5. 6 Settlement Plan

The Tagumpay Settlement, established in 1954, was identified as an area for developing a model agrarian reform community from government-owned lands transferred to the DAR. It was in 1990 when the Bureau of Corrections of the DOF, transferred the settlement area to the DAR for distribution under the CARP, that the farmers of the settlement area became legitimate owners of the land. The farmer beneficiaries were mostly deserving colonists from the Iwahig Penal Colony.

In the Feasibility Study stage, the DAR and JICA have agreed to include in its scope the development of the adjoining farms/ areas, (referred to in the study as the outlying area) and again the DOJ effect the transfer of said land to the DAR. The distribution of lands in the outlying area have not yet taken place and the DAR plans to distribute the remaining lands to the farmer beneficiaries after the completion of the Study.

For the distribution of the farm lot area in the outlying area, the DAR have indicated giving first priority to former inmates of the Iwahig Penal Colony. Other intended beneficiaries are the retired employees of any penal colony in any part of the country who are interested and willing to till the land and landless farmers within and around the settlement areas. Since the general intention of the DAR is to provide land to the landless, it is recommended that only retired employees without any farm land anywhere in the country should become farmer beneficiaries. The distributed land of 3.0 ha inclusive home lot area, could be the area with a land slope of less than 18 % taking into consideration environmental conservation.

5. 7 Cost Estimate

5. 7. 1 Unit Cost

Basic unit prices of major labor and construction materials, and unit construction costs of major works are adopted from the current unit price and unit cost of NIA as of January 1994. (refer to Appendix K)

Foreign and local currency portion on major construction materials are separated based on NEDA's information as follows ;

Materials	Foreign (%)	Local (%)
Aggregate	80	20
Lumber	40	60
Reinforcing bar/Nail/Hardware	90	10
Cement	80	20
Asphalt/Bituminous	80	20
Fuel	80	20
R. C. products	70	30
Steel plate/Angle/Pipe	90	10
Equipment	80	20

5. 7. 2 Composition of Project Cost

The project cost was estimated with the following components ;

Project Cost
- (1) Construction Cost
  - (1-1) Direct Construction Cost
    - (1-1-1) Preparatory works
    - (1-1-2) Civil works
  - (1-2) Indirect Cost
- (2) Associated Cost
  - (2-1) Land Acquisition and Compensation Cost
  - (2-2) Pre-engineering Cost
  - (2-3) Administration Cost
  - (2-4) Consulting Services Cost
- (3) Physical Contingency
- (4) Price Contingency

a) Preparatory Work Cost

The cost for preparatory works includes costs for temporary works (access roads, coffer dam, diversion channels, water supply, electric wiring, protection facilities for environmental pollution, contractor's camp facilities, drainage facilities, etc.), preparation of shop drawings, laboratory tests, etc.

b) Civil Work Cost

The civil work cost covers costs for building and installation of facilities and devices comprising of labor, construction materials, fuel and depreciation of equipment costs.

c) Indirect Cost

The indirect cost includes the over-head, profit, mobilization and demobilization cost, and tax. Based on DPWH's guideline, Order No.30 series of 1991, 20 % of a total direct construction cost which is applied in case of above 50 million pesos of direct cost was employed in this cost estimate.

d) Land Acquisition and Compensation Cost

The costs for land acquisition of facilities and reservoir, resettlement works and cost for damage to improvements will be included under this item. But the cost for this item was not estimated in general, because the land for the project facilities including preparatory facilities will be offered by DAR.

e) Pre-engineering Cost

The pre-engineering cost means necessary costs for topo-survey, meteorological and hydrological observation, geological investigation, etc. to be conducted prior to and/or during the detailed design stage.

f) Administration Cost

The administration cost contains salaries and wages of offices, miscellaneous costs for administration, fuel and light expenses, water charge,

etc. during the implementation period. Ten (10) percent of the total construction cost is adopted as the administration cost.

g) Consulting Services Cost

The expenditure for detailed design for facilities, preparation of tender documents and supervision works during the implementation stage will be required especially for water resources works as consulting cost.

h) Physical Contingency

Physical contingency is estimated at three (3) to seven (7) percent of the base cost which is the sum of construction cost and associated cost in accordance with NEDA's guideline.

i) Price Contingency

Price escalation is estimated at one (1) percent per annum for the foreign currency portion and five (5) percent per annum for the local currency portion as per NEDA's guidelines.

5.7.3 Project Cost

The project cost consists of two (2) stage project costs. The first stage project cost amounts to 415.3 million pesos (foreign currency portion, 249.7 million pesos and local currency portion 165.6 million pesos). The second stage project cost is 1,265.7 million pesos (foreign currency portion 618.9 million pesos and local currency portion 646.8 million pesos). (refer to Table 5.7.1 and 5.7.2)

Table 5. 7. 1 Summary of Project Cost (Stage I)

Description	Total Cost ('000 peso) Total	F/C	L/C	Remarks
1. Construction Cost				
1.1 Water Resources	203,280	131,476	71,804	
1.2 Irrigation and Drainage Facilities	36,923	24,301	12,622	
1.3 Farm to Market Roads (Main 1 - 4)	19,562	12,905	6,657	
1.4 Social Infrastructures	12,218	8,424	3,794	
1.5 Post Harvest Facilities	16,949	11,866	5,083	
Sub-total	288,932	188,972	99,960	
2. Association Cost				
2.1 Pre-engineering Cost	14,447	8,668	5,779	5% of 1.
2.2 Administration Cost	28,893	11,557	17,336	10% of 1.
2.3 Consulting Services Cost	28,893	17,336	11,557	10% of 1.
Sub-total	72,233	37,561	34,672	
Total (1. to 2.)	361,165	226,533	134,632	
3. Physical Contingency	25,282	15,857	9,424	7% of 1. to 2.
4. Price Contingency	28,880	7,272	21,608	3% of 1. to 3. F/C 15% of 1. to 3. L/C
Grand Total	415,327	249,662	165,664	

Table 5. 7. 2 Summary of Project Cost (Stage II)

Description	Total Cost ('000 peso) Total	F/C	L/C	Remarks
1. Construction Cost				
1.1 Water Resources	525,090	355,960	169,130	
1.2 Irrigation and Drainage Facilities	-	-	-	
1.3 Farm to Market Roads (Lateral)	38,349	25,053	13,296	
1.4 Social Infrastructures	43,347	17,119	26,228	
1.5 Post Harvest Facilities	24,608	18,421	6,187	
Sub-total	631,394	416,553	214,841	
2. Association Cost				
2.1 Pre-engineering Cost	31,570	18,942	12,628	5% of 1.
2.2 Administration Cost	63,139	25,256	37,884	10% of 1.
2.3 Consulting Services Cost	63,139	37,884	25,256	10% of 1.
Sub-total	157,849	82,081	75,767	
Total (1. to 2.)	789,243	498,634	290,608	
3. Physical Contingency	55,247	34,904	20,343	7% of 1. to 2.
4. Price Contingency	421,193	85,366	335,827	16% of 1. to 3. F/C 108% of 1. to 3. L/C
Grand Total	1,265,683	618,905	646,778	

CHAPTER 6. PROJECT IMPLEMENTATION AND OPERATION

CHAPTER 6. PROJECT IMPLEMENTATION AND OPERATION

6. 1 The Executing Body

The lead executing agency is the DAR. An Executive Coordination Committee (ECC) who will consists of representatives from DAR Central office, DAR Regional office, NIA-CARP Office, DA, DAR Provincial Office, Governor of Palawan province, Mayor of Puerto Princesa city and MARO of Puerto Princesa, shall be organized to coordinate and facilitate activities of various agencies concerned and to guide and direct the Project Management Office (PMO). An executing body, the PMO will be established at the DAR Palawan Provincial Office (DPPO). The PMO shall be composed of the DAR Provincial Agrarian Reform Officer (PARO) as chairman with the NIA Provincial Irrigation Engineer (PIE), Municipal Agrarian Reform Officer (MARO), the LGU, the NGO, etc. as members. The PMO will be assisted by a support staff composed of water resources engineer, irrigation/drainage engineer, road engineer, water supply engineer, post harvest expert, etc. from existing personnel of DPPO and/or from concerned agencies, such as, NIA, LGU, etc.

The PMO shall be assisted by the Consultants to provide proper guidance, technical supervision and monitoring of project activities. (refer to Figure 6.1)

6. 2 Project Implementation Schedule

a) Consulting Services

The DAR can employ consulting engineers for implementing the detailed design, preparation of tender document and supervision of construction works after the Feasibility Study. The consultants associated with engineers and experts in the field of hydrology, rivers, roads, irrigation, water supply, post harvest, soil mechanics, geology, cost estimates and tendering, etc. shall assist the DAR in the review of project planning, detailed design of water resources and irrigation facilities, rural infrastructures and post harvest facilities, preparation of construction schedule, cost estimate,

preparation of bid documents, tendering and contracting, quality control of construction works and general supervision of the project implementation.

b) Implementation Mode

The construction of irrigation facilities, rural infrastructures and post harvest facilities are scheduled to be completed by 1997/98 as a first stage development. Considering the procurement of huge amounts of construction materials and equipment, and mobilization of a large labor force during such short construction period, it is recommended that works will be carried out on contract basis against force account basis.

c) Implementation Schedule

The integrated project will be implemented in two (2) stages. The first stage development program with the purposes of which are to stabilize settlement of farmer beneficiaries and to introduce irrigated agriculture, consists of a water resources facility available for 130% cropping intensity, irrigation and drainage facilities, main farm-to-market road, rural water supply facility and a part of post harvest facilities. Such facilities will be completed by the end of 1997/1998.

The second stage development program, which will be started within 20 years after implementation of the first stage development, consists of new water resources facilities available for 200% cropping intensity, lateral farm-to-market road, social infrastructures excluding rural water supply facility and remaining post harvest facilities. The second stage development will be implemented after the farmers have improved their income through irrigated agriculture. Implementation will be based on readiness of the farmer beneficiaries and agencies concerned to implement the project.

6.3 Operation and Maintenance of the Project

Prior to the implementation of the Project, various organizations related to the operation and maintenance of the project facilities to be provided in the Settlement Area, will be organized, assisted, strengthened by DAR and other concerned agencies like the NIA, LWUA, LGU, NGO, etc. The concerned agencies will provide the necessary training, skills, and techniques needed to promote the effective participation of farmer beneficiaries in the operation and maintenance of the projects.

After completion of the project facilities, an Operation and Maintenance Section is proposed to be added to the existing set-up of the PMO to assist, monitor and evaluate the activities of the farmer's organization tasked with the operation and maintenance of the project facilities. The monitoring function of the PMO will be transferred to the PDMS Monitoring Division after five (5) years of operation, hence the organization of the PMO terminates after five (5) years of operation. It is expected that by this time the farmer's organization would have become fully developed, operational and matured to undertake other activities on their own. Assistance will still be provided to the farmer beneficiaries by concerned agencies, when needed. (refer to Figure 6.1.2)

6.3.1 Irrigation

The dam facilities and the canal distribution system shall be operated and maintained by the Irrigators Association (IA). The IA shall be organized by DAR as soon as the limits and the coverage of the service area are well defined. The training program for the IA, particularly its officers and key persons, in various aspects like leadership training, water management, operation and maintenance, gate operations, cropping pattern, etc., shall be started prior to the implementation of the Project. The NIA will be tapped by DAR in the development of the IAs as it has already established a system for developing the IA.

The IA will operate and maintain the irrigation facilities, supervise the equitable distribution of water to the farmers and collect the necessary irrigation fees and charges.

6.3.2 Village Water Supply

The water users association (WUA) shall be composed of farmers/households who will directly benefit from the village water supply system. The association will be organized by DAR during construction stage with the assistance of the LWUA and/or LGU to be able to effectively operate and maintain the system, to collect the necessary water users due and eventually in the future, to prepare the plan for the upgrading of the water system from Level II to Level III.

6.3.3 Farm-to-Market Road

Since the roads to be constructed along the main and lateral canals will be connected to the main arterial road and therefore could be used by the general public, it can be considered as farm-to-market roads. After completion of the road component of the project, it will be turned over to the city government of Puerto Princesa, as part of their road network. The operation and maintenance, therefore of these roads will become the responsibility of the city government.

6.3.4 Post Harvest Facilities

As discussed fully in the farmer's organization plan, the existing farmer's association will be organized into one multi-purpose cooperative prior to the implementation of the project, to particularly take care of the post harvest facilities to be provided in the project and to undertake other additional activities to increase farmer's income, which shall include but not limited to provision of credit, marketing of agricultural products, purchase of inputs, etc. (refer to Appendix J.2)

Figure 6.1.1 Organization Chart for Implementation Stage

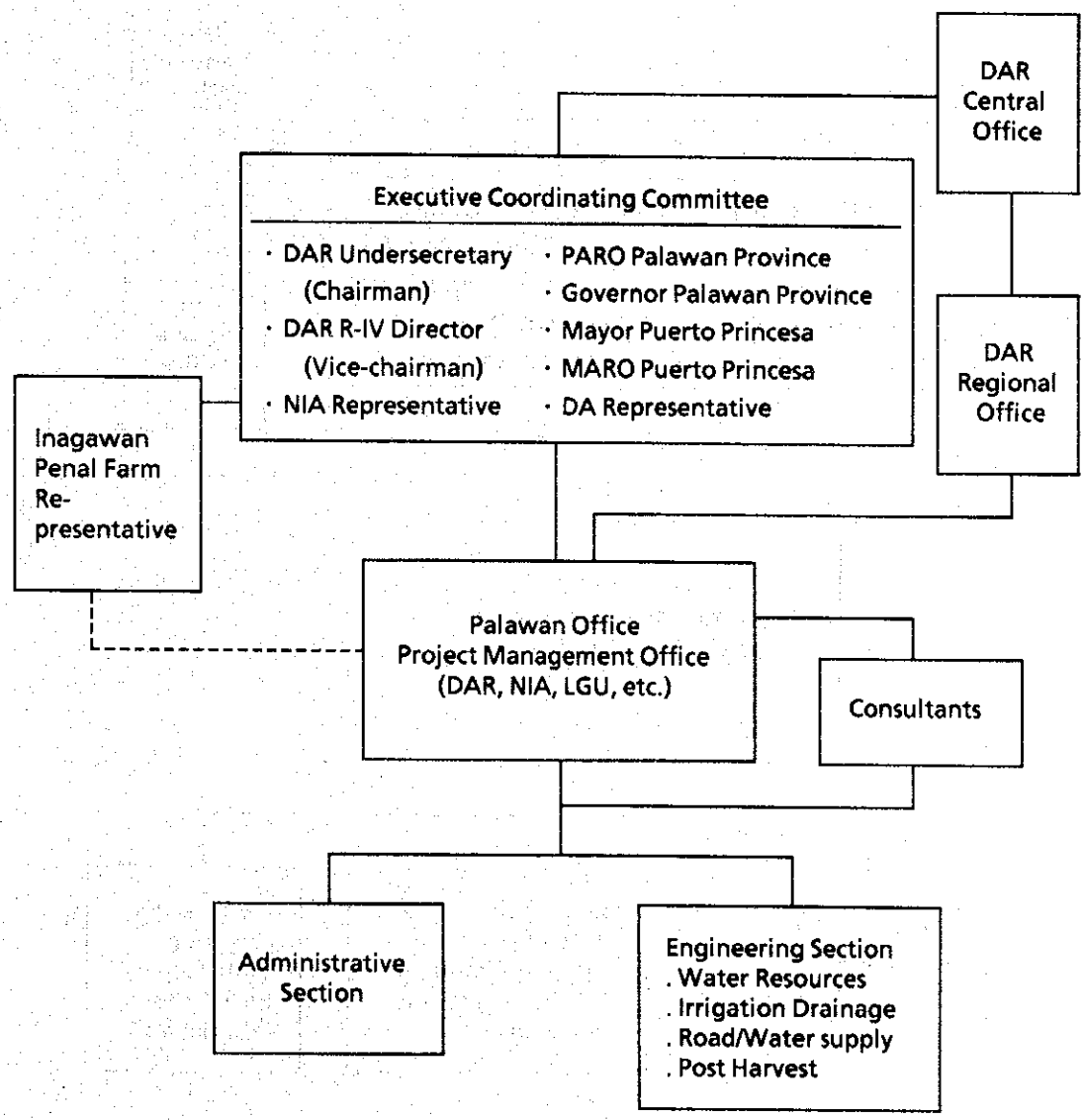


Figure 6.1.2 Organization Chart on O & M Stage

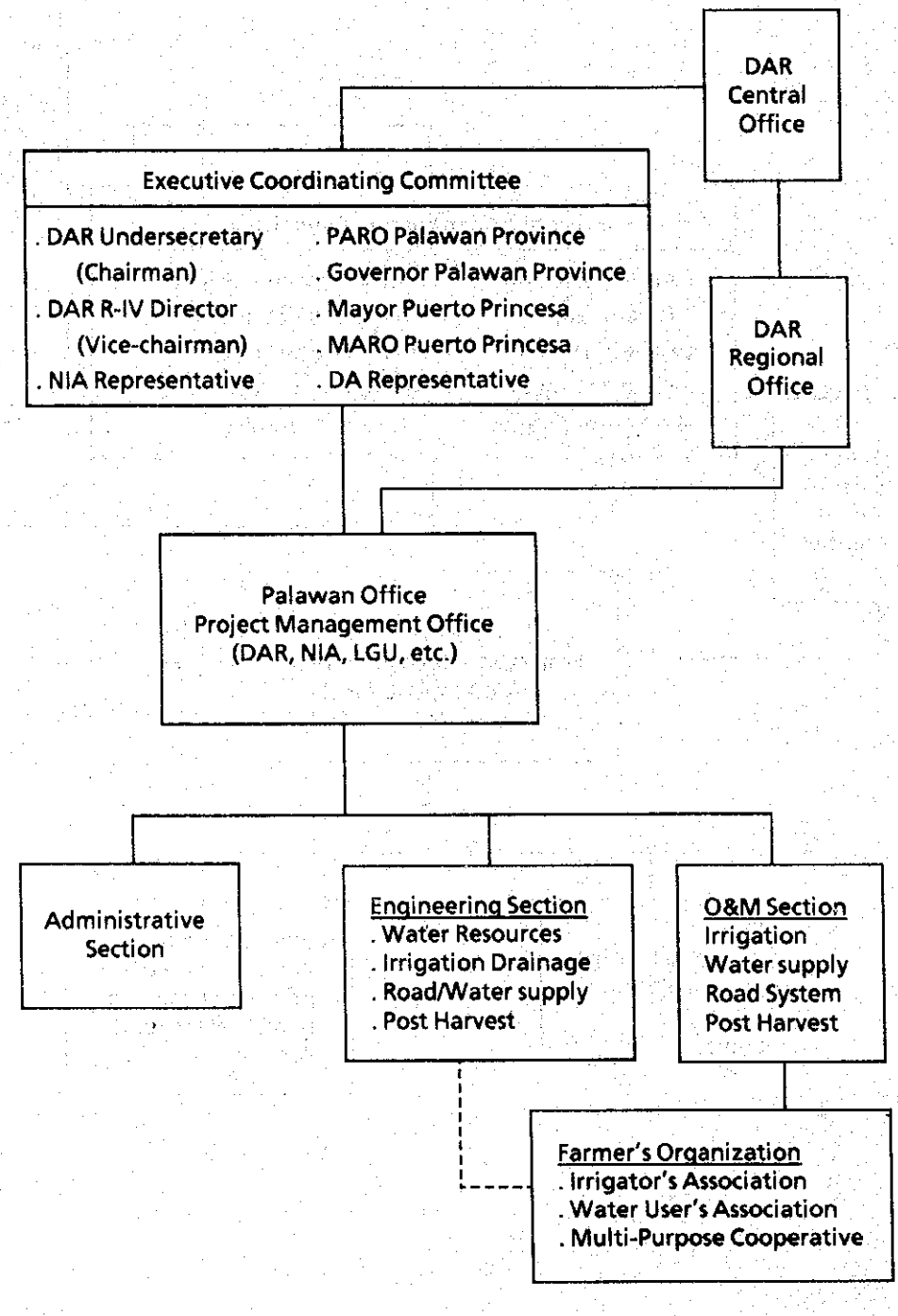


Figure 6. 2. 1 Implementation Schedule for First Stage Project

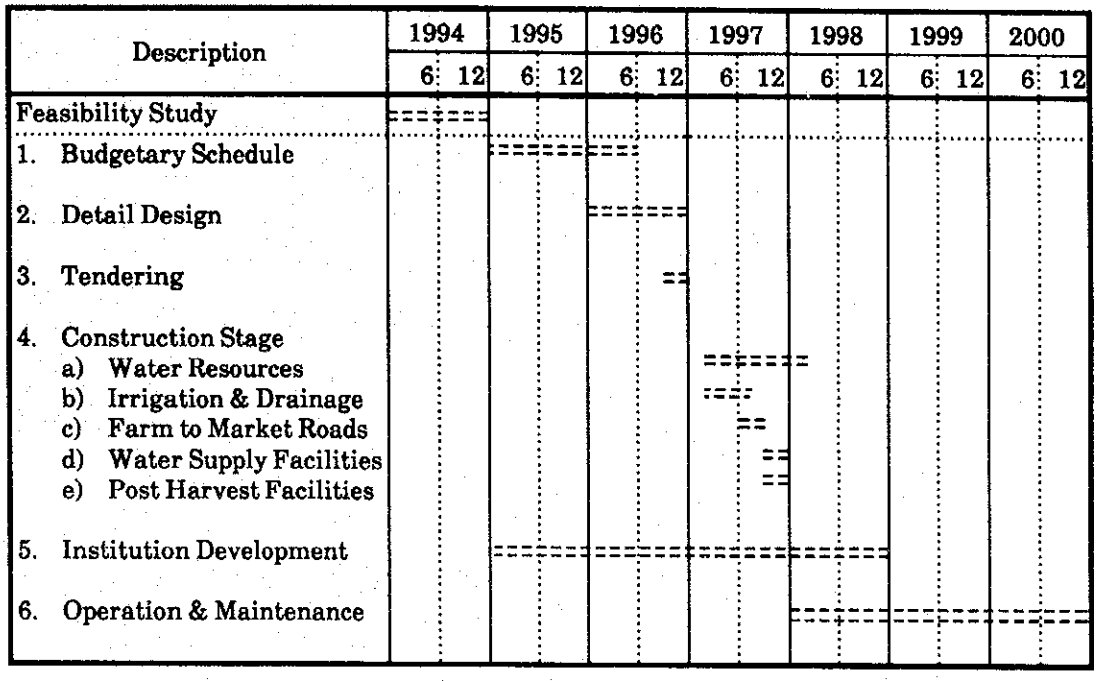
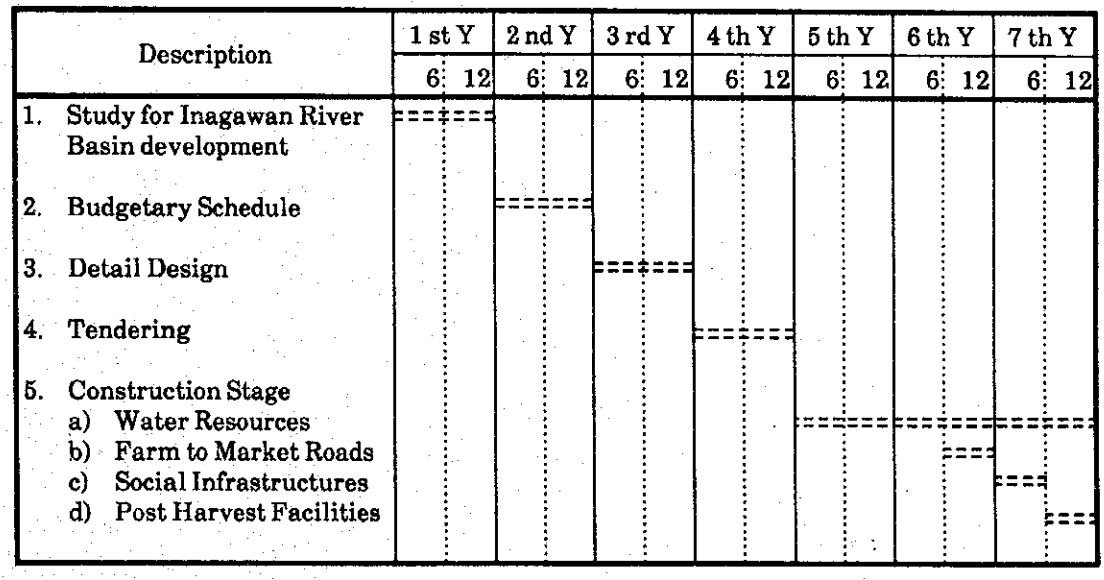


Figure 6. 2. 2 Implementation Schedule for Second Stage Project



CHAPTER 7. PROJECT EVALUATION

CHAPTER 7. PROJECT EVALUATION

7.1 Economic Evaluation

7.1.1 General

The Project aims to consolidate both agricultural and rural infrastructures and facilities in about 2,000 ha of the Tagumpay settlement and outlying areas, in order to improve living standard and alleviate poverty, and to reduce regional differences in income through agricultural production. For the purpose, the Project will be composed of implementation of irrigation facilities including water resources development, farm-to-market roads as agricultural infrastructures, and village water supply and others as rural infrastructure, and agricultural development, post harvest facilities and the like, complying with the policies of poverty alleviation, generation of employment opportunity in the MTPDP (1993-1998).

In the justification of the Project, both economic analysis from the view point of the national economy and financial analysis from private economy were carried out. Project life is 50 years and the prices used in the cost estimate are, as of 1994. To justify the economic feasibility of the Project, economic internal rate of return (EIRR) is applied.

For the project implementation, stage development is proposed taking into account the educational status of the beneficiaries and financial status of the government of the Philippines. After the farmer's organizations will have become fully organized and operational and the farmer's technology for intensive farming will have improved by training, extension services, 200 % of cropping intensity in the irrigable area will be introduced.

7.1.2 Components of the Project Benefits

The project includes not only agricultural infrastructures but also rural infrastructures and post harvest facilities, therefore, several kind of benefits will be generated.

a) Agricultural Benefits

The incremental agricultural benefits will be calculated based on the proposed cropping pattern, which will be generated with increase in cropping intensity and crop yield, etc. Increase in cropping intensity will be realized with the implementation of irrigation facilities, and increase of crop yield from irrigation water supply and extension works for the farmers. Agricultural benefits will be generated according to development stages as mentioned above.

b) Benefit of Village Water Supply System

At present, hauling of drinking water is the daily work of women and children, carrying water from the wells and springs at a distance at 137 m on an average and 1,000 m, at the maximum and spending 36 hours per month per family. In addition, because of their dependence on these water sources as their source of drinking water, settlers often suffer from water-borne diseases like diarrhea.

In the Project, one (1) communal faucet for every six (6) households will be provided, resulting in savings in time on women and children's labor. Thus, the benefits of village water supply system will be generated from savings in labor for water transportation.

c) Benefit of Farm Roads

Benefit from farm road can be estimated as the difference of costs between without and with farm road when transporting 5,800 tons of projected agricultural products. At present, farm products are transported by hired carabao carts at five (5) pesos per 50 kg bag. With the Project, transportation for marketing will be done by trucks owned by the cooperatives, since the cooperative will be strengthened to function in the marketing of crops and inputs.

d) Benefit with Improvement of Paddy Quality

As drying yard is lacking in acreage and number in the Study Area, farmer use the national road for drying paddy. This often resulted to loss and damage of paddy due to unexpected rainfall. With Project, mechanical dryer,

drying yards and warehouses with proper ventilation are provided to prevent loss and damage of paddy and corn. At present farmers are compelled to sell paddy at lower prices because of insufficient drying. The quality of paddy is expected to be improved by the proposed post harvest facilities and will contribute to higher farmgate prices. Therefore, benefits will be generated by the improvement of paddy quality.

e) Benefit of Fish Farming at Proposed Storage Dam

With the construction of the headwork in the first and the storage dam in the second stage, water surface of about 8 ha and 29 ha will be developed, respectively. These area will be useful for fish culture as inland fishery and Tilapia can be raised throughout the year. This will generate fishery income in the Area.

All the benefits generated by the Project are summarized as follows. (for detail refer to Appendix L)

	Benefits (million pesos)	
	Cropping Intensity 130%	Cropping Intensity 200%
Paddy, Vegetables , Fruit	48.88	64.70
Post Harvest	0.49	0.49
Livestock	29.58	29.58
Farm Roads	0.44	0.44
Village Water Supply	1.59	1.59
Inland Fishery	1.14	4.15

7.1.3 Price of Crops and Agricultural Inputs, and Project Cost

a) Crop Prices

Farmgate price of crops included in the proposed cropping pattern are divided into two (2) categories; traded crops and non-traded crops. Paddy, corn and cashew nut are classified as traded crops while the other crops, as non-traded crops. The IBRD projected prices were taken as the long-term projected world market prices for the economic prices of the traded crops. For other non-

traded crops, the average of the farmgate prices during the last five (5) years were computed. (refer to Appendix L)

b) Agricultural Input Prices

The economic price of fertilizers were estimated based on the IBRD's projected prices. As to the economic prices of agri-chemicals and herbicides, conversion factor of 0.865 was applied to financial prices. Economic labor wage rates were estimated applying 0.6 to the financial rates. (refer to Appendix L)

c) Project Cost and O & M Cost

The project cost is composed of foreign currency and local currency. An economic cost to be used in the economic evaluation must be real cost to the national economy, and then transfer payment such as taxes, subsidy, cost for land acquisition, and compensation, price contingency and so on, are deducted from the financial cost. Local currency portion in the financial cost is converted into its border price by applying the conversion factors. (refer to Appendix L)

As mentioned before hand, the Project is proposed to be implemented by stage development taking into account the educational status of beneficiaries and financial status of the Government of the Philippines. According to the development stage, the cost for the water resource development will be invested during the 50 year's project life.

7.1.4 Project Evaluation

Proposed cropping intensity in the first and second development stages are 130% and 200%, respectively, therefore, the incremental benefits will be generated according to development stages.

As compared with the economic project cost and benefits for 50 years, the economic internal rate of return (EIRR) was calculated at 17.1%. As a result of the economic evaluation, the Project can be judged economically feasible taking into account 15 % of the opportunity cost of capital of the Philippines, and evaluation shows that the Project would meet the government

project objectives, such as CARP, poverty alleviation, generation of employment opportunity and reduction of regional disparity in incomes.

While, Financial Rate of Return (FIRR) for overall project calculated using financial costs and prices was estimated at 18.2%.

7.1.5 Sensitivity Analysis

Sensitivity analysis was carried out considering several cases to occur and the results of the analysis are as follows; (refer to Appendix L)

		EIRR(%)	FIRR(%)
①	10% increase of project cost	15.3	15.9
②	20% increase of project cost	13.8	13.8
③	10% decrease of project benefit	15.1	15.5
④	20% decrease of project benefit	11.3	12.7
⑤	combination of ① and ③	13.4	13.3
⑥	combination of ② and ④	10.0	8.8

7.2 Financial Analysis

7.2.1 Objectives

Financial analyses for the typical farms were carried out to estimate farm budgets/incomes in the case of with Project, based on financial prices from the viewpoint of private economy.

As farming types and land uses would vary by condition of distributed lands, the financial analyses undertaken about farming types were paddy farming, vegetables farming and fruit farming taking into consideration the stage development and target annual family income of more than 38,000 pesos.

7.2.2 Typical Farms

The studies on the farm incomes for the typical farms were carried out taking into consideration land conditions as follows;

	First Stage (pesos)	Second Stage (pesos)
a) Farm Model 1 (Paddy Upland)		
Net Farm Income	42,330	66,290
OM Costs	810	810
Debt	5,750	5,750
Living Expenditures	26,800	43,000
Disposable Income	8,970	16,730
b) Farm Model 2 (Upland)		
Net Farm Income	53,830	77,690
OM Costs	810	810
Debt	5,750	5,750
Living Expenditures	36,140	50,790
Disposable Income	11,130	20,340
c) Farm Model 3 (Upland)		
Net Farm Income		58,710
OM Costs		810
Debt		5,750
Living Expenditures		41,220
Disposable Income		10,930
d) Farm Model 4 (Fruit Trees)		
Net Farm Income		49,660
OM Costs		810
Debt		5,750
Living Expenditures		34,520
Disposable Income		8,580

7.3 Impact of the Project

For the technical and administrative aspects of the CARP, the Project is expected to give impacts on land use plan, farming plan, land preservation plan, environment preservation plan and supporting plan for farmers and so on.

Other than the tangible benefits, indirect benefits affecting social and regional aspects will be expected with the implementation of the Project.

- proposed village water supply system will decrease heavy work of women and children and contribute to decrease in water-borne diseases;
- establishment of the IA and WUA and strengthening of the cooperative will contribute to harmony and closer communication among settlers will can lead to the success of the project;
- with the construction works for the Project, employment opportunities becomes available to the farmers hence, their incomes will increase, resulting in the improvement in nutrients and sanitary conditions and educational status of the farmers.

CHAPTER 8. ENVIRONMENTAL ASSESSMENT

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8.1 General

Generally, the effect to the environment of agricultural development is considered to be passive as compared with the drastic effect of the heavy industry development. However, though passive, if no measures are taken in a long time, uncontrollable situations will possibly occur in the project area and the surrounding areas in the future. The project components for the Study Area are development of new settlement, farmland reclamation, irrigation and drainage, etc. The effect of this project to the environment were examined and analyzed individually. The results showed that with the implementation of the project, the following phenomenon will possibly occur ① soil erosion due to the farm land reclamation, ② outflow of earth materials during the construction period, ③ conservation of existing forest area, and ④ water pollution of the drainage including the gray water.

As an initial countermeasure, the land use plan should include the conservation of the existing forest. The protection method for soil erosion and outflow of earth materials shall be considered during the detailed design stage. As to water pollution, more detailed investigation shall be required to be able to undertake the most effective countermeasures.

On the others hand, as to the water resources plan for a stable irrigation, the utilization of stream flow at the tributary of the Inagawan river has been proposed. Based on the contents of the proposed plan, both the scale of structures and intake discharges are minimal. It is therefore considered that the effect to the environment is very minimal.

8. 2 Initial Environmental Examination (IEE)

8. 2. 1 Objectives

In the development of projects whether investigation, study or implementation stage, all possible impacts which could affect project implementation should be evaluated and assessed prior to implementation. At the initial stage of the process, an environmental impact assessment (EIA) is required to provide necessary items of investigation for environmental conservation. This should be included in the determination of countermeasure in the development of the project.

8. 2. 2 Application Method

As a requirement of the Government of the Philippines, an environmental impact assessment be undertaken for all development projects prior to implementation. It is important that the undertaking is conducted in accordance with the guidelines provided by the government agencies concerned. In this connection, the Government of the Philippines has provided the guidelines in accordance with Presidential Decree No. 1151 (1977). The decree pointed out the necessity of submit Environmental Impact Statement (EIS) by the government agencies concerned and the private corporations. Generally, the IEE is prepared to justify the necessity of preparing an EIS (or EIA) on the proposed project.

8. 2. 3 Contents of IEE

a) Preparation of Checklist

In accordance with the guidelines of environmental impact assessment, checklist is compiled. The checklist consist of four main items as follows; ① actions affecting environmental resources value, ② damage to environment, ③ recommended feasible protection measurement, and ④ significant impact. (refer to Appendix M.3)

b) Consideration of Impact for Environment

1) Effect due to Project Location

- Effect to the forest area

The Study Area occupies partly a forest area as mentioned in the present land use. Particularly, it is necessary to undertake a very careful land use plan on forest areas with elevation of less than 100 m. The points to be considered for the land use plan are indicated as ① soil conservation, ② agro-forest, ③ reforestation, and ④ pasture.

2) Remarkable points in planning and design

- Soil conservation

In case of land reclamation of grassland, forest land and wilderness, it is necessary to take into consideration topography, soil and vegetation of the proposed area. Particularly, soil conservation is very important to keep the fertility of the soil and to protect sedimentation.

- Conservation of water quality

Test results shows that the plans proposed will not be affected by water quality except in the shallow wells and springs where water quality are found to be not good for drinking. As a result, deep wells will instead be utilized for the proposed village water supply.

Water quality control are also necessary because with development, agricultural chemicals will be used. Also, domestic water consumption and use will affect the environment. Since waste water will be drained into the sea, through the mangrove areas, measures are recommended for a monitoring system at the end point of each channel in the future.

- Improvement of drainage system

Inadequate drainage system will affect the habitants and farming activity, particularly, the increase of breeding places of

malaria mosquitoes, the reduction of farm production, and difficulties in farm management.

3) Incidental problems with reference to O/M

- Poor water distribution

  If there are no proper water distribution in the Study Area, it may cause reduction of farm production, and unbalance farm income among farmers. Furthermore, said problems may cause social conflict.

- Water oriented disease hazards

  With proper water distribution and interception, water borne diseases will not prosper in the Area.

- Reduction of use of pesticides on crop disease

  Following exact requirement of water would minimize crop disease and therefore would reduce the use of pesticides.

- Losses of fertilizer

  Several kinds of fertilizer shall be applied to support higher crop production during the growing stage, and a correct water management properly carried out will support said practices.

- Effect to aquaculture

  In case, inland fishery will be included in the Study Area, water management is required to be carried out more properly. Especially, water quality control is the most important task

8.3 Agricultural Land Conservation Plan

8.3.1 Soil Conservation of Farm Land

In the irrigation and drainage development plan which include land reclamation works, soil conservation is the most important factor from the standpoint of environmental conservation. Generally speaking, soil erosion will rapidly develop in case of land gradient with more than 14% (8 degrees). Accordingly, the proposed land reclamation plan in the Study Area should be established depending on said recommendation. Fortunately, the concerned government agencies in the Philippines have also applied the same criteria on land reclamation project (less than 15%).

a) Soil Conservation of Paddy Field

As compared with upland field, the paddy field does not pose any serious problems on soil conservation, if water managements is carried out appropriately. The soil is generally clay loam type. However, it is required to improve soil structure of paddy field in case of high rate of percolation, since big holes will sometimes emerge due to strong and quick seepage in the bed of the farm lot. As a countermeasure for said phenomena, the crushing and compaction method is recommended for the elimination of such holes.

b) Soil Conservation of Upland Field

As mentioned in the previous section, the upper limit of land gradient for land reclamation is fixed at 15% based on the criteria in the Philippine, which is reasonable in comparison with other country's standard. However, an upland field is more conducive to soil loss as compared to paddy field, since the surface of soil in sloping area is affected directly by rainfall, wind and etc. In case of land reclamation of upland field, careful implementations are required with the following consideration;

- The long side of the farm lot should be set, parallel to a contour line and the length of the short side shall be fixed depending on the land gradient. The land gradient should be adjusted to become less than five (5) degrees, as much as possible.

- The height of flight between the upper and lower farm lot should be kept within 1.0 m high as far as possible.
- Making of the ridge for crops should be parallel with the contour line.
- Strict water management shall be required to avoid provision of excessive water on upland irrigation.
- Application of mulching is recommended to protect erosion from rain and reduce evaporation from surface of soil.

c) Orchard Reclamation of Sloping Field

In sloping field, the ridge of the orchard should be parallel with contour line. A farm road is provided parallel to the ridge of the orchard, where a ridge is connected to a farm road. In this case, the farm road has two (2) objectives, that is, ① to carry the input and output materials and ② to protect the field from land erosion. Furthermore, if the surrounding area of fruit trees is covered by grasses it would prevent soil erosion.

d) Growth of Sand-Catch Forest

In order to protect the inflow of materials eroded by heavy rain, the sand-catch forest is recommended. The sand-catch forest should be maintained at the surroundings of the farmland, household and reservoir, etc. In case of land reclamation project, it should be considered, to conserve more effectively, the existing forest area in the Study Area.

8. 4 Environmental Conservation Plan

8. 4. 1 Soil Conservation During Construction Stage

During the construction stage, many excavation and embankment works will be carried out in the Study Area. Through these works, large amount of earth materials would be moved from the construction site to the stock yard or from the stock yard to the construction site, etc. Thus, careful handling are required to protect the flow of these materials from the sites to the surrounding area. Definitive countermeasures are therefore recommended.

① It is recommended to keep surplus spaces in the stock yard to protect the flow over of stocks caused by rain. ② It is necessary to cover the surface of embankment materials to avoid surface erosion by heavy rain. ③ Over loading is a cause of spreading of embankment or excavation materials over the road, and surrounding area, hence, it should be avoided. ④ As to earth work of embankment, compaction is conducted with specification. After the completion of construction, land sliding and erosion are usually occurred at the site.

8. 4. 2 Maintenance of Drainage Canals

Generally, drainage canals are constructed without lining. After several years, sliding and/or erosion usually occur in the canals. As a result, the slided and/or eroded area will be expanded and sediment materials will increase and flow into downstream.

8. 4. 3 Conservation of Water Quality

It is considered that farm land will expand to about 1,300 ha including the home lot area, and the population will be also expected to increase to about 6,000. Due to said situation, it is considered that water pollution will increase, and may spread to a wider area in the future. The following phenomena such as ① eutrophication by nutrient rich salts in the sea may appear, and ② agricultural chemicals may accumulate in a soil and diffuse to a wider area, are anticipated under the above mentioned conditions.

a) Countermeasure for Water Pollution

The following approach is the most rudimentary method for the protection of water pollution in the Study Area, and the treatment standard shall be upgraded gradually, depending on the environmental condition in the future. The most elementary method are summarized as follows.

1) First Step of Treatment in Home Lot

Raw materials such as scrap of vegetable, fish, meats and other foods produced every day in each family shall be collected, and utilized to make compost as organic matter. These organic matters should be applied individually in individual farm.

2) Treatment at Pond

According to the field investigation, waste water from individual family in home lots flows out directly near the existing small drainage channel, and finally into the sea. Said water in the home lots should be collected with village drain network and led to a treatment pond. For treatment at the pond, it is recommended to grow water hyacinth, because, it is recognized generally to eliminate nitrogen and the phosphorus through their growing activities.

3) Installation of Screen with Charcoal

The charcoal has a characteristic to help the activities of bacteria for resolution of sludge in waste water. It is therefore recommended to install charcoal screen at the junction between the pond and village drain network.

b) Treatment of the Night-Soil

There are no waste water treatment plant in Puerto Princesa city. Supposedly, the city is required to provide waste water treatment systems for environmental conservation in the city area in future. Since, the Study Area is administratively a part of Puerto Princesa city, the treatment system plan will

have to be considered and established depending on the considerations of the whole city, including the Study Area.

c) Monitoring System

There are no data on water quality except the study team's observations in the Study Area. Basic element of effluent standards has not been examined yet (such as, EC, PH, BOD, DO, SS, COD). It is therefore recommended to establish a monitoring system not only in the Study Area but also the whole Palawan province and/or Puerto Princesa city.

CHAPTER 9. PRIORITY PROJECT

CHAPTER 9. PRIORITY PROJECT

9.1 Selection of Priority Project

The agricultural land development plan consists of the agriculture development and agricultural land development plans to attain sustainable farming, and the rural development plan which aims to attract beneficiaries to settle in the Study Area. The former one, is a countermeasure to provide the beneficiaries the opportunity to earn the necessary income to sustain them and to raise their children as future successful farmers. On the other hand, although they can live in the Area with enough income, it is essential to secure Basic Human Needs (BHNs), like water supply and others, to lead a decent life.

In the Area, only about 20% of the beneficiaries from view point of acreage are settled because of the absence of social and agricultural infrastructures. In order to solve this problem, the agricultural land development plan, mainly composed of ① agricultural development, ② agricultural infrastructure development, ③ rural infrastructure development, and ④ institutional development, shall be proposed to be established and implemented. Since the plan includes various components, it is rather difficult to simultaneously implement these components because of budgetary constraints. The staging of the development plan is therefore proposed.

The components in the development plan are classified into two (2) as, the "Must" components to live in the area and, the "Want" components to improve life through more income in the future. The former one is categorized as the priority project to be urgently implemented for settlement of farmer beneficiaries.

9.1.1 Criteria for Selection

The priority component shall be selected based on the following considerations among the various and many components proposed in the development plan:

- Attainment of Basic Human Needs (BHN)

- Sustainable Farm Household Income Development
- Farmer's Desires
- Easy and Lower Operation and Maintenance Cost
- Work Load Reduction of Women and Children
- Friendly to Environment

a) Attainment of BHNs

The BHNs are the essential and minimum elements needed for the beneficiaries to live in the settlement area. It is rather difficult to live in the settlement without these elements. To realize these elements in the Area, ample time and budget are needed. These element should initially be implemented in the settlement area.

b) Sustainable Farm Household Income Development

The farmers, who were provided with a 3.0 ha lands, could earn sufficient income from their farms, and that these income could represent the most part of his household income, because there is no other employment opportunity in and around the Study Area, now, and even in the future. Farmer's income to maintain his family, therefore, shall be achieved within the Study Area to a large extent and from farming. These income will not only be for managing his life but also for the education of his children.

c) Farmer's Desires

The beneficiaries in the Study Area, clearly expressed their desires as to the kind of development they would want for their area, to improve their income. Most of the desires of the beneficiaries who are living in an undeveloped area, such as, the Study Area without basic infrastructures, should be solved. For the realization of the farmer's desires, the necessity and essentiality of these desires must be justified. As such, necessary components to manage the farmer's life shall be executed as the first priority projects.

d) Easy and Cheaper Operation and Maintenance

The proposed facilities will have to be managed by the farmer's association themselves and the operation and maintenance costs shall be

shouldered by them. Since the farmer beneficiaries are simple farmers with less or minimum skills, the introduction of a highly technical or complicated facility could become a problem. Even minor mechanical trouble and/or a shortage of even a minor spare part will require skill and money which the farmers might not be able to accomplish. It is thus necessary that simple and easy to operate systems must be introduced at the first stage development.

e) Work Load Reduction of Women and Children

Women and children in the Study Area are usually tasked with the very heavy work of housekeeping and farming. Women do not have the time to spend for training/seminars and for attaining further education to improve/level up their life because of the various and heavy duties of attending to the farm, doing house keeping works and hauling of drinking water. High priority will therefore be given to solve these problems.

f) Friendly to Environment

Some components, even if it will satisfy the above conditions, will not be proposed in the Study Area, if and when, the components will destroy the environmental conditions. High priority will be given to the components which would have less disastrous effects to the environment. The facility to be introduced in the Area, will have to improve or conserve the environmental conditions. In Palawan there are many malaria endemic areas and some cases are found even in the Study Area. High priority will be given to the component that will greatly reduce the occurrence of stagnant water ponds to help eradicate breeding places of mosquitoes, the carrier of malaria.

9.1.2 Selection of Priority Component

Based on the above mentioned conditions and constraints, the priority components shall be justified and selected. For evaluation purposes, points from 5 to 1 will be given for each item and the component with the highest total point will be selected as the priority projects. Also, the component with the most adverse impact to the environment will be given negative points of -5 to -1, while the facility helpful to the environment will be given points from 5 to 1.

9.2 Priority Projects

Projects selected as priority component(s) were considered necessary and essential for the beneficiaries. As short term development, the priority component shall be implemented, and in the near future, when the farm household income will have increased, the other components shall be implemented to further sustain and improve the farmers level of living standards. (refer to Table 9.1.1)

The priority project selected based on the above mentioned criteria and procedures, consists of the following:

- Water resources facility;
- Irrigation and drainage facilities;
- Village water supply;
- Farm-to-market road; and,
- Post harvest facilities.

9.3 Project Scale and Cost

The Project cost consists of two (2) items, project cost and the local cost. The project cost amounted to 415.3 million pesos while the local cost was estimated at about 12.8 million pesos. (refer to Appendix II)

The specific details and scale of the priority projects are as follows:

1. Water Resources Facility	
Closure Dam	310,000 cu.m
2. Irrigation Facility	
Main Irrigation Canal	4.21km
Lateral Canal	10.5 km
3. Drainage Facilities	
Drainage Canal	1.8 km
4. Farm-to-Market Roads	
Main farm-to-market road	11.8 km
5. Post Harvest Facilities	1 set

9. 4 Economic Justification

9. 4. 1 Benefits

Various benefits can be derived from the proposed facilities, such as agricultural production, livestock, farm road, village water supply, post harvest and inland fisheries. Full benefit will be attained at 82.10 million pesos. (refer to Appendix II)

9. 4. 2 Operation and Maintenance Cost

The operation and maintenance cost during and after implementation of the Project consists of local costs such as the project management cost, institutional cost and on-farm facilities, and the necessary management costs of associations such as the Irrigators Association, Water Users Association and Multi-Purpose Cooperative and LGU. After completion of the project, the operation and maintenance cost of about 1.72 million pesos in economic cost base will be necessary to maintain the above priority facilities. (refer to Appendix II)

9. 4. 3 Economic Justification

The economic justification is carried out by EIRR method. The EIRR was calculated at 17.3% with the project life span of 50 years (for pump equipment, 25 years).

While, Financial Rate of Return (FIRR) was calculated at 18.0%. (refer to Appendix II)

Table 9. 1. 1 Evaluation of Priority Components

Item	BHN	Susta-nable Income	Farmer's Desires	Easy & Cheaper O & M	WIDs	Impact to Environment	Total
Agricultural Development							
- Solar Drying Place	3	5	3	5	3	0	19
- Dryer Facilities	2	5	1	3	4	0	15
- Storage Facilities Including milling F.	3	5	3	3	3	0	17
- Reinforcement of extension workers	1	5	3	3	3	0	15
Agricultural Infrastructure Development							
- Water Resources Facilities	3	5	5	2	3	-2	16
- Irrigation Facilities							
a. Main Canal	3	5	5	3	3	-1	18
b. Lat. Canal	3	5	5	3	3	-1	18
c. On-Farm Facilities	3	3	3	4	3	-1	15
- Drainage Facility	3	3	1	3	4	4	18
- Farm-to-Market Roads							
a. Main Road	4	3	5	4	5	-1	20
b. Secondary Road	3	3	5	4	4	-1	18
c. O & M Road	3	3	4	3	4	-1	16
Rural Infrastructure Development							
- Village Water Supply	5	2	5	4	5	0	21
- Village Road	3	2	4	4	4	-1	16
- Rural Electrification	1	1	4	1	5	0	12
- Others							
a. Health Center	5	2	4	1	5	0	17
b. Barangay Hall	3	3	4	1	5	0	16
c. School	3	1	1	1	5	0	11
d. Multi Purpose Pavement	3	3	1	3	5	1	16
e. Basketball Court	1	3	1	3	5	0	13

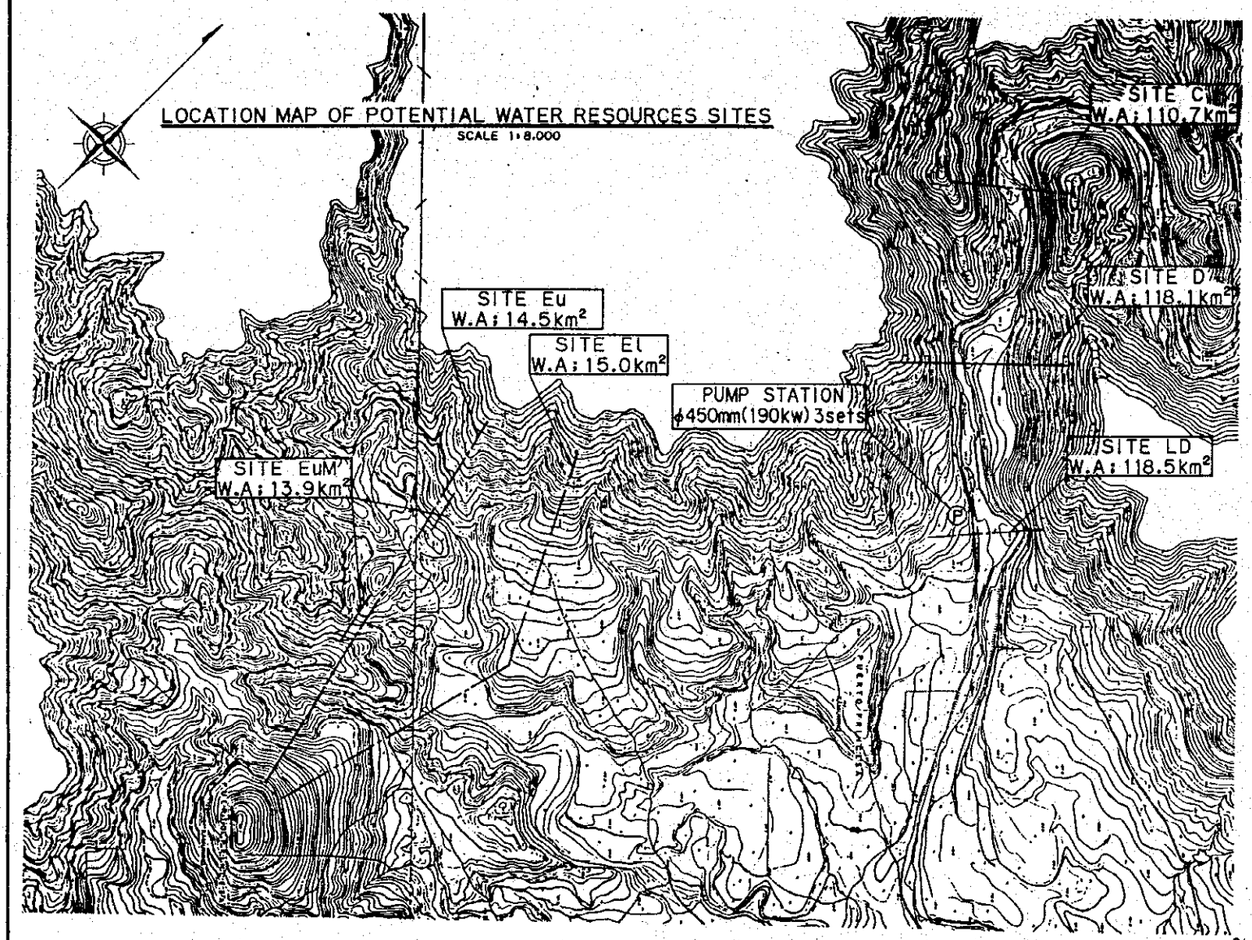
Note : Evaluation includes the implementation stage of the Project

DRAWINGS

LIST OF DRAWINGS

LOCATION MAP OF POTENTIAL WATER RESOURCES SITES

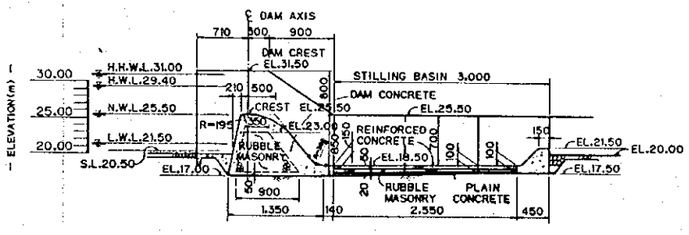
SCALE 1:8,000



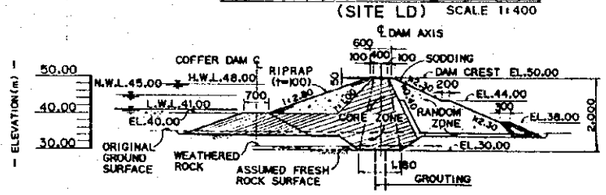
ALTERNATIVE PLAN OF WATER RESOURCES DEVELOPMENT

SITE		SITE Eu	SITE El	SITE D	SITE C	SITE EuM	SITE LD
(1) INTAKE TYPE		GRAVITY W/RESERVOIR					PUMP W/WEIR
(2) WATER SOURCE							
a) RIVER NAME		PINAGSALURAN	PINAGSALURAN	INAGAWAN	INAGAWAN	PINAGSALURAN	INAGAWAN
b) WATERSHED AREA	(km²)	14.5	15.0	118.1	110.7	13.9	118.5
c) RIVERBED ELEVATION	(m)	34.5	29.0	21.2	23.5	34.5	19.5
(3) RESERVOIR							
a) REQUIRED E.STORAGE	(MCM)	1.85	1.61	0.20	0.21	0.20	0.20
b) SEDIMENT VOLUME	(MCM)	0.44	0.45	2.38	2.21	0.11	—
c) DEAD WATER VOLUME	(MCM)	0.44	0.45	2.38	2.21	0.11	0.06
d) H.W.L (MSL)	(m)	54.00	46.50	40.00	42.50	45.00	25.50
e) L.W.L (MSL)	(m)	45.60	37.80	35.00	42.00	41.00	21.50
f) W.SURFACE AT H.W.L	(km^2)	29	28	33	31	8	9
(4) MAJOR FEATURE OF DAM/WEIR							
a) DAM TYPE		FILLTYPE DAM	FILLTYPE DAM	CONCRETE DAM	CONCRETE DAM	FILLTYPE DAM	CONCRETE WEIR
b) DAM CREST ELEVATION (MSL)	(m)	58.00	50.50	44.00	47.00	50.00	31.50
c) DAM HEIGHT	(m)	28.0	25.5	46.0	30.0	20.0	14.5
d) DAM CREST LENGTH	(m)	875	868	355	155	239	221
e) DESIGN FLOOD DISCHARGE	(c.m.s)	430	440	1,600	1,550	420	990
f) INTAKE FOR PROJECT	(c.m.s)	0.84	0.84	0.84	0.84	0.84	—
INTAKE FOR E.PROJECT & R.	(c.m.s)	—	—	0.45	0.45	—	0.45
(5) MAJOR FEATURE OF PUMP							
a) TYPE OF PUMP		—	—	—	—	—	VERTICAL PUMP
b) DIAMETER	(m/m)	—	—	—	—	—	φ450x3units
c) DESIGN DISCHARGE	(c.m.s)	—	—	—	—	—	0.84
d) OUTPUT OF PUMP	(KW)	—	—	—	—	—	190x3

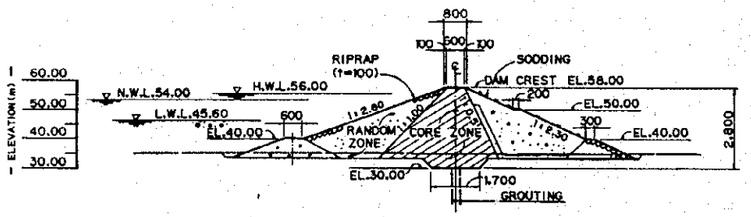
(NOTE) E.STORAGE : EFFECTIVE STORAGE
E.PROJECT & R. : EXISTING PROJECT AND RIVER MAINTENANCE



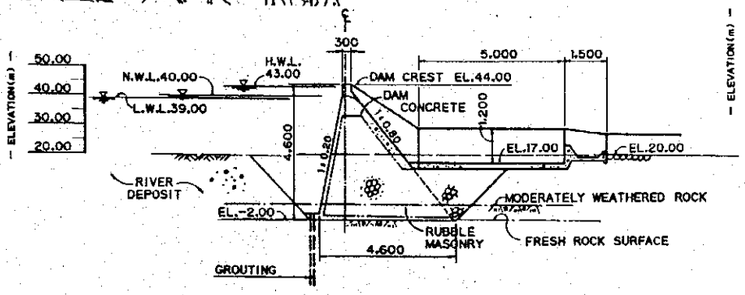
TYPICAL CROSS SECTION OF DAM
(SITE LD) SCALE 1:400



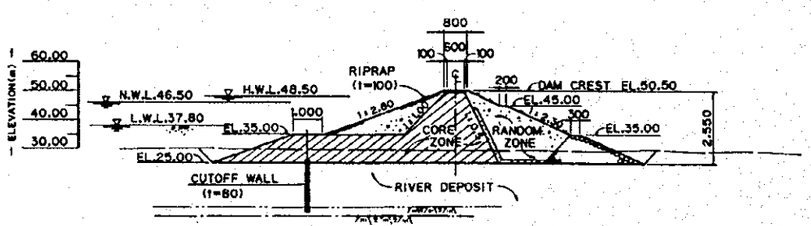
TYPICAL CROSS SECTION OF DAM
(SITE EuM) SCALE 1:800



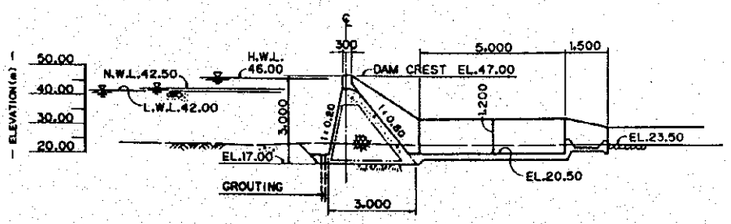
TYPICAL CROSS SECTION OF DAM
(SITE Eu) SCALE 1:1,000



TYPICAL CROSS SECTION OF DAM
(SITE D) SCALE 1:1,000



TYPICAL CROSS SECTION OF DAM
(SITE El) SCALE 1:1,000



TYPICAL CROSS SECTION OF DAM
(SITE C) SCALE 1:1,000

SCALE 1:800 0 20 40m
SCALE 1:400 0 10 20m
SCALE 1:8,000 0 200 400m
SCALE 1:1,000 0 10 20 30 40 50m

NOTE:

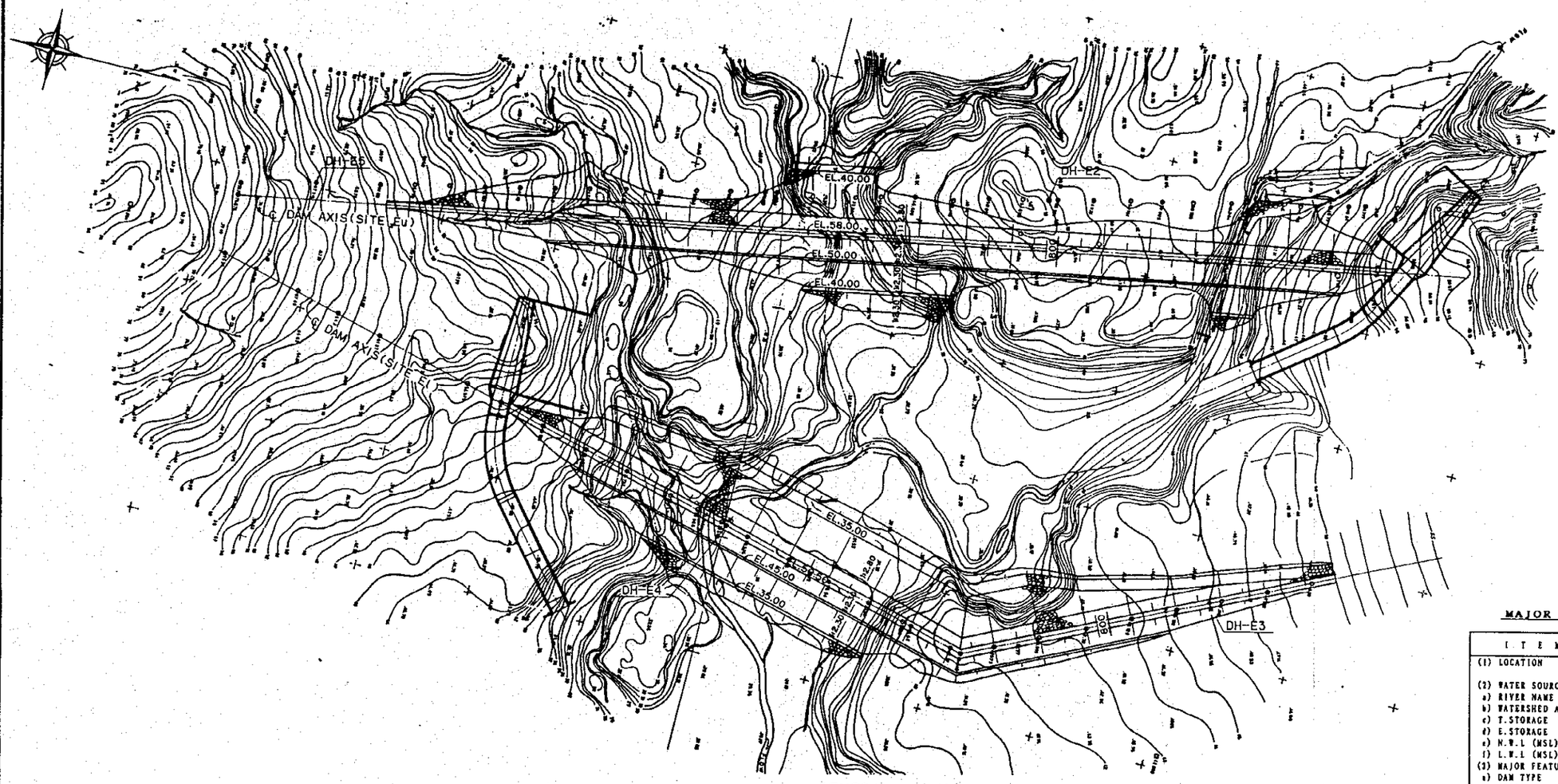
1. ALL DIMENSIONS ARE SHOWN IN CENTIMETER UNLESS OTHERWISE SPECIFIED.
2. ELEVATIONS ARE SHOWN IN METER (M.S.L.).
3. SITE D IS UNSUITABLE FOR DAM DUE TO DEEP RIVER DEPOSIT.
4. THE STUDY FOR SITE D.LD AND E IS MADE BASED ON TOPO-MAP SCALED 1:1,000.BUT SITE C.BASED ON TOPO-MAP SCALED 1:4,000.

THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

WATER RESOURCES DEVELOPMENT ALTERNATIVE WATER RESOURCES

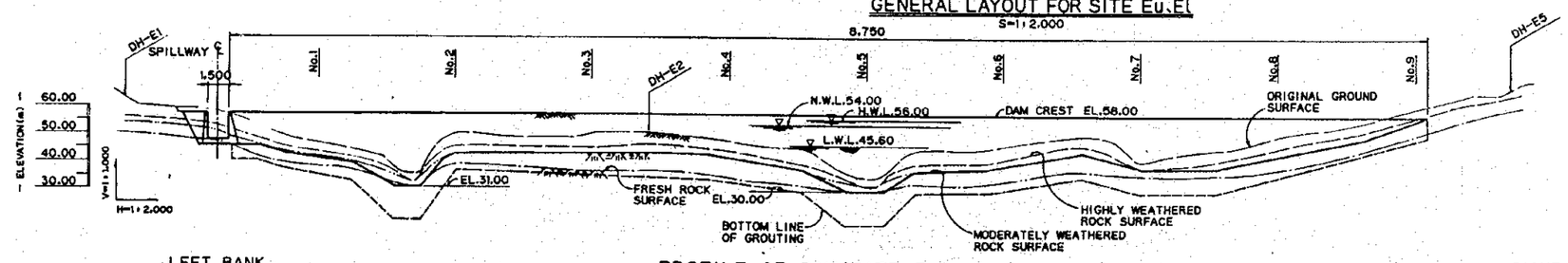
DAR

JICA JAPAN INTERNATIONAL COOPERATION AGENCY



GENERAL LAYOUT FOR SITE Eu,EI

S=1:2,000

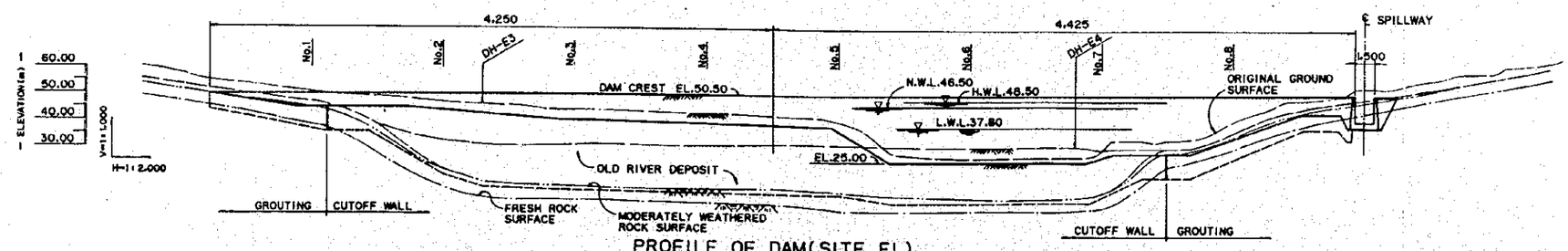


LEFT BANK

PROFILE OF DAM(SITE Eu)

SCALE V=1:1,000 H=1:2,000

RIGHT BANK



PROFILE OF DAM(SITE EI)

SCALE V=1:1,000 H=1:2,000

MAJOR FEATURE OF SITE Eu & EI

ITEM	DESCRIPTION	
	SITE Eu	SITE EI
(1) LOCATION	BARANGAY INAGAWAN PUERTO PRINCESA	BARANGAY INAGAWAN PUERTO PRINCESA
(2) WATER SOURCE		
a) RIVER NAME	PINAGSALURAN R.	PINAGSALURAN R.
b) WATERSHED AREA	14.5 (km²)	15.0 (km²)
c) T.STORAGE	2.09 (MCM)	2.06 (MCM)
d) E.STORAGE	1.65 (MCM)	1.61 (MCM)
e) N.W.L (MSL)	54.0 (m)	46.5 (m)
f) L.W.L (MSL)	45.6 (m)	37.8 (m)
(3) MAJOR FEATURE		
a) DAM TYPE	FILLTYPE	FILLTYPE
b) CREST LENGTH	875.0 (m)	867.5 (m)
c) HEIGHT	28.0 (m)	26.5 (m)
d) CREST ELEVATION	58.0 (m)	50.5 (m)
e) DESIGN FLOOD	430.0 (m³/sec)	440.0 (m³/sec)
f) INTAKE DISCHARGE	0.84 (m³/sec)	0.84 (m³/sec)

NOTE:

1. ALL DIMENSIONS ARE SHOWN IN CENTIMETER UNLESS OTHERWISE SPECIFIED.
2. ELEVATIONS ARE SHOWN IN METER (M.S.L.).

SCALE 1:2,000

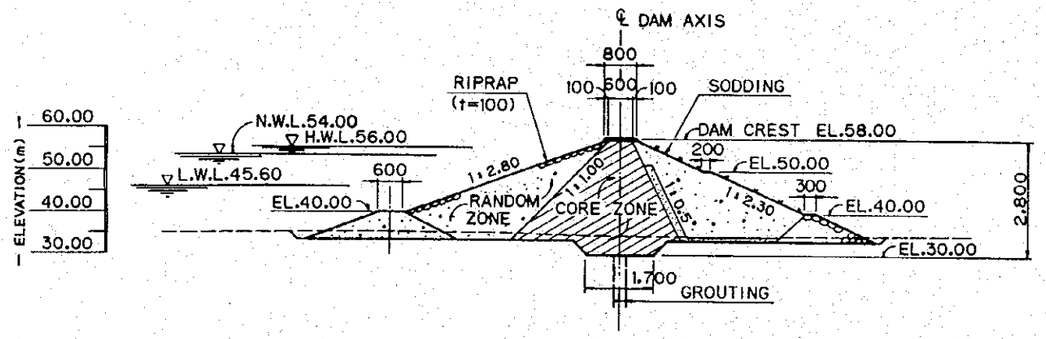
0 50 100m

THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

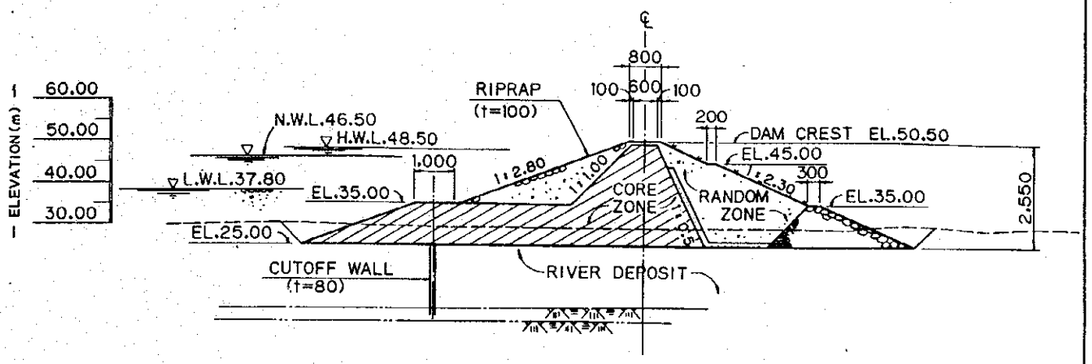
WATER RESOURCES DEVELOPMENT
SITE Eu & EI (1/2)

DAR

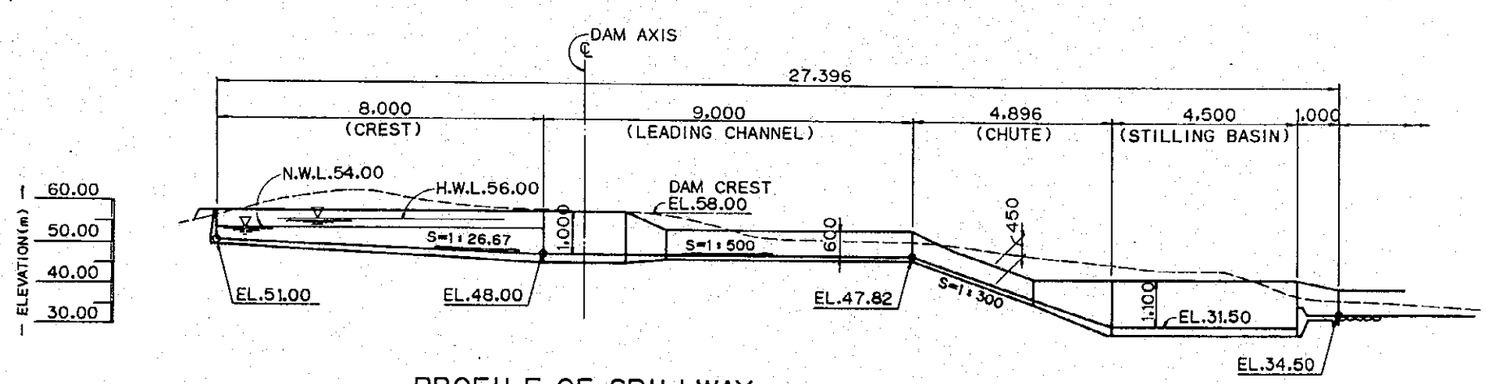
JAPAN INTERNATIONAL COOPERATION AGENCY



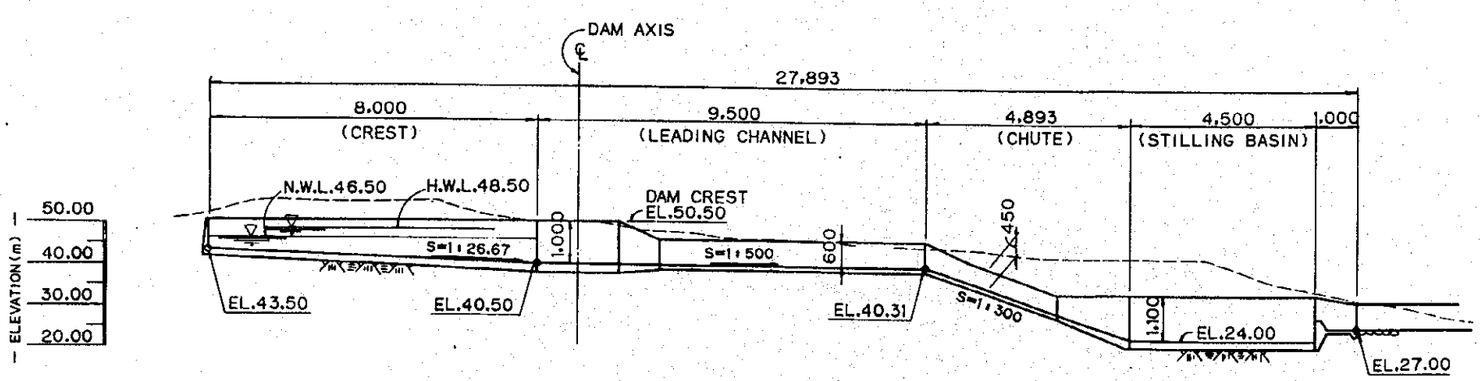
TYPICAL CROSS SECTION OF DAM
(SITE Eu)



TYPICAL CROSS SECTION OF DAM
(SITE El)



PROFILE OF SPILLWAY
(SITE Eu)



PROFILE OF SPILLWAY
(SITE El)

NOTE:

1. ALL DIMENSIONS ARE SHOWN IN CENTIMETER UNLESS OTHERWISE SPECIFIED.
2. ELEVATIONS ARE SHOWN IN METER (M.S.L.).

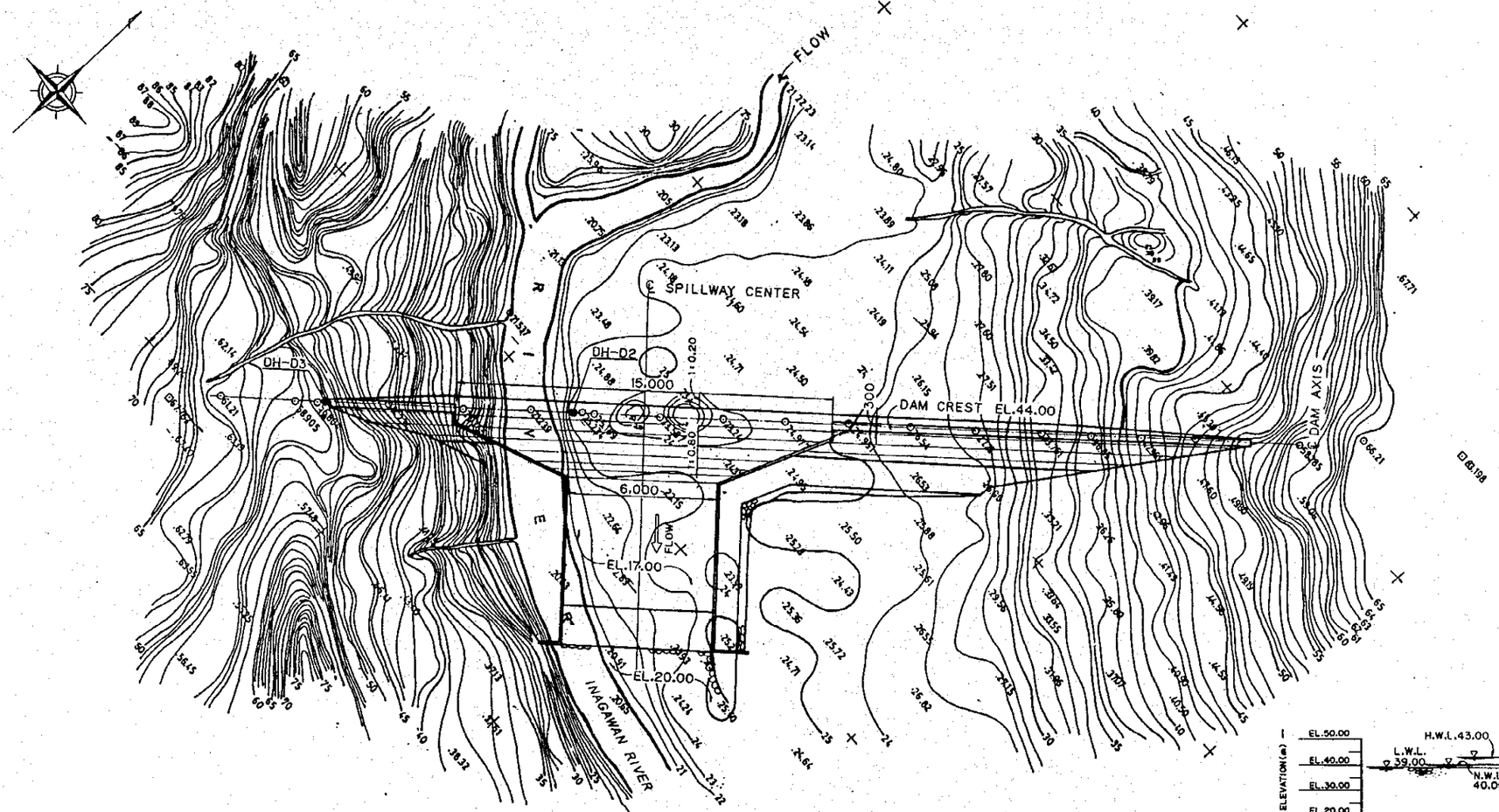
SCALE 1:1,000
0 10 20 30 40 50m

THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

WATER RESOURCES DEVELOPMENT
SITE Eu & El (2/2)

DAR

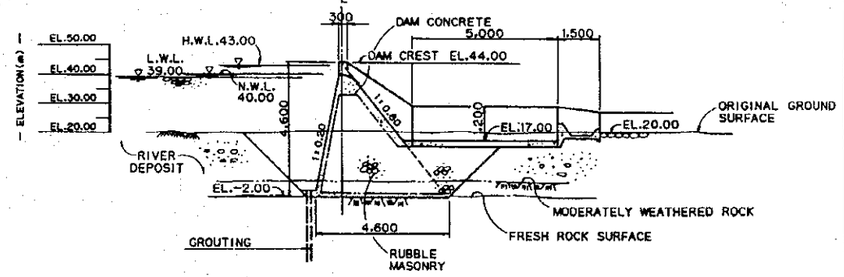
JICA
JAPAN INTERNATIONAL COOPERATION AGENCY



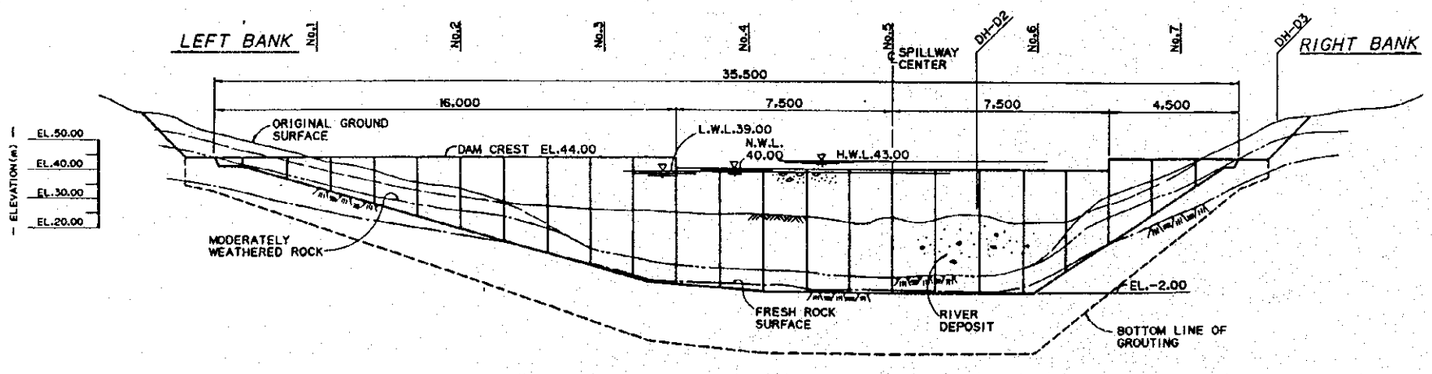
GENERAL LAYOUT FOR SITE D
SCALE 1:1,000

MAJOR FEATURE OF SITE D

ITEM	DESCRIPTION
(1) LOCATION	BARANGAY INAGAWAN PUERTO PRINCESA
(2) WATER SOURCE	
a) RIVER NAME	INAGAWAN R.
b) WATERSHED AREA	118.1 (㎢)
c) T. STORAGE	2.56 (MCM)
d) E. STORAGE	0.20 (MCM)
e) H.W.L (MSL)	40.0 (m)
f) L.W.L (MSL)	39.0 (m)
(3) MAJOR FEATURE	
a) DAM TYPE	CONCRETE
b) CREST LENGTH	335.0 (m)
c) HEIGHT	46.0 (m)
d) CREST ELEVATION	44.0 (m) MSL
e) DESIGN FLOOD	1,600.0 (㎥/sec)
f) INTAKE DISCHARGE	0.84 (㎥/sec)



TYPICAL CROSS SECTION OF DAM
(SITE D) SCALE 1:1,000



PROFILE OF DAM
(SITE D) SCALE 1:1,000

SCALE 1:1,000
0 10 20 30 40 50m

NOTE:

1. ALL DIMENSIONS ARE SHOWN IN CENTIMETER UNLESS OTHERWISE SPECIFIED.
2. ELEVATIONS ARE SHOWN IN METER (M.S.L.).
3. UNSUITABLE SITE FOR DAM DUE TO DEEP RIVER DEPOSIT.

THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

WATER RESOURCES DEVELOPMENT
SITE D

DAR

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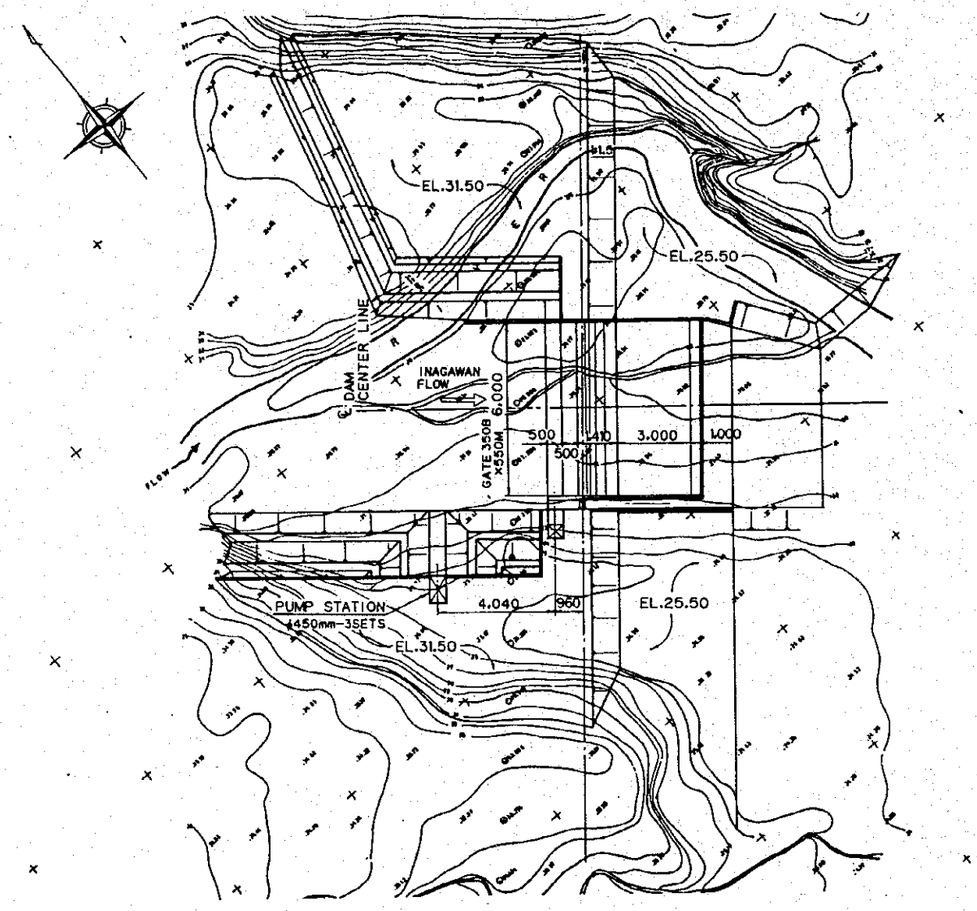
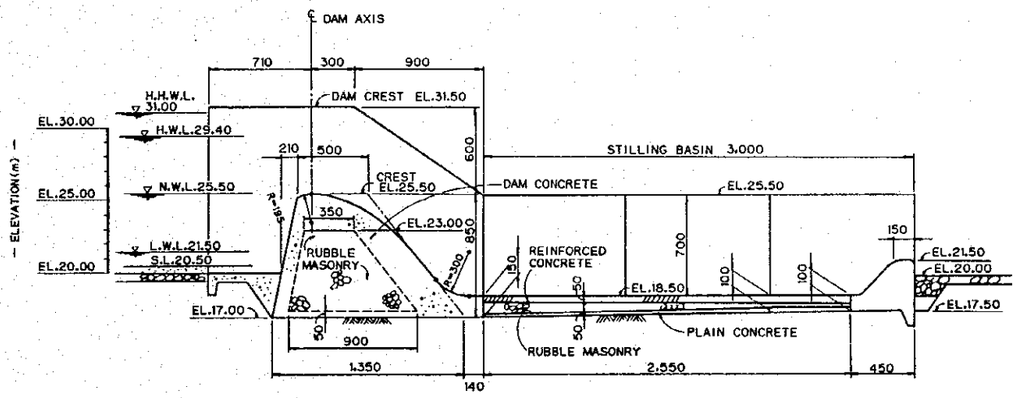
MAJOR FEATURE OF SITE LD

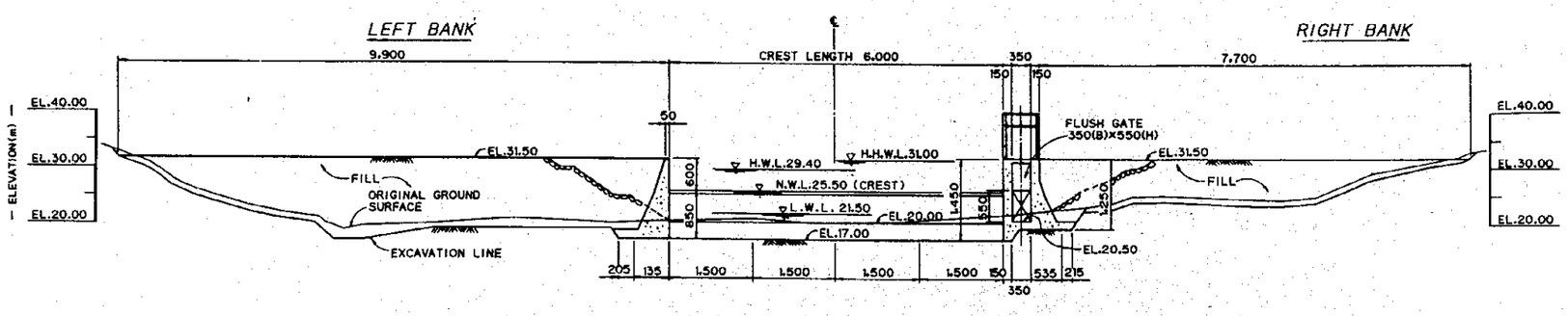
ITEM	DESCRIPTION	ITEM	DESCRIPTION
(1) LOCATION	INAGAWAN PUERTO PRINCESA	(4) PUMP STATION	
		a) DESIGN DISCHARGE	0.84 (m³/sec)
(2) WATER RESOURCES		b) TYPE OF PUMP	VERTICAL PUMP
a) RIVER	INAGAWAN	c) SIZE	φ450mm×3sets
b) WATERSHED AREA	118.5 (km²)	d) OUTPUT OF PUMP	190KW×3sets
c) EFFECTIVE STORAGE	0.20 (MCM)	(5) IRRIGABLE AREA	590 (ha)
(3) WEIR			
a) TYPE	FIXED WEIR TYPE		
b) CREST LENGTH	60.0 (m)		
c) HEIGHT	8.5 (m)		
d) CREST ELEVATION	25.50(m)		
e) DESIGN FLOOD	990 (m³/sec)		
f) INTAKE DISCHARGE	0.45 (m³/sec)		



GENERAL LAYOUT FOR SITE LD
SCALE 1:1,000



TYPICAL CROSS SECTION OF DAM
SCALE 1:200



PROFILE OF DAM AXIS
SCALE 1:500

SCALE 1:200
0 5 10m

SCALE 1:500
0 10 20 25m

SCALE 1:1,000
0 10 20 30 40 50m

NOTE:
1. ALL DIMENSIONS ARE SHOWN IN CENTIMETER UNLESS OTHERWISE SPECIFIED.
2. ELEVATIONS ARE SHOWN IN METER (M.S.L.).

THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

WATER RESOURCES DEVELOPMENT SITE LD (DIVERSION DAM, PUMP STA.) (1/2)

DAR

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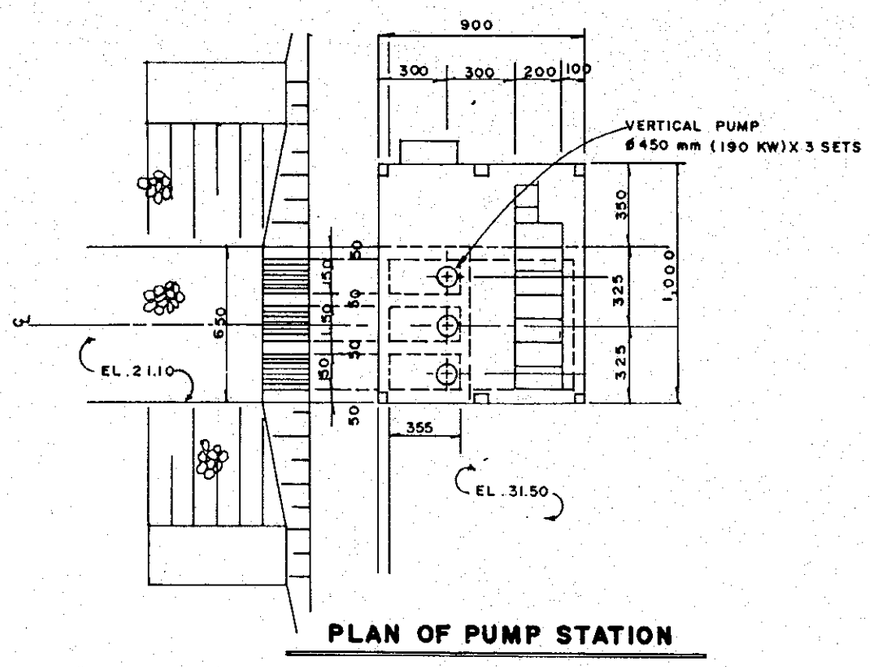
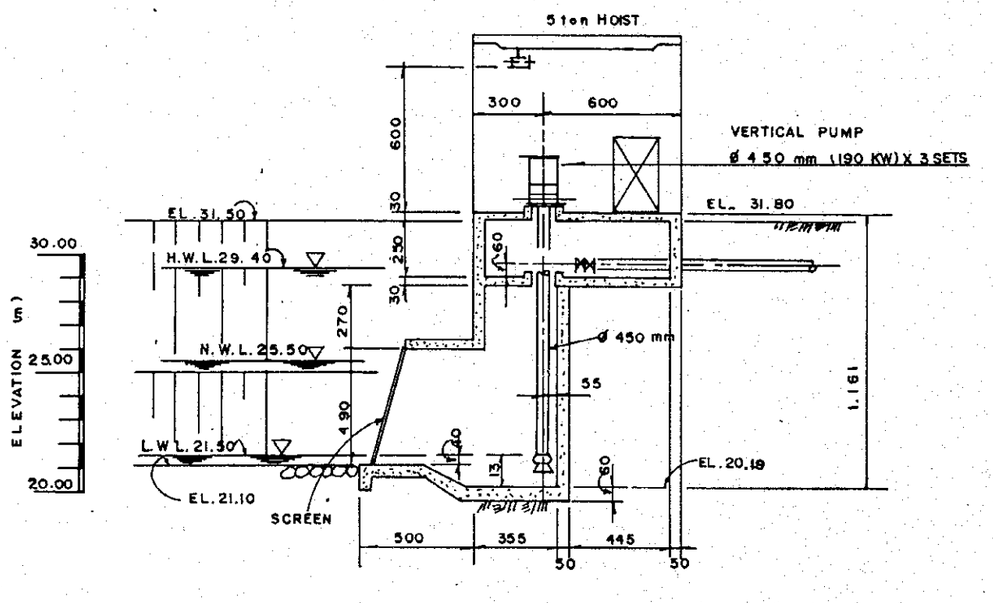


PLAN OF PUMP STATION

SCALE 1: 200



CROSS SECTION

SCALE 1: 200

SCALE 1:200

0 5.0 10.0

THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

WATER RESOURCES DEVELOPMENT
SITE LD (DIVERSION DAM, PUMP STA.)
(2/2)

DAR

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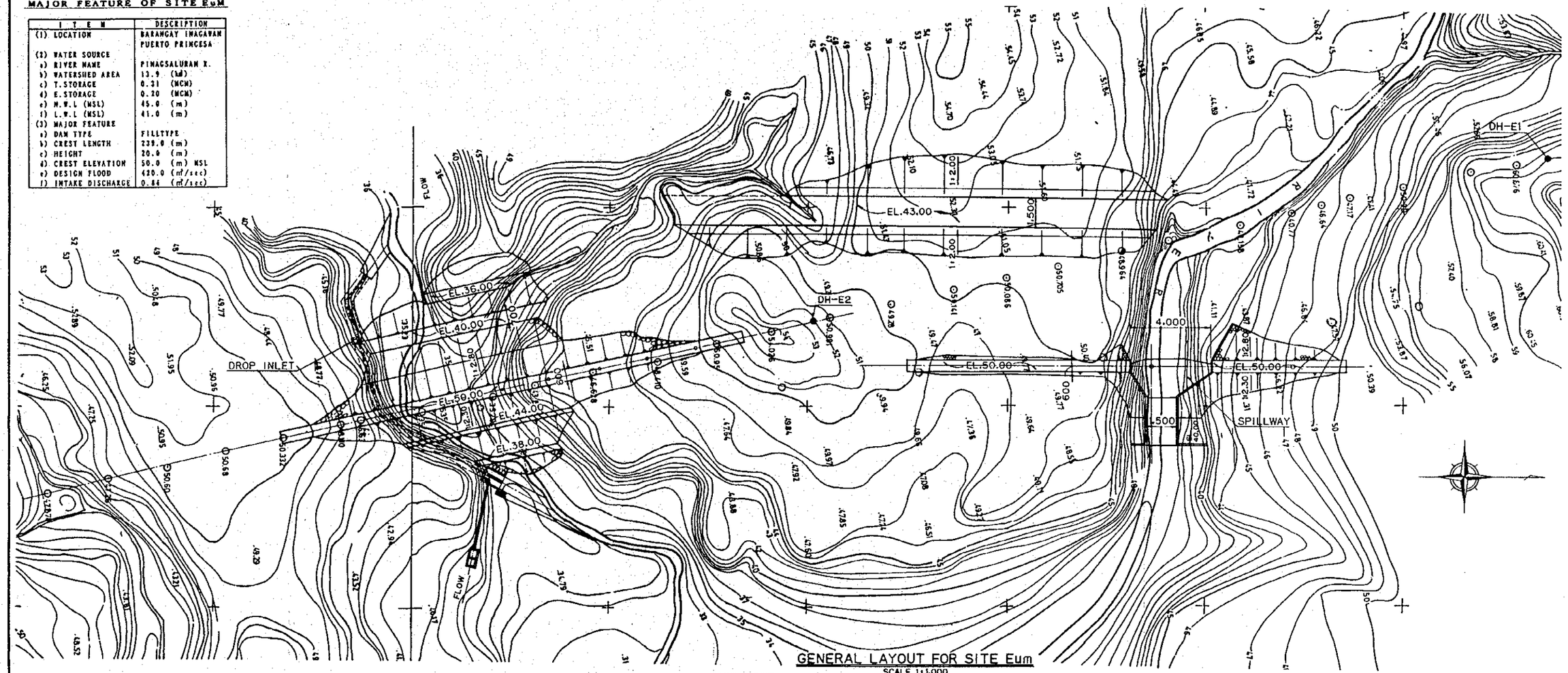
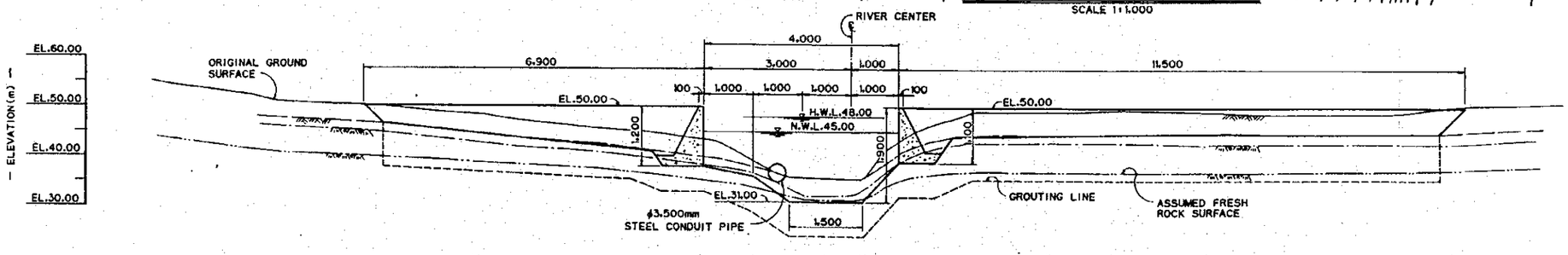
MAJOR FEATURE OF SITE EuM

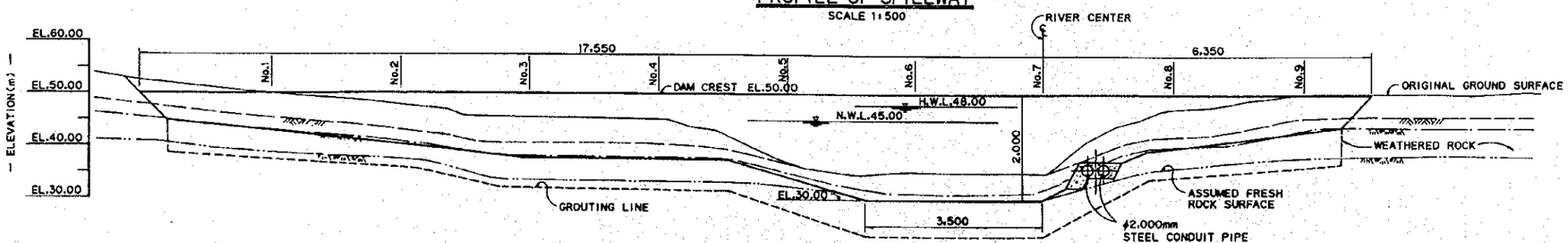
ITEM	DESCRIPTION
(1) LOCATION	BARANGAY INAGAWAN PUERTO PRINCESA
(2) WATER SOURCE	
a) RIVER NAME	PINAGSALURAN R.
b) WATERSHED AREA	13.9 (㎢)
c) T.STORAGE	0.31 (MCM)
d) E.STORAGE	0.20 (MCM)
e) H.W.L (MSL)	45.0 (m)
f) L.W.L (MSL)	41.0 (m)
(3) MAJOR FEATURE	
a) DAM TYPE	FILLTYPE
b) CREST LENGTH	238.0 (m)
c) HEIGHT	20.0 (m)
d) CREST ELEVATION	50.0 (m) MSL
e) DESIGN FLOOD	420.0 (㎥/sec)
f) INTAKE DISCHARGE	0.84 (㎥/sec)



GENERAL LAYOUT FOR SITE Eum
SCALE 1:1,000



PROFILE OF SPILLWAY
SCALE 1:500



PROFILE OF DAM
SCALE 1:500

NOTE:

1. ALL DIMENSIONS ARE SHOWN IN CENTIMETER UNLESS OTHERWISE SPECIFIED.
2. ELEVATIONS ARE SHOWN IN METER (M.S.L.).

SCALE 1:500
0 10 20 25m

SCALE 1:4,000
0 10 20 30 40 50m

THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

WATER RESOURCES DEVELOPMENT
SITE EuM (1/2)

DAR

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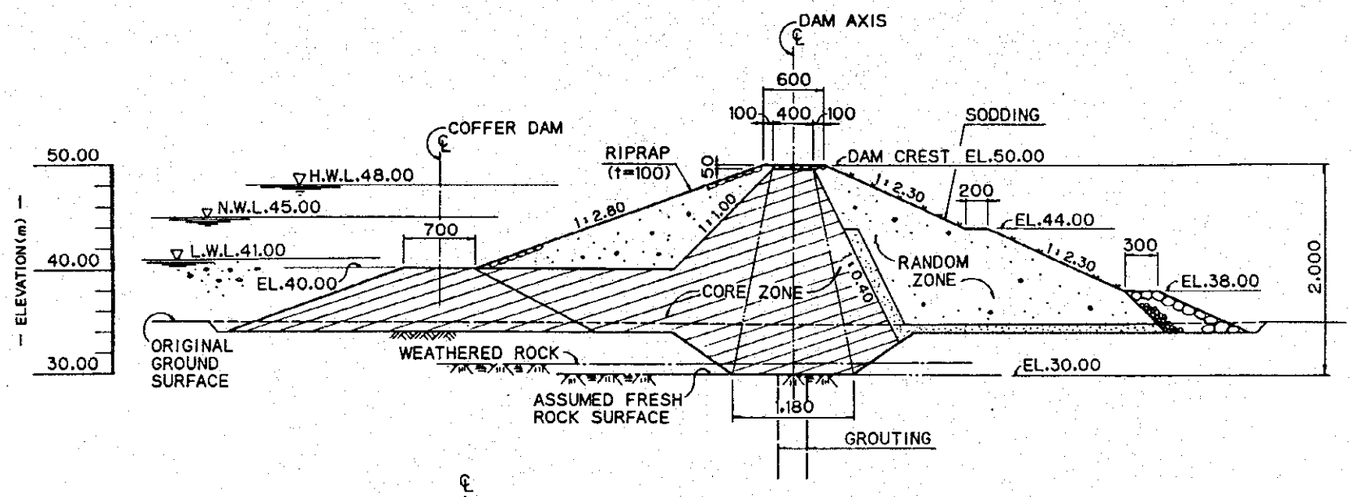
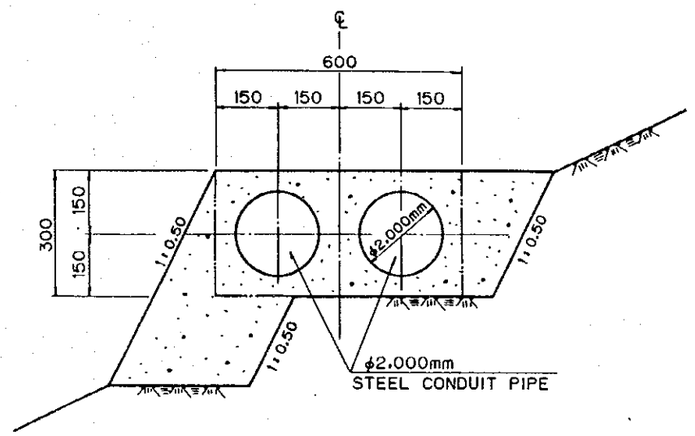


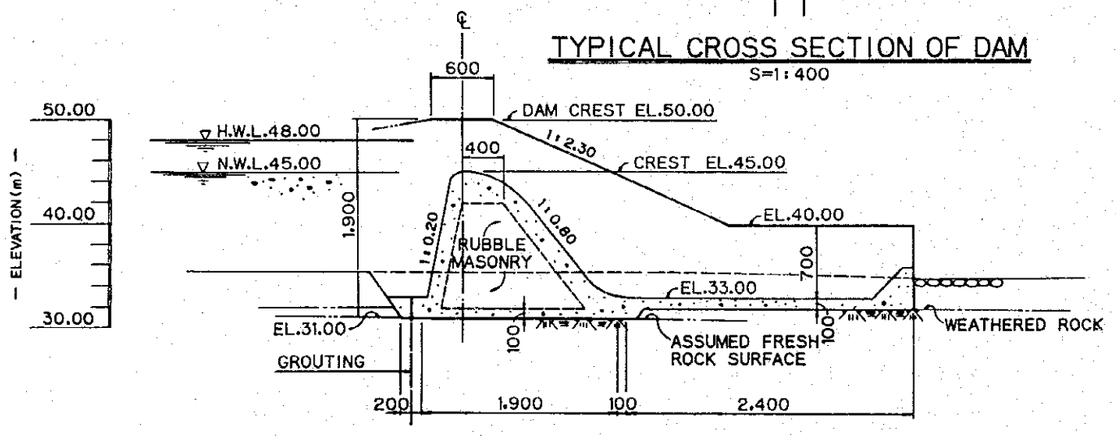
TYPICAL CROSS SECTION OF DAM

S=1:400



SECTION A-A

S=1:100



TYPICAL CROSS SECTION OF SPILLWAY

S=1:400

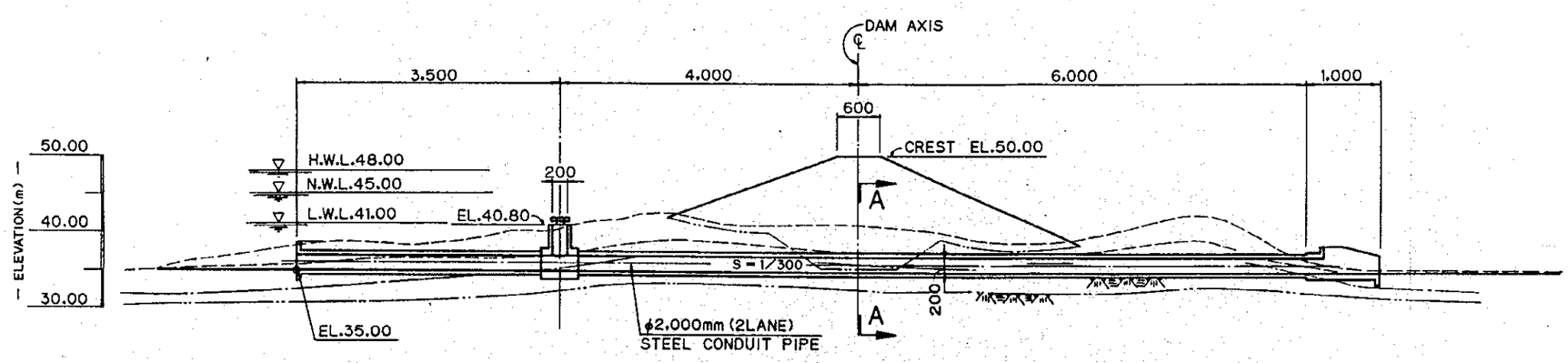
NOTE:

1. ALL DIMENSIONS ARE SHOWN IN CENTIMETER UNLESS OTHERWISE SPECIFIED.
2. ELEVATIONS ARE SHOWN IN METER (M.S.L.).

SCALE 1:400
0 10 20m

SCALE 1:500
0 10 20m

SCALE 1:1,000
0 10 20 30 40 50m



PROFILE OF INTAKE FACILITIES

S=1:500

THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

WATER RESOURCES DEVELOPMENT
SITE EuM (2/2)

DAR

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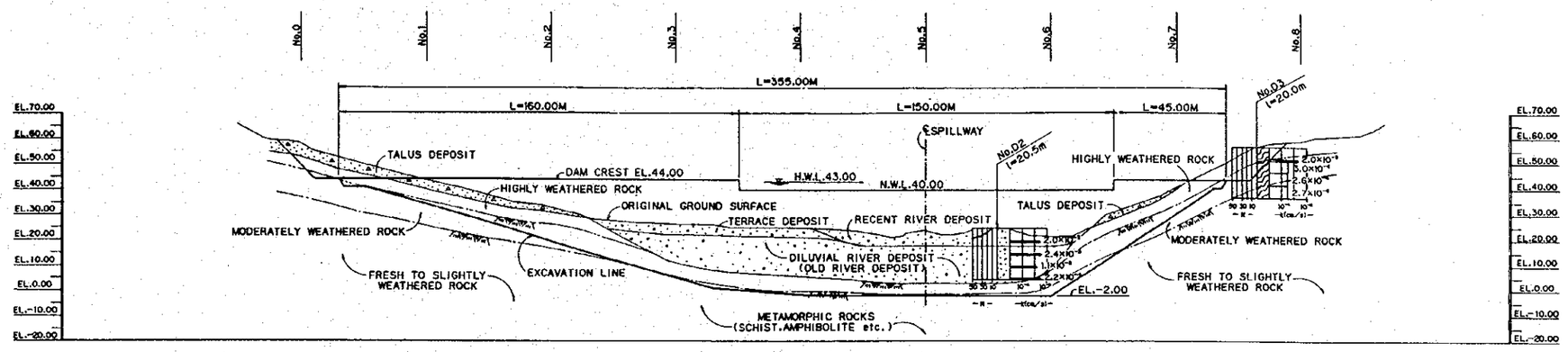
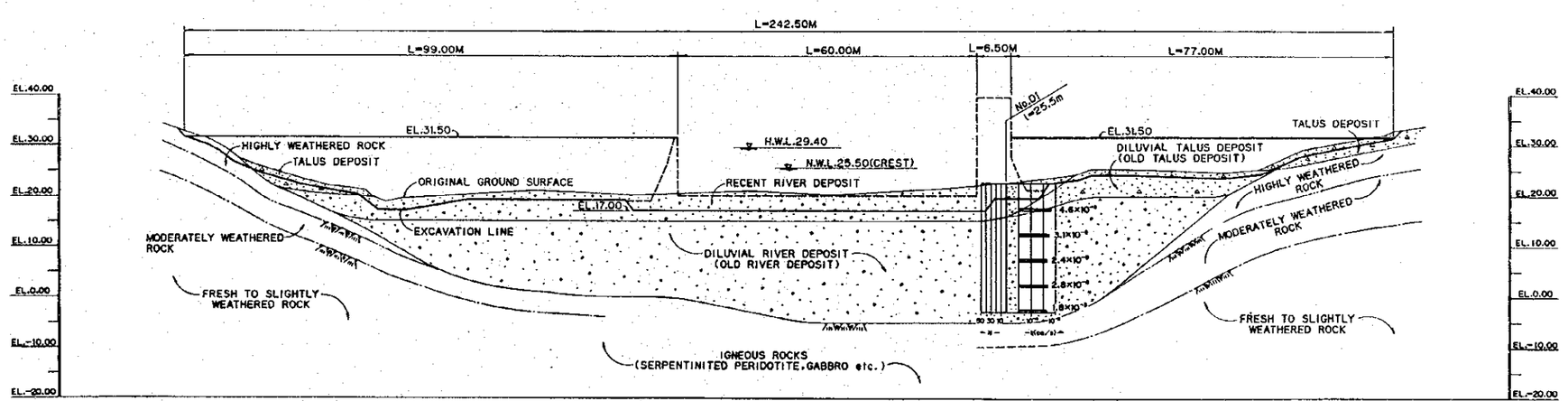


GEOLOGICAL PROFILE SECTION ALONG D DAM AXIS

SCALE V=1:1,000, H=1:1,000



GEOLOGICAL PROFILE SECTION ALONG LD DAM AXIS

SCALE V=1:500, H=1:500

LEGEND

- RIVER DEPOSIT, TALUS DEPOSIT — ALLUVIAL DEPOSIT (HOLOCENE)
- OLD RIVER DEPOSIT (DILUVIAL RIVER DEPOSIT), OLD TALUS DEPOSIT (DILUVIAL TALUS DEPOSIT) — IWAHIG FORMATION (PLEISTOCENE)
- IGNEOUS ROCKS (SERPENTINITED PERIDOTITE etc.) — Mt.BEAUFORT ULTAMAFICS (EOCENE)
- METAMORPHIC ROCKS (SCHIST.AMPHIBOLITE etc.) — INAGAWAN RIVER METAMORPHICS (EOCENE~MIOCENE)
- STAVELY RANGE GABBRO — STAVELY RANGE GABBRO
- ASSUMED MODERATELY WEATHERED ROCK LINE
- ASSUMED SLIGHTLY WEATHERED TO FRESH ROCK LINE
- THRUST FAULT

NOTE:

1. ALL DIMENSIONS ARE SHOWN IN METER UNLESS OTHERWISE SPECIFIED.
2. ELEVATIONS ARE SHOWN IN METER (M.S.L.).

SCALE 1:500
0 10 20 30m

SCALE 1:1,000
0 20 40 60m

THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

WATER RESOURCES DEVELOPMENT
GEOLOGICAL PROFILE SECTION
(SITE D, LD)

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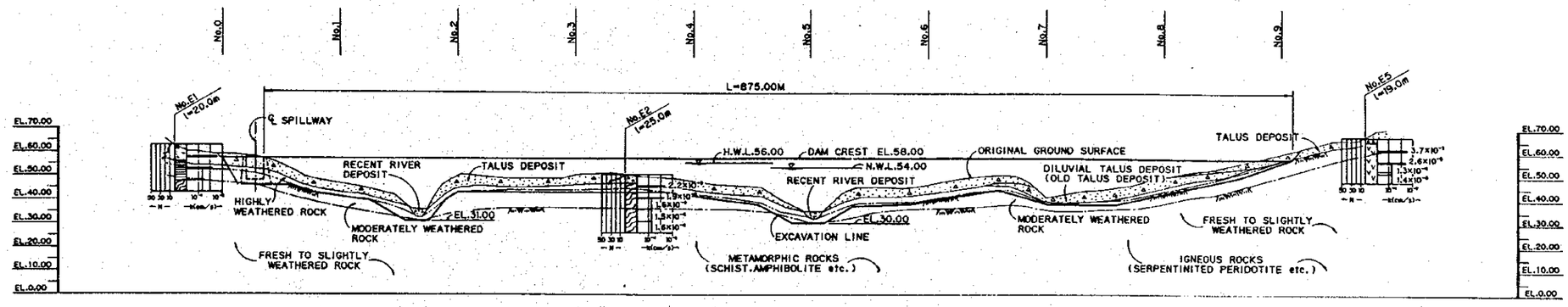
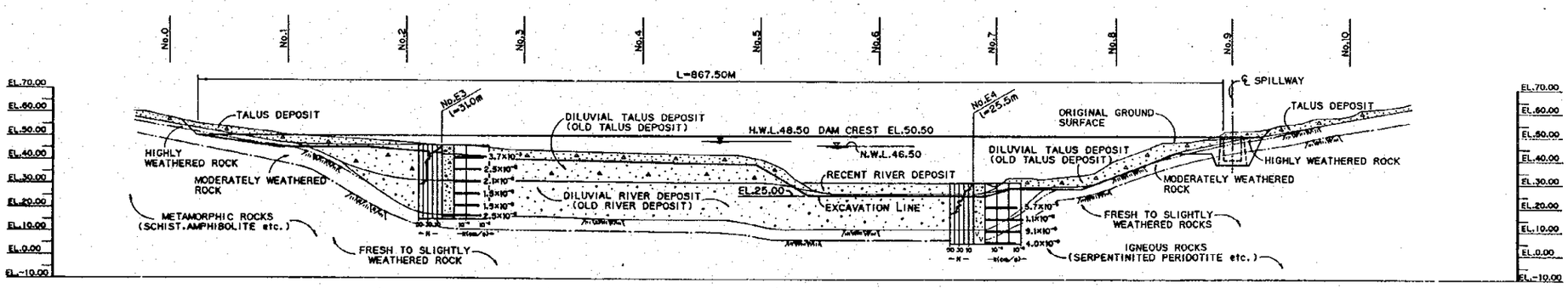


GEOLOGICAL PROFILE SECTION ALONG Eu DAM AXIS

SCALE V=1:1,000, H=1:2,000



GEOLOGICAL PROFILE SECTION ALONG El DAM AXIS

SCALE V=1:1,000, H=1:2,000

LEGEND

- RIVER DEPOSIT, TALUS DEPOSIT — ALLUVIAL DEPOSIT (HOLOCENE)
- OLD RIVER DEPOSIT (DILUVIAL RIVER DEPOSIT), OLD TALUS DEPOSIT (DILUVIAL TALUS DEPOSIT) — IWAHIG FORMATION (PLEISTOCENE)
- IGNEOUS ROCKS (SERPENTINITED PERIDOTITE etc.) — Mt.BEAUFORT ULTAMAFICS (EOCENE)
- METAMORPHIC ROCKS (SCHIST.AMPHIBOLITE etc.) — INAGAWAN RIVER METAMORPHICS (EOCENE~MIOCENE)
- STAVELY RANGE GABBRO — STAVELY RANGE GABBRO
- ASSUMED MODERATELY WEATHERED ROCK LINE
- ASSUMED SLIGHTLY WEATHERED TO FRESH ROCK LINE
- THRUST FAULT

NOTE:

1. ALL DIMENSIONS ARE SHOWN IN METER UNLESS OTHERWISE SPECIFIED.
2. ELEVATIONS ARE SHOWN IN METER (M.S.L.).

SCALE 1:1,000
0 20 40 60m

SCALE 1:2,000
0 40 80 120m

THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

WATER RESOURCES DEVELOPMENT
GEOLOGICAL PROFILE SECTION
(SITE Eu, El)

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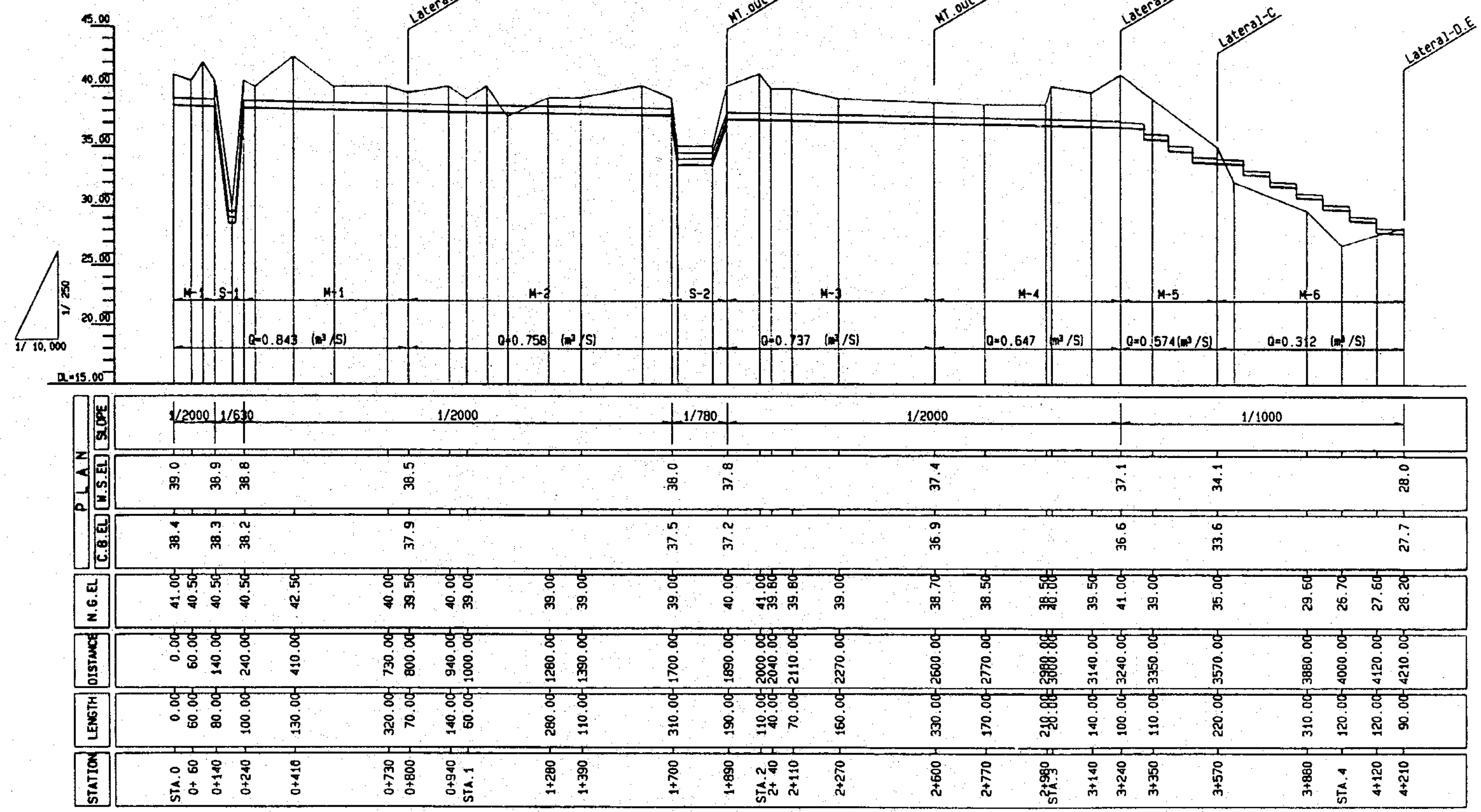
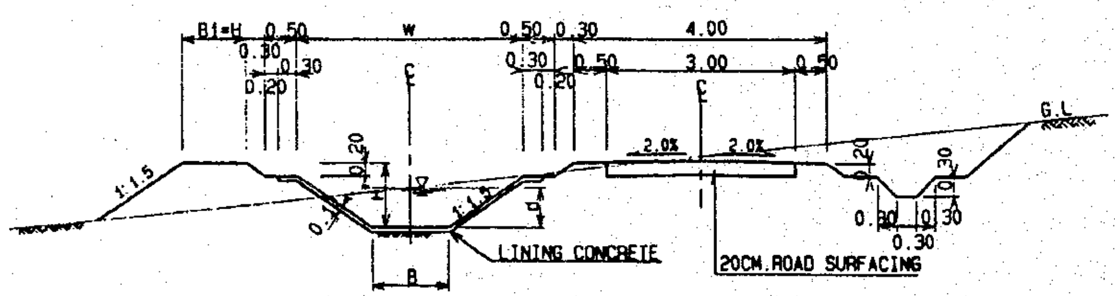
PROFILE OF MAIN CANAL



TYPICAL CANAL SECTIONS



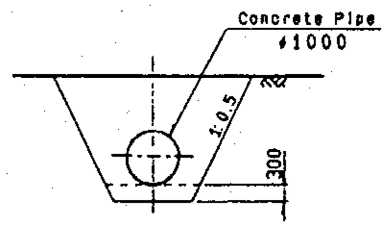
MAIN CANAL (LINED)
TYPE-I

DIMENSION TABLE

Main Canal

TYPE	SECTION	Q (m³/S)	n	I	B (m)	d (m)	H (m)	V (m/S)
I	M-1	0.843	0.018	1/2000	1.20	0.61	1.00	0.65
	M-2	0.758	0.018	1/2000	1.20	0.58	0.90	0.63
	M-3	0.737	0.018	1/2000	1.20	0.57	0.90	0.63
	M-4	0.647	0.018	1/2000	1.20	0.53	0.90	0.61
	M-5	0.574	0.018	1/1000	1.00	0.45	0.80	0.76
	M-6	0.312	0.018	1/1000	0.80	0.36	0.70	0.66

TYPICAL SYPHON SECTIONS



THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

Plofile of Irrigation Canl

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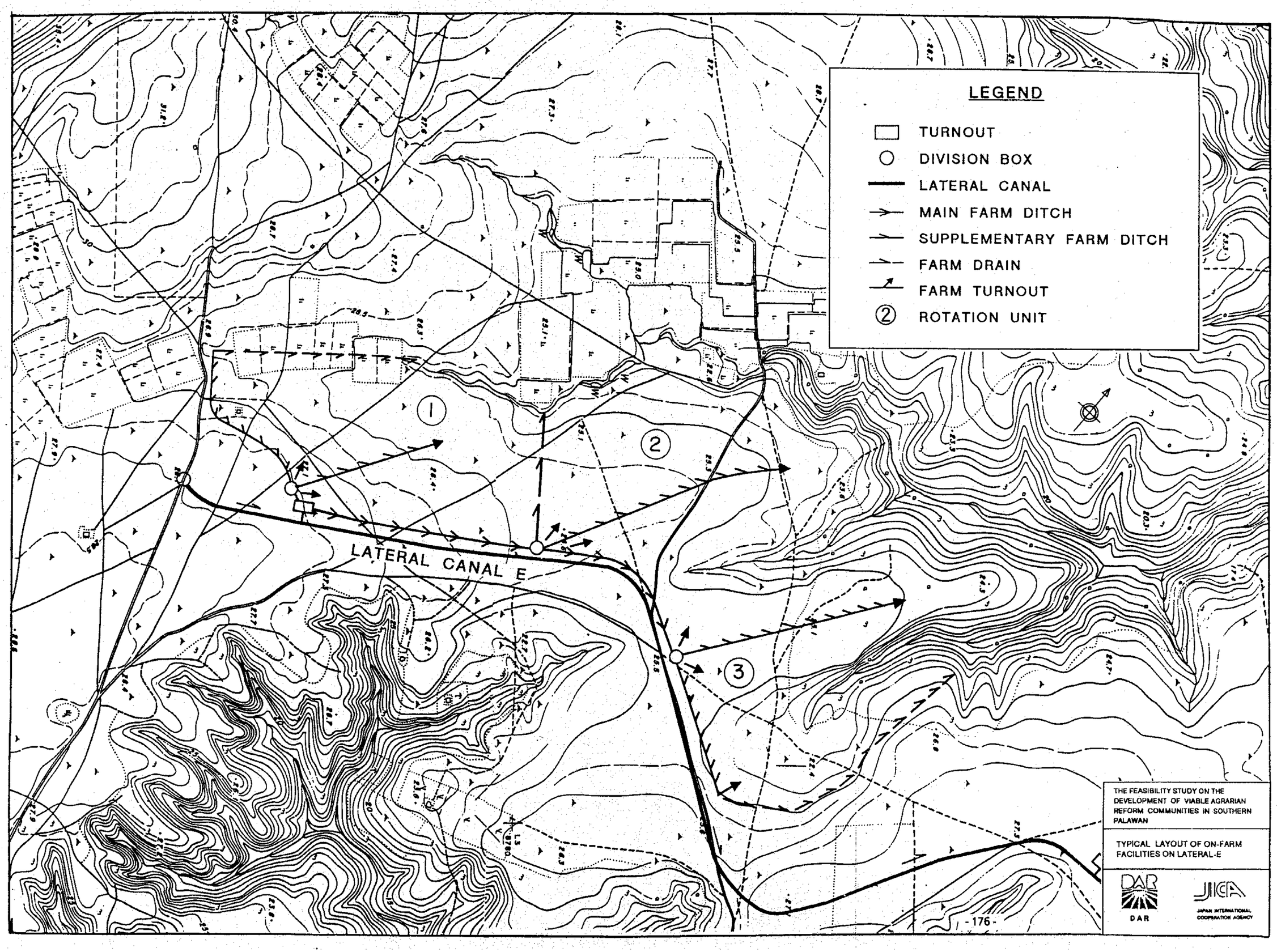
LEGEND
TURNOUT
DIVISION BOX
LATERAL CANAL
MAIN FARM DITCH
SUPPLEMENTARY FARM DITCH
FARM DRAIN
FARM TURNOUT
ROTATION UNIT
①
②
③
LATERAL CANAL E
THE FEASIBILITY STUDY ON THE DEVELOPMENT OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN
TYPICAL LAYOUT OF ON-FARM FACILITIES ON LATERAL-E
DAR
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