriented uses.

The GOP set forth the Medium-Term Philippines Development Plan for 1987-1992 in order to achieve the national development goals such as (1) alleviation of poverty, (2) generation of more productive employment, (3) promotion of equity and social justice, and (4) attainment of sustainable economic growth and put stress on the regional or community development to raise the people's living standard and to create new employment opportunity, especially in economically depressed regions.

The SWIM Projects have the following regional development purposes:

- (1) Acceleration of economic growth in less developed regions/areas and enhancement of living standards of rural people.
- (2) Creation of employment opportunity for rural people through the construction activities as well as operation and maintenance of the projects.
- (3) Promotion of efficient development and utilization of land and water resources by introducing a multi-purpose oriented development.
- (4) Contribution to mitigation of flood damages by creation of water impounding reservoirs.

The SWIM Projects are conceived as a major part of the national infrastructure programs towards the said national development goals and are expected to play an important role to ensure an accelerated rural development.

2.4 Organizational Set-up of SWIM Projects

The SWIM Committee is an autonomous body with the highest authority for implementation of the SWIM Projects, being responsible for (1) formulation of operational policies and targets, (2) approval of annual programs and budgets and (3) designation of implementing and/or cooperating agencies for each of the projects. The Committee is constituted by four (4) Departments with the Department of Public Works and Highways (DPWH) as Chairman, the Department of Environment and Natural Resources (DENR), the Department of Agriculture (DA), and the Department of Budget and Management (DBM).

The Technical Working Group (SWIM-TWG) is the technical and executive arm of the SWIM Committee under the chairmanship of the PMO-SWIM of DPWH, being responsible for coordination among the agencies concerned for (1) selection of the priority projects, (2) execution of feasibility studies and detailed engineering designs, (3) preparation of annual programs and budgets for implementation, and (4) project implementation and monitoring.

The SWIM-TWG is constituted by the technical representatives from eight (8) agencies; namely PMO-SWIM as the chairman, the National Water Resources Board (NWRB) as the co-chairman, the National Irrigation Administration (NIA), the Bureau of Soils and Water Management (BSWM), the National Electrification Administration (NEA), the Forest Management Bureau (FMB), the Bureau of Fisheries and Aquatic Resources (BFAR), and PMO-SWIM of DA (formerly FSDC).

The present organizational set-up for the SWIM Projects is shown in Fig. 2.4.1. The general work flow for implementation of the SWIM Projects is also shown in Fig. 2.4.2.

2.5 Current Activities of SWIM Projects

A total of 550 SWIM projects has been identified throughout the country, out of which 32 projects were already constructed and 17 projects are now under construction (as of March 1989). The remaining 501 projects are still under investigation and subject to further studies at various stages.

It is generally pointed out that:

- (1) the expected project returns have not been realized yet in most of the completed projects mainly due to lack of guidelines for operation and maintenance.
- (2) some of the completed projects were damaged or were washed out by occasional floods due to technical faults in designs and construction.
- (3) field survey and investigation are not fully performed due to budgetary constraints and/or lack of guidelines or criteria for planning and designs.
- (4) those projects under construction will not be completed as scheduled mainly due to budgetary constraints and other constraints such as land acquisition problems which are attributable to insufficient survey and investigation.

There still remains a considerable number of potential projects over the country for implementation. However, these projects are not properly identified mainly due to financial constraints and lack of definitive criteria for project planning and designs. Appropriate guidelines or criteria which can be applied to planning and designs of the SWIM Projects is therefore urgently required.

The master plan study is expected to contribute to improvement of the present SWIM Projects through (1) preparation of an inventory of SWIM Projects, (2) review of the existing plans and designs, (3) establishment of the guidelines for implementation and management and (4) preparation of action program for orderly implementation.

CHAPTER III CURRENT STATUS OF SWIM PROJECTS

3.1 Inventory of SWIM Projects

The lists of SWIM projects which have been identified, studied and/or implemented by implementing agencies as of September 1988 were submitted to the JICA Study Team through DPWH/PMO-SWIM by October 5, 1988. The total number of the proposed projects for implementation is 501. In addition to these proposed projects, there are 49 projects already constructed and/or under construction. The total number of the projects listed for the master plan study is 550. The inventory of these projects was prepared on the basis of those project lists, by grouping into the following two categories.

- (1) The candidate projects for implementation under 10 year action program
- (2) The candidate projects for the post-evaluation study

The lists of these candidate projects for implementation under 10 year action program are shown in Table 3.1.1 and those for the post-evaluation study in Table 3.1.2.

3.1.1 Candidate Projects for Implementation under 10 Year Action Program

The candidate projects for implementation under 10 year action program are all of the projects proposed by implementing agencies (501 projects in total) as follows:

Implementing Agency	Present Status			Total
	Before F/S	F/S	D/D	
PMO-SWIM	15	4	14	33
NIA	198	-	15	213
FMB	56	-	-	56
NEA	14	22	11	47
BSWM	-	-	152	152
Total	283	26	192	501

Note: Since FSDC was abolished in January 1988, the projects formerly managed by FSDC are included in the project list submitted by PMO-SWIM.

Locations of these candidate projects are indicated on Fig. 3.1.1 (LOCATION MAP).

3.1.2 Candidate Projects for Post-Evaluation Study

The projects already constructed and under-construction are 49, of which 32 projects have been constructed and the rest of 19 projects are under construction as shown below (see Fig. 3.1.2 LOCATION MAP):

Implementing Agency	Constructed		Under-construction	Total
	Function	Damaged		
PMO-SWIM	5	5	2	12
NIA	1	-	2	3
FMB	3	-	5	8
NEA	2	-	1	3
BSWM	6	-	4	10
FSDC	10	-	3	13
Total	27	5	17	49

Note: PMO-SWIM of DA is managing the under-construction projects in place of FSDC.

In due consideration of the following factors, the candidate projects for post-evaluation study were selected:

- (a) Implementing agency
- (b) Location (Region)
- (c) Scale of dam
- (d) Purpose of the project
- (e) Present condition (functioning or damaged or washed out)
- (f) Availability of the existing reports
- (g) Security in and around the project site

The selected projects for post-evaluation study are as follows:

No.	Name	Agency	Region	Present Condition
1.	Ilihan SWIP	NIA	VII	functioning
2.	Darapidap SWIP	BSWM	II	functioning
3.	Malinao SWIP	BSWM	VIII	functioning
4.	Pasig Timbu Watershed	FMB	III	functioning
5.	Mantayupan Falls SWIP	NEA	VII	functioning

6.	Bacnotan SWIP	FSDC	I	functioning
7.	Porac Dam	DPWH	III	damaged
8.	Kirong Dam	DPWH	III	damaged
9.	San Ramon Dam	DPWH	III	functioning
10.	Calanggaman SWIP	DPWH	VII	functioning

3.2 Classification of Candidate Projects

Of 501 proposed projects, 331 projects or 66% of all the projects, including 96 projects which are additionally surveyed/studied at Pre-F/S level under Phase-I, are currently supported by reports and designs.

Implementing Agency	Present Status			Total
	Before F/S	F/S	D/D	
PMO-SWIM	10	4	13	27
NIA	71	-	14	85
FMB	27	-	-	27
NEA	14	22	11	47
BSWM	-	-	145	145
Total	122	26	183	331

The available reports and designs were reviewed according to the following steps:

- (1) to prepare the "Project Format" (see Fig 3.2.1),
- (2) to fill up "Project Format", by transferring the data and information from the existing reports and designs,
- (3) to computerize the data and information of the "Project Format" in order to constitute database,
- (4) to classify the data and information in the "Project Format" by various categories, and
- (5) to review and evaluate the said data and information from technical and socio-economic points of view.

The proposed projects are classified in accordance with the results of the above review as given hereunder.

3.2.1 Classification by Implementing Agency

The candidate projects for implementation under 10 year action program are classified by implementing agency as shown below:

Agency	Number of Project	Distribution Rate (%)
DPWH	33	7
NIA	213	43
FMB	56	11
NEA	47	9
BSWM	152	30
TOTAL	501	100

NIA has the largest number of the candidate projects, followed by BSWM, FMB, NEA and DPWH.

3.2.2 Classification by Region

The candidate projects (501 projects) are classified by their located Region as shown below (Fig. 3.1.1, LOCATION MAP to be referred):

AGENCY	R E G I O N												TOTAL	
	I	II	CAR	III	IV	V	VI	VII	VIII	IX	X	XI		XII
DPWH	6	5	1	3	5	2	2	1	2	1	-	2	3	33
NIA	19	-	11	29	8	36	1	59	26	2	13	-	9	213
FMB	8	10	-	7	12	2	1	3	3	4	2	2	2	56
NEA	5	1	-	6	6	11	3	6	3	2	-	2	2	47
BSWM	25	28	6	17	5	5	8	13	10	7	10	9	9	152
TOTAL	63	4	18	62	36	56	15	82	44	16	25	15	25	501

The candidate projects presently supported by the existing studies and designs (331 projects) are distributed as shown below.

AGENCY	R E G I O N												TOTAL	
	I	II	CAR	III	IV	V	VI	VII	VIII	IX	X	XI		XII
DPWH	6	3	1	3	5	2	1	0	2	0	0	1	3	27
NIA	15	0	0	11	3	14	1	34	6	1	0	0	0	85
FMB	5	4	0	4	5	1	1	1	1	1	1	2	1	27
NEA	5	1	0	6	8	11	3	6	3	0	0	2	2	47
BSWM	24	28	6	17	4	5	8	9	9	7	10	9	9	145
TOTAL	55	36	7	41	25	33	14	50	21	9	11	14	15	331

The candidate projects are distributed over the country; however, the projects are not equally distributed to each Region.

3.2.3 Classification by Development Purposes

The projects are classified by their development purposes. Of 331 projects, 48 are single purpose projects and the rest or 283 projects are multi-purpose oriented as shown below:

AGENCY	MAIN PURPOSE					INCIDENTAL PURPOSE					
	IR	WM	MH	WS	TOTAL	IR	IF	FC	WM	MH	WS
DPWH	24 (-)	-	2 (-)	1 (-)	27 (-)	1	15	27	-	7	2
NIA	85 (-)	-	-	-	85 (-)	-	14	85	-	9	1
FMB	-	27 (-)	-	-	27 (-)	-	-	27	-	-	-
NEA	-	-	47 (47)	-	47 (47)	-	-	-	-	-	-
BSWM	144 (-)	-	-	1 (1)	145 (1)	-	142	142	144	-	-
TOTAL	253 (-)	27(-)	49 (47)	2 (1)	331 (48)	1	171	281	144	16	3

Note: IR: Irrigation
 IF: Inland fishery
 WS: Water supply
 WM: Watershed management
 MH: Mini-hydro power

The figures in parentheses show the number of single purpose projects.

All the projects proposed by NEA are single purpose (mini-hydropower), while almost all of the others are multi-purpose projects.

The projects proposed by NIA and BSWM are primarily geared to irrigation. The projects proposed by DPWH have also irrigation purpose; however, some projects have other main purposes such as mini-hydropower generation and water supply. The projects proposed by FMB are only for watershed management.

Flood control is the largest incidental purposes of the SWIM projects, irrespective of the implementing agencies. Other incidental purposes are; for DPWH, inland fishery, mini-hydropower and water supply; for NIA, inland fishery, mini-hydropower and water supply; for BSWM projects, inland fishery and watershed development.

3.2.4 Classification by Catchment Area

The projects are classified by the catchment areas at the proposed damsites as shown below:

AGENCY	CATCHMENT AREA (km ²)											TOTAL	
	0-10	<20	<30	<40	<50	<60	<70	<80	<90	<100	>100		Unknown*
DPWH	14	7	2	3	1	0	0	0	0	0	0	0	27
NIA	45	15	13	6	1	0	2	1	0	0	2	0	85
FMB	-	-	-	-	-	-	-	-	-	-	-	27	27
NEA	11	9	5	4	5	2	1	0	0	1	7	2	47
BSWM	144	0	0	0	0	0	0	0	0	0	0	1	145
TOTAL	214	31	20	13	7	2	3	1	0	1	9	30	331

Note: *no data available or not studied.

Most of the dams have small catchment areas in the range of 0.1 km² and 50 km²; especially, all the BSWM projects have smallest group of the dams with the catchment area of less than 10 km².

3.2.5 Classification by Dam Height

The projects are also classified by structural height of the dams as shown below:

AGENCY	DAM HEIGHT (m)								TOTAL
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	Unknown*	
DPWH	0	1	6	10	7	3	0	0	27
NIA	2	8	8	4	21	38	4	0	85
FMB	-	-	-	-	-	-	-	27	27
NEA	39	0	1	0	0	0	0	7	47
BSWM	3	58	76	7	0	0	0	1	145
TOTAL	44	67	91	21	28	41	4	35	331

Note: * no data available or not studied.

The SWIM projects are defined as those dams with structural height of less than 30 m. However, in case of some projects proposed by NIA, dam height exceeds this limit.

Almost all of the projects proposed by NEA have low dams with height of less than 5 m. Dam height of the BSWM projects are in the range of 5 m and 15 m, while those of DPWH dams are between 15 m and 30 m. The NIA dams are distributed in rather wide range of 10 m and 35 m. FMB projects are not classified by dam height, since their proposed project facilities are only check dams and other structures.

3.2.6 Classification by Storage Capacity

The SWIM projects is also defined in term of storage capacity as " those with storage capacity not exceeding 50 MCM". The following shows the classification of the projects by the storage capacity.

AGENCY	STORAGE CAPACITY (MCM)												TOTAL
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	Unknown*	
DPWH	16	7	1	0	1	0	1	0	0	0	1	0	27
NIA	28	19	13	6	5	2	3	3	0	1	5	0	85
FMB	-	-	-	-	-	-	-	-	-	-	-	27	27
NEA	-	-	-	-	-	-	-	-	-	-	-	47	47
BSWM	140	1	0	0	0	0	0	0	0	0	0	4	145
TOTAL	184	27	14	6	6	2	4	3	0	1	6	78	331

Note: * no data available or not studied.

The storage capacity of the candidate projects is generally small, indicating below 4 MCM. NEA has proposed the weir type dams which have no storage capacity. The largest storage capacity among the proposed projects is 32.7 MCM of the Bayawan SWIP proposed by NIA.

3.2.7 Classification by Embankment Volume

The embankment volumes of the SWIM projects are rather small; almost all dams (97%) have embankment volume of less than 300,000 m³. The largest embankment volume among the proposed projects is about 2.0 million m³ of the Aulo River SWIP proposed by DPWH.

AGENCY	EMBANKMENT VOLUME (MCM)												TOTAL
	0-0.1	0.1-0.2	0.2-0.3	0.3-0.4	0.4-0.5	0.5-0.6	0.6-0.7	0.7-0.8	0.8-0.9	0.9-1.0	>1.0	Un-known*	
DPWH	12	11	3	0	0	0	0	0	0	0	1	0	27
NIA	43	27	8	4	2	1	0	0	0	0	0	0	85
FMB	-	-	-	-	-	-	-	-	-	-	-	27	27
NEA	-	-	-	-	-	-	-	-	-	-	-	47	47
BSWM	138	1	0	0	0	0	0	0	0	0	0	6	145
TOTAL	193	39	11	4	2	1	0	0	0	0	1	80	331

Note: * no data available or not studied.

3.2.8 Classification by Development Scale

Irrigation is one of the important major purposes in the SWIM projects proposed by DPWH, NIA and BSWM. Its development scale varies project by project as well as agency by agency. The irrigation area proposed by each agency is summarized below:

AGENCY	Irrigation Area (ha)		
	Average	Minimum	Maximum
DPWH	277	21	1,000
NIA	411	5	3,000
BSWM	79	10	530

The SWIM projects are classified by irrigation area as presented below:

(Unit: nos of projects)

AGENCY	IRRIGATION AREA (HA)											TOTAL
	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1,000	>1,000	
DPWH	7	8	2	0	4	2	0	1	0	1	0	25
NIA	20	20	13	6	8	4	1	2	1	2	8	85
BSWM	124	16	2	1	0	1	0	0	0	0	0	144
TOTAL	151	44	17	7	12	7	1	3	1	3	8	254

DPWH, NIA and NEA have proposed mini-hydropower generation in their projects as one of development purposes. Proposed installed capacity by each agency is as shown below:

AGENCY	Installed Capacity (kW)		
	Average	Minimum	Maximum
DPWH	260	90	600
NIA	307	165	520
NEA	1,790	500	8,520

The installed capacity of the proposed projects is distributed as follows:

(Unit: nos of projects)

AGENCY	INSTALLED CAPACITY (kW)											TOTAL	
	0-200	200-500	500-1,000	1,000-1,500	1,500-2,000	2,000-2,500	2,500-3,000	3,000-3,500	3,500-4,000	4,000-4,500	4,500-5,000		
DPWH	5	3	1	0	0	0	0	0	0	0	0	9	
NIA	3	5	1	0	0	0	0	0	0	0	0	9	
NEA	0	1	18	7	9	5	2	2	0	0	1	2	47
TOTAL	8	9	20	7	9	5	2	2	0	0	1	2	65

3.3 General Features of Candidate Projects

General features of the candidate projects proposed by implementing agency are outlined hereunder.

3.3.1 SWIM Projects Proposed by DPWH

The DPWH projects aim at uplifting the public welfare in rural areas, centering on the construction of small water impounding reservoirs in their development plans. Reflecting this basic policy, the DPWH projects are generally of multi-purposes nature, and include various activities in their development plans which are suitable to the areas and will accelerate the rural economy.

The proposed dams is of medium scale like those of NIA, with the average dam height of 20 m. Development scale of irrigation and mini-hydropower plans is also medium as compared with those projects proposed by NIA and NEA. Inland fishery is included in most of the proposed projects. The main feature of the DPWH projects are summarized as follows:

Item	Unit	Range	Average
Dam Type	Zoned Earthfill of reservoir type		
Dam Height	m	10 - 29	20
Storage Capacity	MCM	0.2 - 11	2.2
Irrigation Area	ha	21 - 1,000	370
Install Capacity	kW	90 - 900	260
Inland Fishery	ton/year	10 - 1,470	460

Direct benefits are expected not only from main purposes, but also from incidental purposes except for flood control, because direct benefit from flood control is very nominal in consideration of small-scale reservoir capacity. Indirect benefits such as flood control, cost savings in health services, raising the income level of the farmers, recreational value of the dam, etc. are also considered in formulation of the projects.

3.3.2 SWIM Projects Proposed by NIA

The NIA projects are mainly formulated as irrigation development project to supply dependable water to the existing communal irrigation systems (CIS) and communal irrigation projects (CIP). Incidental purposes such as mini-hydropower and inland fisheries are also planned in some projects. The CIS and CIP are generally defined as follows:

Item	Irrigation Area	Status
CIS	less than 1,000 ha	existing system
CIP	less than 1,000 ha	before implementation

NIA has implemented CIS and formulated CIP so far in the Philippines nationwide by their own funds. Total irrigation service area covered by CIS is 709,000 ha which corresponds to 47 % of total irrigation service area, 1,524,000 ha, in the Philippines as of December 1987. Due to lack of regulating facilities upstream of service areas, all CIS's suffer from shortage of irrigation water especially in the dry season. Under such situation, the SWIM projects are expected to be countermeasures for such problems by creating new water resources for the CIS and CIP.

The NIA projects are characterized as comparatively large-scale project. The main features of the projects are summarized as follows:

Item	Unit	Range	Average
Dam Type	Zoned Earthfill of reservoir type		
Dam Height	m	2 - 33	24
Storage Capacity	MCM	0.01 - 33	3.2
Irrigation Area	ha	5 - 3,000	410
Install Capacity	kW	165 - 520	310

3.3.3 SWIM Projects Proposed by FMB

Purpose of the FMB projects is watershed management accompanied by incidental purpose of flood control.

Forest area in the Philippines is about 15.9 million ha which corresponds to 53% of the whole country area. During the past decade, the forest area of 6.5 million ha have been denuded by felling, shifting cultivation and forest fire. The Government of the Philippines has promoted the reforestation projects and the conservation works for proper maintenance of the watersheds through the SWIM program on a long-term basis.

The SWIM projects proposed by FMB mainly consist of three (3) measures; (i) engineering measures, (ii) vegetative measures, and (iii) a combination of these two measures (it is called vengineering measures). Engineering measures comprise construction of the infrastructures such as check dams, terraces, ripraps, etc., aiming at conserving soil, water, and forest resources. Vegetative measures mean the reforestation works for the denuded areas in the watersheds.

The projects are implemented under direct management of FMB. During the course of implementation of projects, FMB employs the local people as labor force, giving them income generating opportunity.

The FMB projects are expected to generate following benefits.

- (1) Flood mitigation
- (2) Erosion control in the watershed
- (3) Mitigating the fluctuation of river bed (sedimentation and scouring)
- (4) Enforcement of water holding capacity in the watershed.

However, any direct benefit is not counted in economic evaluation of the FMB projects, since such benefits are intangible and hardly quantified.

3.3.4 SWIM Projects Proposed by NEA

The NEA projects are formulated with a single purpose of mini-hydropower generation. The main features of the NEA projects are summarized as follows:

Item	Unit	Range	Average
Dam Type	Concrete weir of run-of-river type		
Install Capacity	kW	not more than 5,000kW	1,800
Gross Head	m	3 - 280	103

All the projects are of run-of-river type, not regulating the natural river flow by reservoir. The main components of the project facilities are as follows:

- (1) Concrete weir and intake structure
- (2) Power tunnel and forebay
- (3) Surge-tank and penstock
- (4) Power house and power plant
- (5) Tailrace

(Substation and transmission line are not included in the project components.)

After completion of the projects, all the facilities are transferred to the Electrical Cooperatives who amortize the investment cost to NEA. The Cooperatives make O&M of the projects and supply electricity to the surrounding rural area.

3.3.5 SWIM Projects Proposed by BSWM

The BSWM projects aim at small scale agricultural development in small river basins. The BSWM projects are conceived directly to serve the farmers who live in the small river basins and have not benefited from irrigation so far and are left behind economically. Various activities which are suitable to the areas and will accelerate the rural economy, are included in their development plans. The BSWM projects are therefore multi-purpose oriented, centering on the small scale irrigation development. The main features of the BSWM projects are summarized as follows:

Item	Unit	Range	Average
Dam Type	Homogeneous earthfill of reservoir type		
Dam Height	m	0.5 - 19	10
Storage Capacity	MCM	0.01 - 1.1	0.2
Irrigation Area	ha	10 - 530	80
Inland Fisheries	ton/year	0.6 - 32	7
Watershed Development	ha	12 - 690	100

The BSWM projects has a incidental purpose of the watershed development which will give another income-generating opportunity to the occupants already settled in the watershed areas as well as the resettlers from the prospective reservoir areas.

3.4 Post-Evaluation Study on Completed SWIM Projects

3.4.1 Method and Work Flow of Post-Evaluation Study

In order to carry out the post-evaluation study, all the data and information on plans and designs of the listed projects were collected through the relevant agencies. Visits to the selected projects sites were jointly made by the Team and the counterpart personnel in November 1988. The site inspection was satisfactorily completed without any security problem.

The Team, however, faced to the difficulties in collecting the reliable data and information on the selected projects. At the time of site inspection, the Team distributed the questionnaire specially designed for each completed project to the site office of each agency concerned and asked the office to fill up the questionnaire. The answers were submitted to the Team by the end of November, 1988. In general, the answers have not fulfilled the requirement of the Team for the post-evaluation study, because the projects were already handed over from each agency to the individual cooperatives who operate the projects and most of the data and information were not kept properly by each agency any more.

3.4.2 Completed Projects for Post-Evaluation Study

Based on the collected data, the post-evaluation study was made on the selected 10 projects. The general features of the projects are summarized in Table 3.4.1 and the

results of the post-evaluation study for the respective projects are shown in Table 3.4.2. The general conditions of these projects are described below:

(1) Project Implementation

In general, the each implementing agency has implemented the project from its identification to construction, except two (2) projects; the San Ramon and Calanggaman projects which were first studied by BSWM and transferred from BSWM to DPWH at construction stage. The construction works of the Calanggaman project was undertaken by the Bohol Provincial Irrigation Office of NIA. The Ilihan project undertaken by NIA, was implemented without feasibility study on political reason.

(2) Present Status of Major Facilities

Present status of each project is summarized as follows:

Project	Dam	Irrigation	Power/Others
Ilihan	Functioning	Functioning	-
Darapidap	Functioning	Functioning	-
Malinao	Functioning	Not completed	-
Pasig Timbu	-	-	Not monitored
Mantayupan	Functioning	-	Functioning
Bacnotan	Functioning	Functioning	-
Porac	Washed out	Not constructed	Not functioning
Kirong	Damaged	-	Not functioning
San Ramon	No functioning	Not constructed	-
Calanggaman	Not completed	Not constructed	-

As seen from the above, the projects which is functioning well, are only four (4); namely, the Ilihan (NIA), Darapidap (BSWM), Mantayupan (NEA) and Bacnotan (FSDC) projects. In the remaining projects, the project returns are not fully attained compared to the targets which have been set up before construction.

(3) O&M System

Present O&M systems of the completed projects are summarized as follows:

Project	Dam	Irrigation	Power/Others
Iliban	NIA / IA	IA	-
Darapidap	FC	FC	-
Malinao	IA	IA	-
Pasig Timbu	-	-	District Office
Mantayupan	CEBECO	-	CEBECO
Bacnotan	ISA	ISA	-
Porac	Not managed	Not managed	Not managed
Kirong	Not managed	-	Not managed
San Ramon	Not organized yet	Not organized yet	-
Calanggaman	Not organized yet	Not organized yet	-

Note: CEBECO: Cebu Electric Cooperative Inc.
IA: Irrigators Association ISA: Integrated Services Association
FC: Farmers Cooperative

Most of the projects were transferred to the Irrigators Associations and/or Farmers Cooperatives after completion of the projects for their operation and maintenance of the project facilities. No Irrigators Associations and/or Farmers Cooperatives are organized in those projects damaged such as the Porac and Kirong projects.

3.4.3 Major Findings of Post-Evaluation Study

The major findings on engineering aspects obtained from the post-evaluation study are briefed hereunder.

(1) Planning Stage:

- (a) Dam plans are generally well prepared. The survey and investigation are concentrated into the dam and reservoir plans.
- (b) Development plans for flood control as well as for utilization of the reservoir water such as irrigation, mini-hydropower and inland fisheries are not fully examined.
- (c) Socio-economic aspects such as living conditions of beneficiaries, market demand of the products, water right, land tenure conditions of reservoir areas and irrigation areas, etc. are not sufficiently surveyed and studied
- (d) hydrological studies on water resources are not fully made due to the general difficulties involved in data collection.
- (e) The development plans are neither explained to nor confirmed with the people to be influenced before construction.

(2) **Detailed Engineering Design Stage:**

- (a) The dam body itself is generally well-designed.
- (b) In case of large dams, the appurtenant structures are not designed based on the detailed field investigation.
- (c) Project facilities other than the dam and its appurtenant structures, are not included in the detailed engineering designs.

(3) **Construction Stage:**

- (a) Construction period is often prolonged.
- (b) Insufficient technical guidance in construction stage coupled with some faults in dam designs result in the fact that some dams have been damaged or washed out after construction.
- (c) Construction plan of dam is always advanced, and it is not well harmonized with the development plan in the downstream area.

(4) **Operation and Maintenance (O&M) Stage:**

- (a) In general, the SWIM projects have contributed much to the beneficiaries in the rural areas through the following aspects:
 - increased crop and fish production,
 - stable supply of power energy,
 - improvement of nutrition condition,
 - creation of employment opportunity,
 - increased income level, and thereby
 - enhancement of living standard.
- (b) No guidelines and/or criteria for O&M have been established.
- (c) Only the projects that O&M system is established, are successfully operated.
- (d) Insufficient number of technical staff often makes proper O&M system difficult, and
- (e) Shortage of annual budgets for proper O&M is often observed.

3.5 Present Institutional Framework and Procedures for Implementation of SWIM Projects

3.5.1 SWIM Committee

In order to ensure the effective and coordinated implementation of the SWIM Projects, an inter-agency Small Water Impounding Management (SWIM) Committee was established by the President's Letter of Instruction No. 898 dated 25 July, 1979.

In July 1987, the SWIM Committee was re-organized in line with the new policy for re-structuring of government offices and is presently constituted by the top-echelon officials each from:

Department of Public Works and Highways	: Chairman
Department of Environment and Natural Resources	: Member
Department of Agriculture	: Member
Department of Budget and Management	: Member

The SWIM Committee is an autonomous body. The Undersecretary of DPWH, Mr. Romulo del Rosario has been concurrently designated as the chairman of the Committee since 11 August, 1988. The Committee has been responsible for the following major functions:

- (1) formulation and coordination of operational policies and targets for the development of SWIM projects,
- (2) interfacing activities with the programs for Bagong Lipunan Sites and Services (BLISS), livelihood, energy development, food production, water supply, flood control, erosion control, and watershed management,
- (3) determination of priority areas for SWIM development,
- (4) adoption of annual SWIM integrated programs and budgets,
- (5) selection of the lead implementing agency and cooperating agencies for each SWIM project,
- (6) overall coordination and supervision of SWIM programs implementation, and
- (7) regular reporting to the President on the performance and progress of the SWIM projects.

3.5.2 Technical Working Group

The Technical Working Group (TWG) for implementation of the SWIM programs was also established under the Ministry of Public Works by the President's Letter of Instruction No. 898 dated 25 July, 1979 to serve as the technical and executive arm of the SWIM Committee.

In July 1982, a Project Management Office for SWIM projects (PMO-SWIM) was established in DPWH. The PMO-SWIM office is headed by a Project Manager, who is concurrently the chairman of the Technical Working Group (TWG). After creation of the PMO-SWIM, the Technical Working Group was also re-organized and is presently constituted by the representatives each from:

PMO-SWIM	: Chairman
National Water Resources Board (NWRB)	: Co-chairman
Department of Public Works and Highways (DPWH)	: Member
National Irrigation Administration (NIA)	: Member
Farm Systems Development Cooperation (FSDC)	: Member
National Electrification Administration (NEA)	: Member
Bureau of Soils and Water Management (BSWM)	: Member
Forest Management Bureau (FMB)	: Member
Bureau of Fisheries and Aquatic Resources (BFAR)	: Member
Department of Budget and Management (DBM)	: Member

The present activities of TWG are rather limited mainly due to financial constraints; however, the TWG has been expected to be responsible for the following:

- (1) identification, selection and approval of the projects submitted by the agencies for inclusion in the SWIM program,
- (2) review and preparation of approval and/or recommendation for the project studies, surveys and designs undertaken or to be undertaken by the agencies,
- (3) preparation of annual SWIM integrated programs and budgets, and
- (4) monitoring and coordination of project construction in accordance with the policies, guidelines and programs adopted by the SWIM Committee.

3.5.3 Implementing Agencies

Six (6) implementing agencies have been involved in the implementation of the SWIM projects; they are PMO-SWIM, NIA, BSWM, NEA, FMB and FSDC (FSDC was abolished in January 1988; therefore five (5) agencies are participating in the SWIM program at present as the implementing agencies.). These implementing agencies are outlined hereinafter.

(1) Project Management Office (PMO-SWIM)

The Project Management Office of the Department of Public Works and Highways (PMO-SWIM / DPWH) was created on July 1, 1982. A Project Manager heads the office which is concurrently the chairman of the Technical Working Group. Major functions of this office are:

- (1) to supervise, monitor and coordinate the implementation of SWIM projects,
- (2) to develop standards and guidelines for planning, programming and prioritizing of the SWIM projects, and
- (3) to develop standards, criteria and guidelines for all technical activities involved in planning, design, construction, utilization and operation and maintenance of the facilities under the SWIM projects.

Since its inception, PMO-SWIM has been responsible for use of the SWIM project fund which is being financed from the regular annual budgetary allocation of DPWH. The SWIM project fund has been utilized for construction of the SWIM projects as well as the feasibility studies and detailed engineering designs. The total budget for the SWIM project over the period of 1982-1988 was about ₱300.8 million or about ₱43.0 million per annum on an average which correspond to about 2% of the total annual budget of DPWH (₱2,018 million per annum on an average).

PMO-SWIM is a coordinating body for implementation of the SWIM projects; however, at the same time it is also concurrently one of the implementing agencies. PMO-SWIM has implemented 12 SWIM projects so far, out of which 10 projects were completed and two (2) projects are under construction

(2) National Irrigation Administration (NIA)

NIA was created out of the Irrigation Division of the Bureau of Public Works by the Republic Act No.3601 (NIA Charter) on June 17, 1963. The NIA Charter was amended by the Presidential Decree No.552 on September 11, 1974 and NIA was granted the broader power and authority to undertake more comprehensive water resources development projects for irrigation purpose as well as concomitant activities such as flood control, drainage, land reclamation, hydropower development, etc. The Presidential Decree No.552 was further amended by the Presidential Decree No.1702 on July 18, 1980 and capitalization of NIA was allowed up to ₱10,000 million.

Major functions of NIA are:

- (1) to support the government policy on self-sufficiency in food,
- (2) to maintain a satisfactory level of irrigation services,
- (3) to catalyze development in the rural areas, and
- (4) to implement its capital investment construction program in a cost-effective manner.

NIA has implemented three (3) SWIM projects so far; one has been completed and other two projects are still under construction.

(3) Bureau of Soils and Water Management (BSWM)

BSWM was created from the former Bureau of Soils by virtue of the Executive order No.116 dated January 30, 1987 as one of the staff offices under the Department of Agriculture. The former Bureau of Soils was established by the Executive Order No.216 in January 1957.

Major functions of BSWM are:

- (1) to advice and render assistance on the matters relative to the utilization and management of soils and water as vital agricultural resources,
- (2) to formulate measures and guidelines for effective utilization and management of soil, land and water resources as well as soil conservation in agricultural areas,
- (3) to coordinate with relevant agencies in resettlement areas and prepare the necessary plans for provision of technical assistance in the development of

water impounding projects, prevention of soil erosion, fertility preservation and other related matters,

- (4) to undertake soil land capability studies, and
- (5) to recommend the plans, programs, policies, rules and regulations for the soil and water management sector, to the Secretary for Department of Agriculture.

BSWM has implemented 10 SWIM projects so far; six (6) have been completed and the other four (4) projects are still under construction.

(4) National Electrification Administration (NEA)

NEA was created under the Department of Energy in August 1969 by virtue of Republic Act No.6038. NEA is a government agency under the Department of Environment and Natural Resources empowered and is directed to undertake the rural electrification programs on an area coverage basis with electric cooperative as the primary medium to achieve the objectives of making electric services available throughout the nation. NEA makes long-term, low interest loans to electric cooperatives for area-wide services as well as provides technical assistance in engineering, construction, organization, accounting, legal matters and operations.

In particular, the functions of NEA are:

- (1) to make loans to the electric cooperatives for the construction or acquisition, operation and maintenance of mini-hydropower generation, transmission and distribution facilities and all related properties, and
- (2) to invest or grant loans for development of power generation including mini-hydro power plants and water impounding reservoir.

NEA has implemented three (3) SWIM projects so far; two (2) have been completed and other one project is still under construction.

(5) Forest Management Bureau (FMB)

FMB was created by the Presidential Decree No.705 dated May 19, 1975. FMB has jurisdiction and authority over all forest land, grazing land and all forest reservations including watershed reservations. FMB has been entrusted with the following responsibility:

- (1) to protect, develop, manage and re-generate all forest land,
- (2) to regulate and supervise the operation of licenses, lessees, and permittees, for the taking or use of forest products therefrom or the occupancy or use thereof, and
- (4) to enforce laws, rules and regulations for forestry, reforestation, parks, game and wildlife.

FMB has implemented eight (8) SWIM projects so far; three (3) have been completed and the other five (5) projects are still under construction.

(6) Farm Systems Development Corporation (FSDC)

FSDC was created on April 4, 1975 under Presidential Decree NO.681 and abolished in January 1988. FSDC implemented 14 SWIM projects so far out of which 11 projects were completed and three (3) projects are still under construction. The completed projects were transferred to the farmers cooperatives called "Integrated Services Associations (ISA)". The on-going three (3) projects were transferred to the Project Management Office under the Department of Agriculture for completion. All other studies and designs of the projects before construction were transferred to PMO-SWIM of DPWH for further consideration.

3.5.4 Cooperating Agencies

NWRB and BFAR are the cooperating agencies in the SWIM program. These agencies are not directly involved in implementation of the SWIM projects. However these agencies have cooperated with the implementing agencies for making plans and designs as well as operation and maintenance of the projects.

(1) National Water Resources Board (NWRB)

The National Water resources Council (NWRC) was created on March 28, 1974 under Presidential Decree No.424. NWRC, which is now the National Water Resources Board (NWRB) pursuant to Executive Order No.124-A, is a body responsible for coordinating and integrating all activities related to water resources development and management. Its principal objective is to achieve a scientific and orderly development and management of all the water resources of the nation consistent with the principles of optimum uses, conservation and protection to meet present and future needs. The