FEASIBILITY REPORT
OF
AGRICULTURAL DEVELOPMENT PROJECT
IN CEYLON
FOR
DEWAHUWA COMMUNITY

June 1969

THE OVERSEAS TECHNICAL COOPERATION AGENCY
GOVERNMENT OF JAPAN

FOREWORD

The Overseas Technical Co-operation Agency (OTCA) has the pleasure of presenting this report of the Second Survey Mission for Agricultural Development to Ceylon.

The Mission was organized and dispatched to Ceylon by OTCA upon instruction from the Government of Japan as a follow-up of the recommendations made by the previous team headed by Prof. Dr. Nasu.

The second team stayed in Ceylon from 15 February to 6 April 1969 and, during its 51 days' stay, selected one village in which technical co-operation for agricultural development including, inter alia, agricultural production, marketing, farmers organization, might be concentrated. The team further drew up a development plan to be carried out in that village with technical co-operation between the Governments of Ceylon and Japan.

The development project suggested in this report is meant for providing a nucleus of a series of chain-reactions provocative to similar developmental efforts among the villagers elsewhere in Ceylon. Since economic development of Ceylon as a whole depends upon a sound development of her agricultural sector, the project like this which aims at providing an example of and establishing guide-line for rural development will be a worthy subject-matter of technical co-operation between the two countries.

It is very much hoped for that the project suggested in this report will be taken for implementation by the both governments not only for the economic development of Ceylon but also for strengthening friendly relationship between Ceylon and Japan.

The OTCA is deeply indebted to the leaders and members of the team for their laborious work and to the authorities of the Government of Ceylon, both in central and local levels, for their co-operation extended to the team. Acknowledgement is also made with gratitude to the assistance given by the Japanese Embassy in Colombo.

June 1969

S. Shibusawa

Shinichi Shibusawa
Director-General
Overseas Technical Co-operation Agency

ACKNOWLEDGEMENT

Following to the idea established by the First Survey (Basic) Mission for Agricultural Development which visited Ceylon in July 1968 and for translating the very idea into a workable programme, the Second Survey (Planning) Mission was deputed with the terms of reference covering the selection of proper project-area having characteristics categorical to the Island and the working-out of tangible rural development programme to be implemented there. Experts and specialists pertaining to infra-structural matters, farm-management problems and socio-economic issues were thus put together under the leadership of Dr. Hitoshi Fukuda, in its former-half and Mr. Motonaga Ohto, in its latter-half.

Selection of the project-area might not have been made in perfect compliance with Dr. Nasu's idea but the programme which has been chalked out as a common product of the knowledgeable and experienced Members is an all-round rural development scheme embracing as its multilateral aims, such as the infra-structural improvements, the establishment of stable farm-management practices, the betterment of socieoeconomic organizations and the elevation of the people's living-standards, combinedly purported for a wider "spill-over" of the project's benefits, as visualized by Dr. Nasu.

Agricultural Development Project in Dewahuwa is now looking forward the deputation of the Japanese experts and the arrival of necessary equipment and material and its success will demand a good co-ordination between two Governments of Ceylon and Japan and exertions on the part of the project-personnel from both sides. On behalf of the Mission-Members and on our own behalf, cordial thanks are due to the Japanese Embassy in Colombo and the Japanese experts assigned to Ceylon as well as Ceylonese Embassy and official organs of the Government of Ceylon stationed in Tokyo and the Japan-Ceylon Association. The assistances offered by the authorities concerned of the Government of Japan and the staff in charge of the Overseas Technical Co-operation Agency are fully appreciated by all of us. Success of the project as visualized in this Report will heavily depend upon their continuing assistance and co-operation.

Leader Hitoshi Fukuda

June 1969

Leader Motonaga Ohto

MEMBER-LIST OF THE FEASIBILITY SURVEY TEAM

FUKUDA,	Hitoshi	Leader	Professor-Emeritus, The University of Tokyo
OHTO,	Motonaga	Leader	Executive Director, O.T.C.A.
KIMURA,	Takashige	Sub-Leader Irrigation & Drainage	Senior Irrigation Engineer, Design Div., Construction Dept., Agricultural Land Bureau, M.A.F.
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NAKAMURA,	Hisashi	Rural Society	Research Staff, The Institute of Asian Economic Affairs
KAWAJIRI,	Yu-ichiro	Land Consolidation	Irrigation Engineer, Engineering Div., Planning Department, Agricultural Land Bureau, M.A.F.
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M. A. F. = Ministry of Agriculture & Forestry

O.T.C.A. = Overseas Technical Co-operation Agency

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(ii) Map Showing the Location of 8 Candidate-sites;

(iii) Mr. Mahadeva's Letter addressed to Dr. Fukuda in Finalization of the Project-area;

(iv) Memorandum submitted by the Team to Mr. Banda upon Completion of its Mission;

(v) Record of Discussion between the Mission and the Government of Ceylon

(vi) Mr. Mahaveda's Letter addressed to Mr. Ohto re. "Record of Discussion".

Chapter 1 : INTRODUCTION

1-1 : Purpose of this Report

This Report deals with both the analytical study of the current situations prevailing in Dewahuwa and the feasibility of Community Development Programme to be inplemented there. They are the outcomes of the grass-root field-investigation carried out by a team of 11 experts ranging for 12 fields of speciality for a period of 50 days (February to April 1969) with the collaboration of 7 counterpart-officials of the Government of Ceylon.

This Report is meant for scrutinization by the Governments of Japan and Ceylon; upon their approval, necessary actions will follow to materialize the Project on the general lines as herein proposed.

1-2 : Background of the Project

It may be mentioned here that this Project owes its inception at the discussions held between the Hon'ble Prime Minister Mr. Dudley Senanayake of Ceylon and H.E. Mr. Sato the Prime Minister of Japan, in pursuance of which the team of experts headed by Dr. Shiroshi Nasu visited Ceylon for three weeks beginning in July 1968. The Report and Recommendations submitted by the same team having been welcomed by the Government of Ceylon, the present Team was deputed to make feasibility survey called for the implementation of one of Dr. Nasu's proposals: that is, a combination programme of improving irrigation systems, introducing modern techniques, and developing farmers' organizations, through renovation of physical infra-structures in a selected village. This team, led by Dr. Hitoshi Fukuda in the former part and Mr. Motonaga Ohto in the latter, arrived in Ceylon in the middle of February 1969 and, within the said period of time, completed two important tasks: one was selection of the project-area out of 8 candidate-villages named by the Government of Ceylon and the other, grass-root field-investigation in the selected area for implementing Community Development Project. Outline of the Team's fulfilment of its mission is given in its Memorandum submitted to the Hon'ble Mr. Banda, the Minister for Agriculture & Food, on April 3 1969.

While this type of Rural Development Programme designed for overseas technical co-operation is so far a unique venture on the part of the Japanese Government, general upliftment of rural community as a whole in its Dry-Zone, where rests high hopes for future agricultural development of the country, must be of many-phased significance for the Ceylonese Government.

1-3 : Guiding Principles of the Project

(1) Aims

a.- Rural Community colonized on some 1,000 acres of land extending in the upper-stream of Dewahuwa as one unit of production-cum-livelihood will be made a compact target for combined input of various inter-related improvement factors. Well-planned and yet flexible Community Development Programme there would expand the community's productivity by two-times, while elevating general standard of the people's living to such a level as commensurating to production-increase.

b.- All-out participation of the villagers which is indispensable for the success of this Project will have to be made possible through re-organization of their co-operatives. In order to make their self-motivated, joint efforts towards the end really fruitful:
(i) Physical infra-structure will have to be improved (betterment of irrigation facilities and field conditions, to start with) so as to make the irrigation-water available even at its peripheral paddy-field, and (ii) farm-management guidance based on modern techniques shall be made available which will help exploiting underdeveloped potentialities there through adequate extension services.

(2) Self-Imposed Limitations

This Project, to be a worthy pilot programme exemplary for development of other villages and settlements in the Dry-Zone, shall need to be modest in its investment plan; otherwise its beneficiary results, if any, will have no merit of "spill-over" due to financial limitations set by 'Self-Help' type of rural development efforts among the people and by the Government of Ceylon.

(3) Implementation

Formal Agreement is to be signed between the two Governments of Japan and Ceylon prior to its implementation. Mutual efforts in expediting the signing of the Agreement are hoped for, as the Government of Ceylon is anxious to put this Project going from October 1969.

1-4 : Scope and Scale of the Project

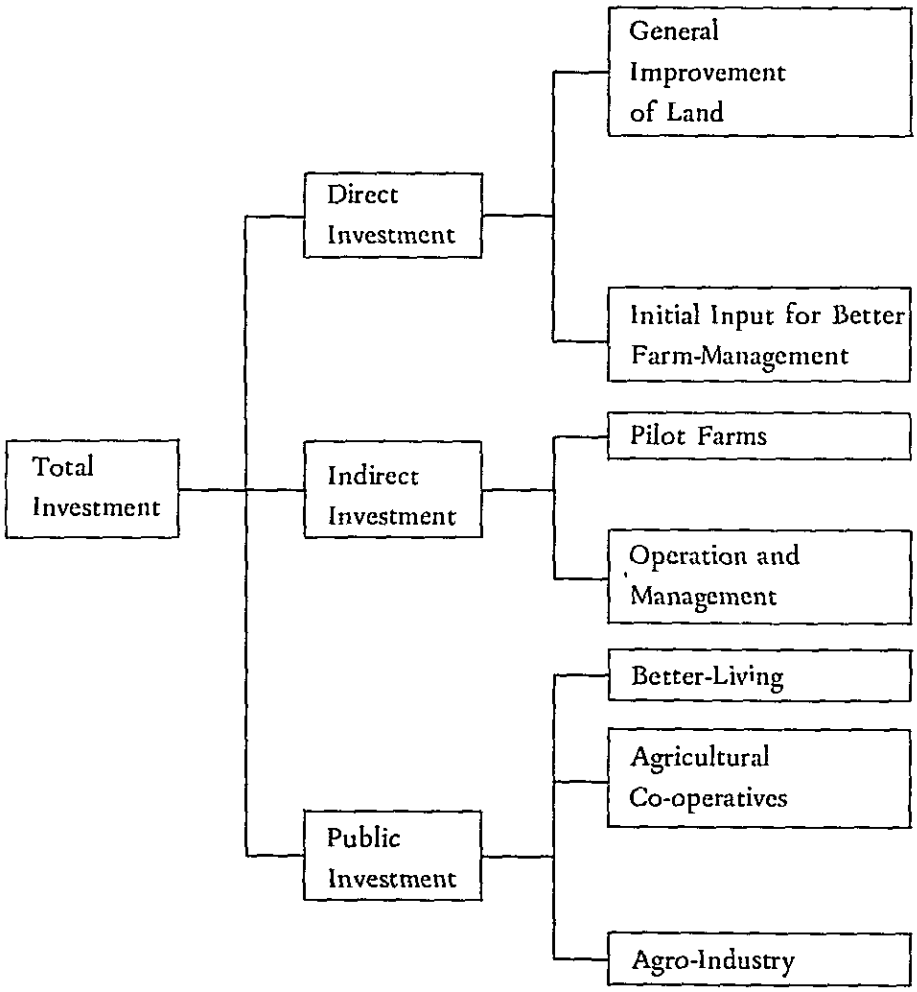
(1) Size of the Project-area

The project-area covers approx. 770 acres of paddy-land, plus adjacent highland (made up of upland-field, orchards and colonists' homestead) which consists of a cadastrally coherent plot of land within Dewahuwa Colonization Scheme of the extent of 2,330 acres

of paddyland and 1,412 acres of highland, in total.

(2) Cost-Estimate and Contents of the Project

This Project, being a kind of multi-purposed Community Development Project, has as its contents many-phased work-load. Investment plan is accordingly framed in 3 broad categories. Actual investment will be made in harmonious manner taking into consideration interrelationships among different items of input on varying stages of its implementation.



Cost-estimate of total investment in term of the local currency, i.e., Ceylonese Rupees, is summed up as follows (unit: thousand Rupees):

Item of Cost	Total	Local Currency part	Foreign-exchange (CIF)
Direct-Investment	3,593	967	2,626
Indirect-Investment	2,085	1,047	1,038
Public-Investment	688	454	234
Incidental Cost (*)	412	412	-
Total Investment	6,778	2,880	3,898

(*) = Estimate of local cost primarily for inland-freight and storage of various equipment and material, *corresponding roughly to 10% of the foreign-exchange part of the investment.*

Direct-investment is meant exclusively for our immediate project-area (770 acres of paddyland plus 100 acres of upland-field); Indirect investment covers total Dewahuwa Colonization Scheme area (2,330 acres of paddyland and its adjacent highland), and Public-investment directed to our immediate project-area as far as Better-Living and Agricultural Co-op. are concerned, but Agro-Industry portion of it is not confined within Dewahuwa Scheme area alone.

(3) Size of Investment per Acre & per Household

Unit-calculation of the investment worked out for this Community Development Project is as follows:

Direct Investment

Infra-Structural Renovation (*1)	per acre	Rs 1,700 ($710/ha)
Initial Input for Better Farming (*2)		
(Farm-machinery only)	–"–	Rs 980

Public Investment (*3 & *4)

Better-Living Programme	per household	Rs 690
Agricultural Co-op. Development	-"-	Rs 1,140

(Note = *1: Paddyland irrigation works designed in Infra-Structural Renovation Plan covers the whole area of Dewahuwa Colonization Scheme; the pertinent figure for our immediate project-area is given here;

*2: Cost for Fertilizer and Farm-chemical is excluded on the ground that it constitutes production-cost meant for reasonable return year after year and not a lump-sum capital requirement over a specific period of time. Their incremental input is made possible through capital-accumulation among the cultivators;

*3 Investment for implementation of Better-Living Programme and Agricultural Co-op. development is to benefit the whole populace of the area and, therefore, it has been distributed evenly among the entire households there, and

*4 Investment for Agro-Industry Development is on experimental basis and its benefits are not confined to Dewahuwa area alone nor is made a criterion for'spill-over' effects, hence it is excluded from our calculation.

The above Investment -Plan has been worked out in view of attaining the maximum benefit out of the minimum cost so that the outcome of this experiment will, upon its successful implementation, be 'spilt-over' to the adjacent locality as well. The size of the direct investment visualized under this project,which contributes to an increased agricultural production and thereby prepares a solid foundation for a series of developmental projects to follow thereupon,will not go far beyond the limits of the national efforts among the Ceylonese themselves,provided that appropriate institutions for provision of long-term loans and for making grants for developmental purposes will come to be established in the country in due course of time.

The pattern in which public-investment is synchronized to the direct-investment,as under this project,does not necessarily be copied in other region; once direct-investment will be made as pump-priming-water and productivity start increasing in the locality, public or indirect-investments may follow as and when required in view of sustaining such productivity-increase and of accelerating sound capital-accumulation and its productive ploughing-back, not only for enlarged reproduction but for the people's livelihood-improvement as well.

(4) Duration of Project and Composition of Japanese Resource-persons

a.- This Project will run for full five years in attaining its ultimate purposes; after the termination of the project, a few Japanese personnel may stay over for a little while, mainly for pursuing evaluation of the project's achievements and to facilitate for their 'spill-' over' effect among neighbouring villages and settlements in the Dry-Zone.

b.- Japanese resource-persons who participate this project will consist of experts and specialists on different operational fields; members of the Japan Overseas Co-operation Volunteers are expected to join them for establishing and operating the Pilot-Farms within the project-area.

c.- Japanese resource-persons will be accommodated with their families at either Colombo or Kandy for the first two years. They will report at the Project-area at the beginning of each week, rejoining their families at week-end. From the third year, both the resource-persons and their families will be resided at the Project-area itself. Facilities, particularly for the resource-persons' families there, will have to be healthy and wholesome ones.

d.- Categories of Japanese experts and specialists participating this Project and their number will be determined upon discussion with the authorities of the Government of Ceylon.

Chapter II : CURRENT SITUATIONS IN DEWAHUWA

2-1 : Natural Features

2-1-1: Location and Topography

Dewahuwa is located at the centre of the Island of Ceylon, in its Dry-Zone. It is one of the Major Colonization Schemes by the Government, spreading over some 2,330 acres of paddyland inbetween Galewela and Kalawewa. To the west of this Colony, Hawanella Oya is flowing from south to north; in its upper-stream is Dewahuwa-wewa, a tank made by barraging the said Hawanella Oya. To its west is spreading the highland which is being utilized for the colonists' homestead, orchards and upland-fields. As a whole, the Colony is gently slanting from south to northward within the altitude of 500 – 600 feet above sea-level.

2-1-2: Area and Cadastral Demarcation

Our project-area consists of Tracts 1 to 4, out of 9 Tracts which make up the Major Colonization Scheme of Dewahuwa (completed in 1951), spreading on Central Province and North-Central Province. The project-area has a size of approx. 770 acres of paddyland plus adjacent highland. According to the original plan, Dewahuwa Scheme was made up of the following:

Table 2-1 : Area of Dewahuwa Colonization Scheme (in acres)

Tract	1	2	3	4	Total of 1 to 4	5	6	7	8	9	Total of 1 to 9
Paddyfield	68	51	538	114	771	331	259	315	482	179	2,337
Highland	39	30	324	71	464	198	157	195	292	106	1,412
Total	107	81	862	185	1,235	529	416	510	774	285	3,749

The project-area is duly blocked among the colonists. Figures given in the above Table 2-1 are those specified at the time of the original Colonization Scheme and the actual size of paddyfield and highland in each Tract has not been confirmed so far.

2-1-3: Atmospheric Phenomena

(1) Rainfall

Data Used: Data available at Dewahuwa check-point located at 604.75 feet a.s.l. for the last 15 years (October 1953 to September 1968) as assimilated in the publications of the Meteorological Department.

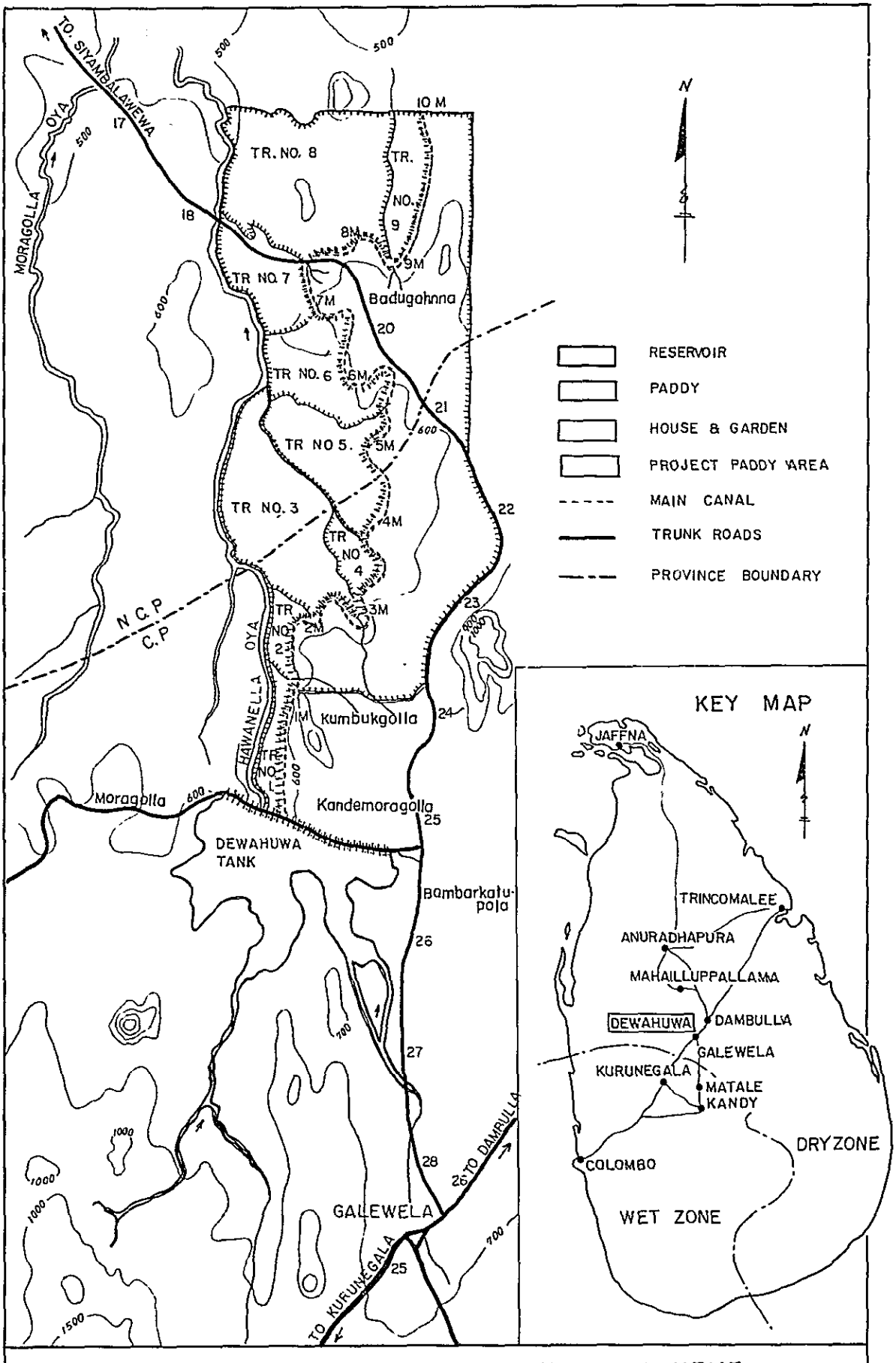


FIG 2-1 LOCATION PLAN OF DEWAHUWA SCHEME

Miles 1 0.5 0 1 2 Miles

SCALE : ONE INCH TO ONE MILE (1 63,360)

Annual Rainfall : Precipitation from October to September (one year cycle) for the last 15 years averages at 70.28 inches. Maximum rainfall was recorded during 1957–58 (110.45 inches) and the minimum, during 1955 – 56 (30.05 inches), with the standard deviation of 19.8 inches (see Table 2-2). 75% of the average annual rainfall (that is so-called 'drought-year') comes to 52.71 inches. The maximum and minimum rainfalls stand for 96.3 inches and 45.8 inches, respectively, at 'one-in-ten' probability and 122.0 inches and 29.3 inches at 'one-in-hundred' probability.

Maximum Daily Rainfall : During the last 15 years, maximum daily rainfall reached 8.83 inches and the minimum, 2.93 inches (see Table 2-2). Maximum daily rainfalls at 'one-in-ten' and 'one-in-hundred' probabilities would be 6.36 inches and 10.58 inches, respectively.

Rainfall distribution: Average monthly rainfall and its standard deviation are given on Table 2-3. It rains more during Maha season (particularly between October and December) and less during Yala season (particularly during June and September). Drought conditions lasted for 73 days at the maximum (June 30 to September 8 1956) during the same period of time. Monthly rainfall and the arrival of rainy season fluctuates with a considerable range year after year, hence paddy-cultivation is made rather unstable.

Table 2-2 : Annual Rainfall and Maximum Daily Rainfall

Year	Annual Rainfall	Maximum Daily Rainfall		Remarks
		Rainfall	Date of Occurrence	
1953 – 54	93.77	4.56	10-10-1953	
1954 – 55	99.28	3.65	14-10-1954	
1955 – 56	30.05	2.32	29-11-1955	
1956 – 57	66.83	4.87	15-11-1956	
1957 – 58	110.45	8.83	26-12-1957	
1958 – 59	51.42	2.93	24-12-1958	SDY
1959 – 60	77.77	2.65	11- 7-1960	
1960 – 61	65.66	5.60	22-10-1960	
1961 – 62	71.01	3.62	31-10-1961	
1962 – 63	61.96	3.42	12-10-1962	
1963 – 64	67.86	3.12	21-10-1963	SAY
1964 – 65	52.40	3.20	13- 2-1965	SDY
1965 – 66	64.38	3.03	9-11-1965	
1966 – 67	72.72	4.57	30-11-1966	
1967 – 68	65.94	6.74	5-12-1967	
Average:	70.28			SD = 19.8

Note: SDY = Standard Dry Year
SAY = Standard Average Year
SD = Standard Deviation

Table 2-3 : Monthly Rainfall, Number of Rainfall Days & Number of Continuous Drought Days (1953–54 to 1967–68)

Month	Monthly Rainfall (inch)			Standard Deviation	Number of Rainfall Days	Number of Continuous Drought days	
	Average	Maximum	Minimum			Average	Maximum
Oct.	12.64	19.90	3.33	4.8	12	11	12
Nov.	12.57	23.75	5.29	5.6	14	7	12
Dec.	11.93	39.79	1.70	9.7	12	12	30
Jan.	5.89	9.72	2.35	2.5	8	14	30
Feb.	3.63	8.90	0	2.9	5	18	44
Mar.	4.53	12.05	0.72	3.4	5	20	36
Apr.	7.70	17.98	2.20	3.9	9	11	21
May	4.16	10.96	0.04	3.2	6	19	48
Jun.	1.67	4.97	0.50	1.3	4	20	32
Jul.	2.12	10.99	0	2.7	4	25	45
Aug.	1.17	3.76	0	1.2	2	33	73
Sep.	2.27	9.37	0.06	3.6	4	26	69
Annual	70.28	110.45	30.05	19.8			

(2) Temperature and Humidity

According to the observation-records at Maha-Illuppalama (about 20 miles to the north of Dewahuwa), monthly average of maximum daily temperature is highest in April, at 92.3°F and the lowest in January, at 69.0°F, while the monthly average of mean daily temperature is highest in September (83.2°F) and lowest in January (76.7°F); its yearly range (of monthly averages) being as small as 6.5°F. Daily range (of monthly averages) is biggest in March, at 18°F and smallest in December, at 14°F. Monthly average of relative temperature is 69–82%, generally higher in Maha season and lower in Yala season (see Table 2–4).

(3) Sunlit Hours

Monthly averages of sunlit hour are given on Table 2–5. Their figures have been obtained at Maha-Illuppalama for 6 years between 1959 and 1964.

(4) Wind

Wet north-eastern monsoon blows during Maha season (from November to March), bringing rains to this region, while dry South-western monsoon, often exceeding 50 miles/hour, blows over the area during Yala season (from May to September) which is responsible for terrible evaporation there.

(5) Evaporation

According to the observation-data available at Kalawewa, 12 miles north of Dewahuwa, for 3 years from 1963 to 1965, average annual evaporation is in excess of average annual rainfall, reaching to 88.8 inches. Figures for average monthly evaporation (evaporation-pan) are given on Table 2–6. It is generally less during Maha season and more during Yala season. Standard values of evaporation (evaporation-pan) in the Dry-Zone are said to be 0.13"/day for Maha season and 0.25"/day for Yala season.

Table 2–4 * Temperature & Humidity Data at Maha-Illuppallama (average 1958–67)

(Unit = Temperature in ^{O}F; Humidity in %)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Monthly average of Maximum Daily Temperature:	84.0	86.2	91.6	92.3	90.1	90.1	90.6	91.4	91.7	89.4	85.5	84.1	88.9
Monthly average of Minimum Daily Temperature:	69.0	69.1	73.7	74.5	75.5	75.5	75.0	74.9	74.6	73.8	71.0	69.9	73.0
Monthly average of Mean Daily Temperature:	76.7	78.2	80.0	82.8	82.1	82.8	82.8	83.1	83.2	81.1	77.9	76.9	80.6
Monthly average of Mean Daily Relative Humidity:	80	72	72	75	77	72	70	69	69	74	82	82	77

Table 2–5 : * Sunlit Hours at Maha-Illuppallama (average 1959–1964)

(unit = hours/day)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
6.56	7.54	8.30	8.83	7.95	7.99	7.49	8.69	7.51	7.43	6.70	5.96	7.58

Table 2–6 : Monthly Evaporation at Kalawewa (average 1963–1965)

(unit = feet)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
0.40	0.50	0.50	0.60	0.65	0.74	0.75	0.68	0.69	0.53	0.38	0.44	7.39

FIG 2-2 DEWAHUWA SCHEME GENERAL PLAN

TANK BUND DAFA

LENGTH OF BUND	= 29 0 CHS
TOP LEVEL OF BUND	= 604 75
FREE BOARD	= 4 60 FT
HIGH FLOOD LEVEL	=
FULL SUPPLY LEVEL	= 597 50
BUND TOP WIDTH	18 00 FT

DEWAHUWA TANK - 1/5 (1165' x 6.70')

L B SPILL
LENGTH = 600 FEET C O & NATURAL ROCK WITH CREST WALL
TYPE = 200 FT CLEAR OVERFALL - CONCRETE.
= AND 400 FT NATURAL ROCK SPILL WITH CRESTWALL
CREST LEVEL = 597 50
TO PASS CYCLONIC FLOOD OF 10 630 CUSECS

R B SLUICE
TYPE = HUME PIPE & TOWER SLUICE-FOOTBRIDGE
SIZE OF OPENING = 36" DIA
SILL LEVEL U/S = 570 00
HEAD OF WATER = 2750 FEET
MUST IRRIGATE = 2336 50 ACRES

NOTE
EXISTING ROAD THAT WILL BE SUBMERGED AFTER COMPLETION OF THE SCHEME SHOWN THUS

TANK I DATA
CATCHMENT AREA = 26 50 MILES
AREA AT F S L = 960 00 AC I APPROX
FULL SUPPLY LEVEL = 597 50
CAPACITY AT F S L = 8800 AC FT

R B CHANNEL DATA - MILE I

AREA	= 2480 ACRES
	= 40
Q	= 470 CU
BW	= 13 50 FT
DEPTH	= 2 13 FT
GRADIENT	= 00029
SIDE SLOPE	= 1/2 I

FROM GALEWELA — TO KEKIRAWA THROUGH DEWAHUWA SCHEME

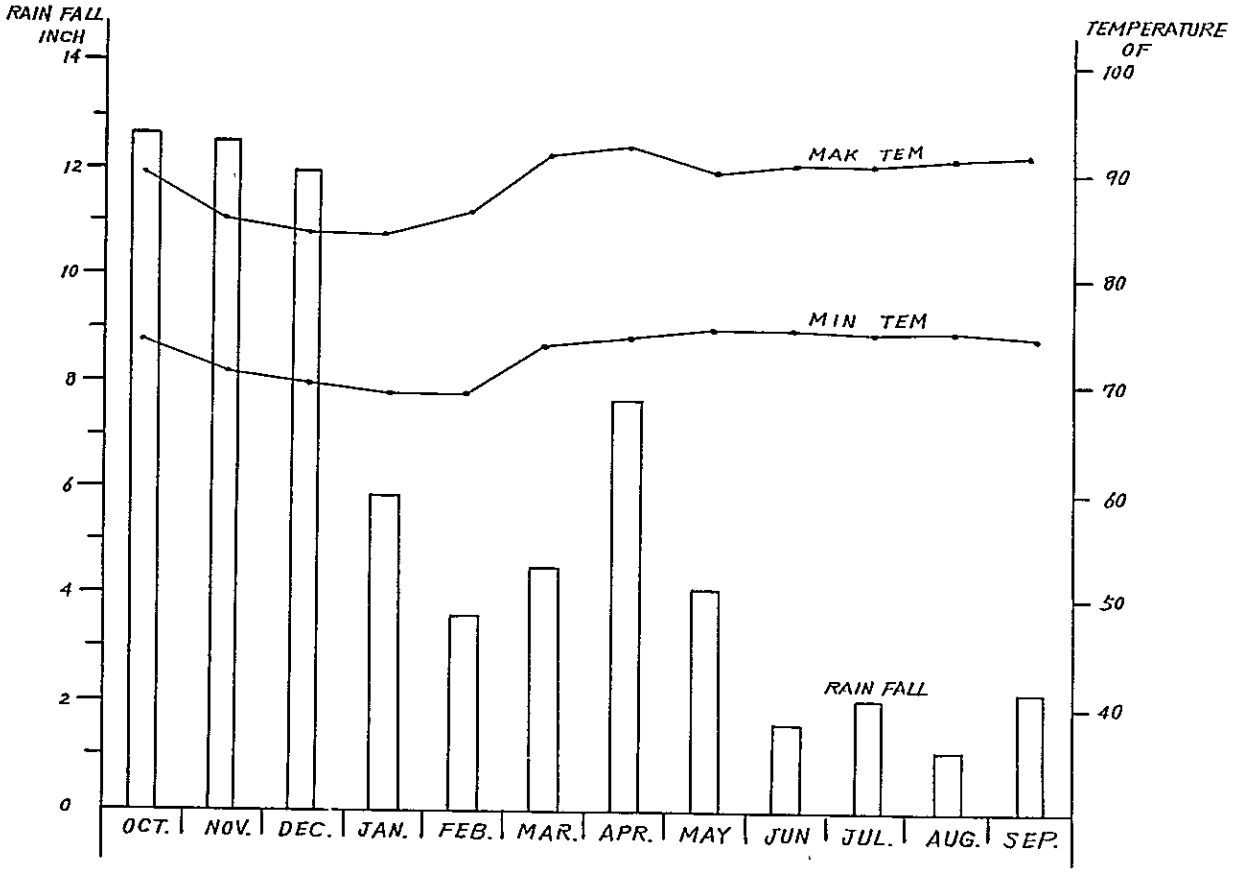
FROM GALEWELA — EXISTING ROAD — BANDARANKE STATUS — OFFICE OF GRAMSEWAKA

REFERENCE

- PADDY LOTS SHOWN THUS
- PADDY LOTS IN THIS PROJECT AREA SHOWN THUS
- HOUSE & GARDEN LOTS SHOWN THUS
- RESERVED AREA CROWN SHOWN THUS
- RESERVED " PASTURE " "
- RESERVED " PARK CIVIC CENTRE ETC SHOWN THUS
- MAIN CHANNEL SHOWN THUS
- MAIN CHANNEL ROAD SHOWN THUS
- EXISTING ROADS SHOW THUS
- PROPOSED ROADS IN H G AREA SHOWN THUS
- ROCKS & STEED LAND SHOWN THUS
- OUTLET FROM MAIN CHANNEL SHOWN THUS
- BRANCH FIELD CHANNEL IN THIS PROJECT AREA SHOWN THUS
- BRANCH ROAD IN THIS PPOJECT AREA SHOWN THUS

CAUSEWAY SHOWN THUS
0 6 12 24 36 48 CHAINS

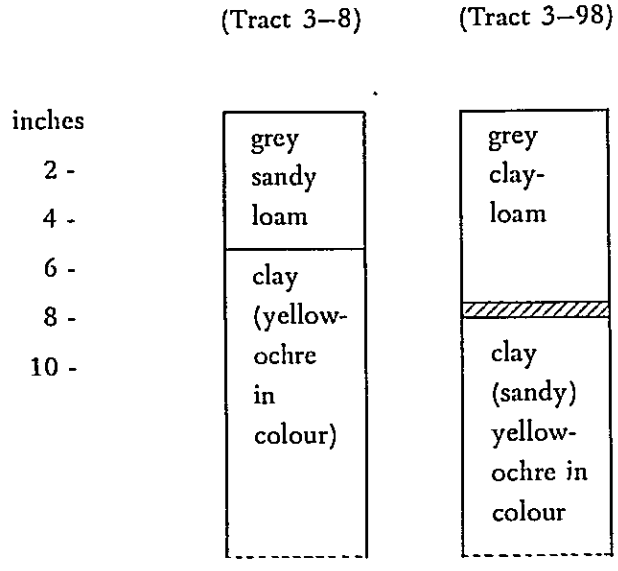
FIG : 2-3 : MONTHLY RAINFALL AND MONTHLY TEMPERATURE



2-1-4: Soil

Soil-boring-tests at a certain spots, coupled by soil-analysis by a portable-soil-tester at various plots where unit-acreage sample surveys were conducted, show that the soil of our project-area is generally sandly-loam or loam, while the lower-stream is made up of clay-loam. Subsoil is made up of clay - yellow-ochre in colour - containing gravels, with least vertical permeability in both upper-and lower-streams.

Fig. 2–4 : Paddy Soil Secton



Analytical data of soil are given on Table 2–7. Its contents of salts show little difference. Contents of potassium, calcium etc may assume different patterns if analyzed at the end of Yala season. Upland soil is almost exclusively made of light-brownish heavy clay which is generally known as "reddish-brown earth" in Ceylon.

Table 2–7 : Soil Examination Data

(Yanagita-Type Nutritional Diagnosis Instrument was used)

Block No.	1–11	2–2	3–26	3–29	3–82	4–5	3–29	3–44
Fertilization	nill	nill	nill	nill	nill	nill	nill	nill
Ph	5.6	6.0	5.8	6.0	5.8	6.0	7.0	6.5
NH_4-N	20	15	20	25	20	20	10	10
NgO	20	20	23	20	23	20	25	20
Mn_2O	2.5	2.5	3.0	2.5	3.0	2.5	less than 0.5	0.5
CaO	0.5	1.0	1.0	1.0	1.0	1.5	0.5	0.5
P_2O_5	less than 5	less than 5	5	5	5	5	5	5
Fe_2O_3	2	1	3	1	1	1	less than 1	less than 1
FeO	1.5	1	2	1.5	1.5	1.5	1	1
K_2O	10	25	25	25	25	25	200	200

2-1-5: Hydrology

Nawakka Ela, Kuda Oya and Kulugal Oya are the three principal rivers flowing into Dewahuwa Tank, but their flow-observation data are not available. Monthly run-off coefficient of Dewahuwa Tank's catchment have been calculated from the figures pertaining to monthly in-flow into the same Tank (from Annual Statement of Reservoir Replenishment and Behaviour, prepared by the Irrigation Department) and monthly rainfall data (prepared by the Meteorological Department) as per Table 2-8:

Table 2-8 : Monthly Run-off Coefficient

Monthly Rainfall (R)	Monthly Run-off Coefficient (Rc)
$R \leqq 5$ inches	Rc = 0.15
$5 < R \leqq 10$	Rc = 0.20
$R > 10$	Rc = 0.30

Precipitation-intensity at Anuradhapura, 45 miles north of Dewahuwa, is 3.4"/hour at 'one-to-twentyfive' probability. Assuming that this value is applicable to Dewahuwa, the inflow into Dewahuwa Tank would, at its peak, exceed its discharge-capacity through spillway. Collection and assimilation of hydrological data is imperative for safe maintenance of Dewahuwa Tank and effective utilization of its water. System and facilities for this end are regretfully poor at the moment.

2-2: Sociological Conditions

2-2-1: Historical Background of Dewahuwa Colonization Scheme

Dewahuwa Tank is said to have been originally built by King Dutugamunu, the greatest hero of the Ceylonese ancient history, during the 2nd Century B.C., while he was marching northward at the head of a mighty Sinhalese army to challenge Tamil forces encamped at Kalawewa some 12 miles downstream and, in anticipation of a protracted war against the Tamils, he designed to build a dam which would serve two purposes of cutting off water-supply to the enemy's stronghold in the downstream and securing irrigation-water for production of foodstuff needful for maintaining his own army. The legend goes on saying that King Dutugamunu laboured himself in carrying stones for embankment-work among his soldiers and the God, in its appreciation and praise, placed a string around the King's neck, hence the name Dewahuwa was given to this place (Deva stands for God and huwa for string, in Pali language). Apart from such a legendary origin, the intake-pattern, the material used for construction of its spillway and the technique adopted for the purpose betray that Dewahuwa Tank dates back as old as Kalawewa which is in downstream. Completion of this engineering work at Dewahuwa quickened the formation of an extensive agricultural-belt spreading to Anuradhapura, capital of the ancient Sinhalese kingdom, enormously contributing to the blossoming and enrichment of the ancient civilization in this Island.

Extraordinarily heavy rain lasted for many days in a certain year of the 10th Century or so and it washed away the embankment of Dewahuwa, together with an elaborate irrigation-network spreading at its foot which had been maintained for many a centuries. Nature did not wait long to turn once-flourishing paddyfield into a thick jungle and as soon as human-being left the place, wild animals like elephants and leopards made it an abode of their own. The remains of this Tank came to be discovered by the colonial government in 1883 and since then, proposals for its restoration came to be repeatedly made. Yet, people who were ekeing out a meagre livelihood by clinging at a number of small water-pools for their paddy-cultivation and tilling a few patches of 'chena' there could have been rewarded only after nearly half-a-century later.

2-2-2: Land Development Scheme and Terms of Colonization

It was only after enactment of Land Development Ordinance (1935) which aimed at agricultural development in the Dry-Zone and in answer to the strong urges from amongst the residents there that the Colonization Scheme centering at restoration of Dewahuwa Tank came to be worked out, accompanying with a series of surveys and researches towards the area. It was primarily planned to develop 2,100 acres of paddyfield irrigating 1,500 acreas, or 5/7 of the total, for 165 days a year but, immediately before starting on the actual work in 1946, the plan was enhanced to cover 2,400 acres of paddyfield and to bring all of it under irrigation.

Eventually, paddyfield reclaimed in its beneficiary area was 2,336.5 acres.

In September 1949, when upper-stream was completed, the area under Tracts 1 to 4 (corresponding to our project-area) was allotted at a parcel of 5 acres of paddyfield plus 3 acres of highland among 139 colonists' families. Villagers of Bambarakatupota, Moragolla and Henelowewa which has been submerged under the Tank and the people who had been residing in such villages which were engulfed within the Colony as Makulgaswewa, Bulanawewa, Watagala and Demalagollagama were given priority for entry, together with the labourers who had been mobilized and continued working for the construction of the dam. Residential quarters with a separate latrine was built by the Government for each family who was also provided the sum of Rs 300/- for development of their paddyfield. In addition, living allowance of Rs 30/-per head per month was given until the first crop was harvested. They were also furnished free with tools like plough, hoe, sickles, etc. and saplings of such as Jack, bread-tree, mangoe, orange, etc.

Some of the important terms for colonization read as follows: (i) payment of water-rate at Rs 5/- (per acre per year as with other dues and charges which follow), Rs 10/- for annual payment, Rs 6/- for acreage-levy payable to Cultivation Committee and Rs 6/-for crop insurance-premium;(ii) living within the allotment; (iii) no fragmentation of alloted land through transfer or lease; (iv) nomination to a single successor (since 1969, number of legal successors to the allottee has been made to two); (v) personal operation and maintenance of the alloted land (on the paddyfield, paddy shall be planted - at least 1 acre must be trans-planted - during Maha season and rotation of crops such as tobacco, chilli, onions, green grams and cow-peas during Yala season. Highland shall be utilized for homestead (½ acre), vegetables (¼ acre), pasture and banana (1¼ acres), coconut (½ acre) and other fruit-trees (½ acre).

The above terms and conditions, however, merely stood as principles and have not necessarily been abided by the colonists;none of them who failed to do so was deprived of their entitlement. Due to Government policy which has been heavily biased to rice-production, no irrigation-water was furnished for any kind of farming excepting paddy during Yala season; colonists who could not utilize their paddyfield for cultivation of other items would go out for the purpose to 'chena', particularly in case of tobacco. Ceylonese Parliament is currently debating amendments to the Land Development Ordinance in view of authorizing the proprietorship, on conditions, of the allotment and settlement of mortagage on it, to the colonists.

2-2-3: Inhabitants of Dewahuwa

There has been maintained no residents'-roster in Dewahuwa colony, hence the shift of population in the past is unknown. It was, however, made clear through the socio-economic

survey conducted by our team inside the project-area that its inhabitants would fall into 4 different categories as detailed in the below. Total number of households is 311, with the population of 1,993, of which the work-force (between 14 and 60 years and those who are willing and capable to work) consists of 508 males and 455 females.

(i) Colonists and their legal successors

Those who got formal permission to occupy and cultivate their alloted land (so-called "permit-holders") and their legal successors.

Cultivation Committee No. 1 ..... 60 households
Cultivation Committee No. 2 ..... 95 households

(ii) Offshoots of the "Permit-Holders"

Those who have not been nominated as legal successors to the colonists' allotment, but are actually domiciled and cultivating within the colony. Most of them consist of the colonists' children. In the traditional society of Ceylon, children are both customarily and legally authorized to inherit their parents' properties in equal proportions among them. In Dewahuwa Colony, however, only one successor is to be nominated, to avoid framentation of land. Nevertheless, even those who have not been nominated as such are cultivating portions of their fathers' allotment in customary way. Most of these families are living in huts built on their parents' homestead. Their distribution in the project-area is as follows:

Cultivation Committee No. 1 ..... 17 households
Cultivation Committee No. 2 ..... 19 households

(iii) Bulanawewa Villagers

Bulanawewa is a tiny natural village nestling in Dewahuwa Colonization Scheme area. It was originally a small hamlet consisting of 4 farmhouseholds, all-together operating 7.6 acres of paddyfield encircling the Bulanawewa tank. Immediately before Dewahuwa Colonization Scheme was implemented, its villagers had disposed of their uplandfield (mostly the Crown-land used to be cultivated as 'chena') whose proprietorship had not been clearly defined, to the third persons outside their own village. Population of the village was thus suddenly inflated and the many among them who keep deed issued by Land Kachcheri are 'squatters' in the strict sense. Partly due to the improvements made to the Tank and partly to encroachment upon the Crown-land, Bulanawewa villagers' paddyfield has expanded to 21 acres. Yet, as the number of families has increased to 30 in the meanwhile, arable land available per family has been considerably belittled and many of them are working on the colonists' paddyfield as tenants. They are now more inclined to be admitted into Dewahuwa Colonization Scheme, although they determinedly stayed out of it 20 years ago.

(iv) Squatters (Encroachers upon the Crown-Land)

Those who have encroached upon, built their huts and are continuing cultivation in the Crown-land which was specified as "reserved-land" that is the land-space reserved by the Government for roads, parks, pasture-lands, cemetries and other public purposes. Most of them are working as tenants or agricultural labourers at the paddyfileds belonging to the colonists, beside raising subsidiary food-crops on highland in a limited way. There are 90 such families in the project-area, 70 of them engaging in paddy-cultivation and 6 of them, non-farming households. The Government is right-earnest in coping with this squatter-problem and is planning to put into effect an allocation of "reserved-land" among the squatters, in the similar way as with the developed land among the permit-holders, along two criteria specified in the below, so that accumulated illegal acts in term of encroachment upon Crown-land would be liquidated and, through such regularization measures, the landless peasants' livelihood could be improved:

(i) that distribution of the Crown-land among the "squatters" will not be detrimental to the permit-holders, either for their farming or any way else: and
(ii) that the "squatters" have been living on the Crown-land continuously for many years, having no land of their own and their neighbours are not against such "regularization" measures.

As the above-mentioned regularization measures are supposed to be completed by the end of 1969, the squatters will be turned into so many "permit-holders" with status comparable to the legitimate colonists, provided that the former may not be allocated with as much as 5 paddy-acres and 3 highland-acres.

2-2-4: Races, Religions and Languages

Approximately 90% of the people living in the project-area are Sinhalese (so-called "Kandyan Sinhalese") and the remaining 10% are the Muslims with Ceylonese citizenship, commonly called "Moors". There is found no Tamil. Majority of these Moors belong to a group who came over here from Bambarakatupota, a Muslim village submerged under Dewahuwa Tank, and thereby compensated by the Government. They are living together in one sector in Tract 4 (19 permit-holders and 12 squatters), speaking among themselves in Tamil language. Due to differences in social usage and poorness in Sinhalese language, they are clustering together within their own community, maintaining least social intercourse with Sinhalese neighbours. Some of their old-time friends in the submerged village of Bambarakatupota did not comply with expropriation of their land against compensation, preferring to remain at a corner of the reservoir, and they are raising three paddy-crops a year from the paddyfield which they reclaimed on a shallow part of the Tank. In view of this fact, the Moors in the project-area are living with a sense of resentiment for their deserting the old village where they would return if it were ever

possible. Reclamation of a part of the reservoir into paddy-field obviously accelerates silting of the Tank and helps discounting the capacity and utility of the dam but no serious measures are being taken to make them discontinue such an offence to a common interest of the people domiciled in its beneficiary area.

2-2-5: Caste System

In the initial stage of colonization, low-caste colonists such as Berawa (drummers), Hinna (washermen), Galaddu (blacksmith) and others were often ostracized by the upper-caste Goigama (cultivators), but such caste-discrimination has been in a decline though gradually. Even today, however, inter-marriage and dining is rarely witnessed between the upper- and lower-caste people. Caste-composition of the people living in the project-area is roughly as follows:

Caste	Traditional profession	Composition
Goigama	Cultivation	40%
Padu	Litter-bearers	20%
Hakuru	Sugar-making	20%
Berawa	Drummers	10%
Hinna	Washermen	5%
Galaddu	Black-, gold- & silver-smith	5%
Oli	Basket-making	a few

2-2-6: Education

There is only one primary school meant for elementary education upto 5th standard in the project-area and boys and girls desirous of getting higher education have to attend at a secondary school in Makulgaswewa which is half-an-hour distance on foot from their village. Although there is in Tract 7 of Dewahuwa Colonization Scheme a high school named Buddgehinne Maha Viddyalaya providing GCEAL (General Certificate of Education Advanced Level), no one of the area attends it probably because it is too far away. Muslim children do not attend at local school and prefer attending Muslim school (GCEOL - upto 10th standard) in the adjacent village. Educational level of the heads of families in the area is rather low: 24% of them do not have any school-education at all, 54.5%got only elementary education from 1st upto 5th standard. Thus nearly 80% of them have got no schooling or minimum education eligible for simple reading and writing. Only 4 of them obtained education equal to compulsory (8 years course) and above, but none got GCEAL (10–12 years). Level of school-education among the adults in the area is considerably lower than that prevalent among the Sinhalese villagers in the Wet-Zone. Still, it would not take very long for them to reach the educational standard enjoyed in the Wet-Zone, as the younger becomes the age the more attend at schools, so much so no child in the age-bracket of compulsory education fails to attend school nowadays.

Those who have undergone vocational trainings or gifted with special skills among the inhabitants are reported as follows:

Carpentry	16	Motor-driving	5
Masonry	5	Blacksmithy	3
Weaving	7	Tailoring	3
Metal-working	2		

Nobody has learnt advanced mode of technique required for modern industry as Dewahuwa is far away from big cities and Ceylon itself is not yet very highly industrialized.

2-3: Economic Conditions

2-3-1: Dewahuwa in Ceylonese Economy

Dewahuwa is situated at the centre of the Island of Ceylon, with a slight northward shift, spreading over Central Province and North-Central Province. The border-line between these two Provinces corresponds to that between Matale District and Anuradhapura District. Geographically speaking, Dewahuwa belongs to the "Dry-Zone", but it really is in the transitory belt lying between Dry-Zone proper and Intermediate-Zone. Its distance from Colombo, capital of Ceylon, is 88 miles, and that from Kandy, 46 miles; both of them are linked by metalled roads. Local transport to nearby cities and towns is generally cartered by regular bus services (Ceylon Transport Board) on which the people of the project-area are heavily dependent. Each one service per day to both Matale (31 miles) and Anuradhapura (42 miles) where people have to travel on government business with Kachcheris. 5 buses are running everyday to Kurunegala (30 miles) and 8 runnings to Galawela (6 miles) which ranks among the important trading centres of farm produce in the Dry-Zone. It will show Dewahuwa's close economic tie with Galawela.

Climatically unsuitable for cultivation of strategical export-crops like tea and rubber, and with limited coconut production barely meeting domestic consumption, Dewahuwa has no plantation agriculture which is characteristically of the Wet-Zone. It is one of the Major Colonization Schemes primarily meant for increased production of rice - the staple food of the Ceylonese people - with the target of its self-sufficiency whose necessity was badly realized during the last World War. Therefore, rice production is standing as the economic backbone of Dewahuwa and, beyond Dewahuwa, of the region as a whole.

Next comes tobacco. Its cultivation-area has steadily expanded (mainly, on 'chena') for the last 4–5 years but it is only meant for beedi. Paddy-cultivation here is not as intensive as in the Wet-Zone and, excepting the introduction of large-sized tractors in and around 1960, there has been no significant change during the last 20 years. Without conspicuous yield-

increase nor rationalization efforts, Dewahuwa seems to lag far behind those Colonies in the same Dry-Zone like Mineriya and Elahera whose achievements have helped them ranking as forerunners of nation-wide Food-Drive. Stagnant conditions in which Dewahuwa is claimed to have been damped for many years are partly attributable to inefficient operation resulting from extensive farming of as big a land as 8 acres per family under a severe labour-shortage prevalent in the Dry-Zone. Smaller allotment of 2 paddy-acres plus 1 highland acre per family in the case of Colonization Schemes nowadays seems to be more inducive for intensive cultivation.

Dewahuwa Scheme itself can be broadly split into 3 zonal tracts. Judging from fertility of soil, technical levels of the people and their managerial capability etc, the middle-stream seems to rank atop among these three. In fact, Tracts 5 & 6 lying in the middle-stream are together designated as the Special Development Project Area within the District. In the meanwhile, the lower-stream is handicapped by inconveniences of irrigation which no doubt are discouraging factors for the people living there. Taking all these and other factors in consideration, the upper-stream which has been chosen as our project-area seems to fall in middle rank. Possibly due to the fact that the majority of the people there consist of the residents of old villages displaced for implementation of the Colonization Scheme, the trends for stratified class-formation among the farm-households there seem to be less operative than in middle- and lower-stream regions.

In the project-area are 1 rice-mill, 1 blacksmith, 3 carpenters, 1 barber, 10 washermen, 3 Ayurvedic doctors, 10 tea-shops and 2 grocery shops; they are operating on either full-time or part-time basis. There is also 1 weaving-school opened by the Department of Rural Development & Small Scale Industry where 9 unmarried girls of the area are weaving sarongs, sarees etc. Their products, however, seem to be less competitive to mill-made clothes and bringing little return to the weavers as well as the school. There are 8 white-collar workers in the area, 7 teachers and 1 employee of the local agricultural co-operative. Besides, there seem to be a number of people who are brewing and distributing illicit liquor on a professional basis but their details are kept unknown.

2-3-2: Farm Produce and Their Marketing

Principal farm-produce of the project-area are, as mentioned in the above, paddy (mainly wet-paddy) and tobacco. According to the team's socio-economic survey, out of the total value of farm-produce marketed during 1967–1968 (agricultural year), 51% was made up of paddy and 37%, of tobacco. Other agricultural products marketed during the same year include: chilli (5%), English vegetables (3%), onions (1%) and gingili (0.8%), plus maize, egg-plant, banana, pumpkin etc, which are less important in either production-amount or sales-value.

Marketing of farm-produce as it is currently practiced in the project-area has been studied with the findings as follow:

(i) GPS (Guaranteed Price System) Items

Guaranteed Price System, at present covering 21 items of farm-produce, was originally meant for stabilization of farmers' income by guaranteeing the price of strategical farm-produce in the country. Due to a lack of efficient organization and function in collection and distribution, however, the System is not being utilized very satisfactorily excepting paddy and onions. As for procurement of paddy, again, there are found a number of factors which prevent cultivating farmers from positively utilizing the same System, particularly since the Government's rice collecting and distributing policy was amended in 1966/1967. It was in December 1966 that the Government changed its rice-ration system from 2 measures per adult a week at Re. 0.25/measure to a free distribution of 1 measure per adult a week. This decision naturally stimulated the merchants to enter into speculative purchasing of paddy in the countryside. After nearly a year, that was in November 1967 (Yala-paddy harvesting season in the Wet-Zone and Maha-paddy sowing season in the Dry-Zone, also synchronized to devaluation of Ceylonese currency), the Government raised the Guaranteed Price for paddy from Rs. 12/- to Rs. 14/- per bushel. Rivalry between the Multi-Purpose Co-operative Society as the procurement-agent of GPS paddy and the merchants was thus intensified in procurement of paddy. MPCS (Multi-Purpose Co-operative Society) generally played a part of underdog in this competition because of many reasons, the most outspoken of which being its bureaucratic attitudes and inefficient services towards the cultivating farmers. For instance, MPCS asks the farmers to bring their paddy to its warehouse, applies rather strict standards in procuremrnt of paddy (dryness of paddy; chaff-mixture torelance upto 6% - maximum torelance is upto 12% but with reduction of Re 0.15 per % for chaff-mixture above 7% - : mud-, sand- and pest-free etc), delays its payment to the sellers, deducting from it miscellaneous dues and charges such as unpaid share-capital and Paddy-Cultivation Loan. For the cultivators who have been long accustomed to thresh their paddy through stamping-method by use of tractor or baffalo and to select their paddy-grains by winnower, it is not easy to pass the GPS standards and criteria claimed by MPCS; they have to pay for transport-cost of their paddy to MPCS warehouse which equals to 1 bushel for each 50 bushels of paddy-load. Moreover, deduction of their dues from the proceeds is generally accepted by the simple farmers, though erroneously, as an outright loss.

On the other hand, merchants go all the way to buy up the farmers' paddy at their homestead, are very liberal as for the quality of paddy, and pay in ready cash on delivery. Accordingly, the farmers prefer to sell their paddy to merchants even though unit-price is less than that offered by GPS. In fact, the price payable by the merchant for a bushel of paddy is around Rs 12/-; nearly 15% less than GPS price. It is well known that the merchants use measure approximately 7% bigger in size when buying up farmers' paddy. On the assumption

that a farmer disposes GPS-standard paddy to a merchant, the total loss on the former's part would be calculated as follows:

	(A)	(B)
To whom he sells =	MPCS	Merchant
Unit price/bushel =	Rs 14.00	Rs 12.00
Deduction	=(cartage)0.28	(x) 93% (over-measurement)
	Rs 13.72	Rs 11.16

(A) Rs 13.72 – (B) Rs 11.16 = Rs 2.56
Rs 2.56/Rs 13.72 = 18.7%

This apparent disadvantage ranging to 19–20% per bushel on the part of the producing farmers is being torelated not simply due to their traditional mode of paddy-cultivation but also to their economic dependence upon merchant-class in general, both in their productive and consumptive ways of life. As long as cultivating farmers are put under the prevailing circumstances, crop-failures due to bad weather or any other unexpected calamities would mean semi-permanent indebtedness to merchant who is not so generous as to allow the farmers to reap all what their sweat and labour has raised from their field or, worse even, to remain as rightful cultivators of their land.

Rumours are freely going nowadays that the Government is considering restoration of old rice-ration system of 2 measures per adult a week at an attractive price while maintaining or rather raising the producer-price of paddy (in view of imminent political issue?): these rumours are not without influences upon the merchants in refraining from a massive procurement of paddy in the countryside. Government also decided on March 25, 1969 to offer special paddy procurement commission of Re 0.20 per bushel to MPCS. These two may combinedly work to augment farmers' GPS sales of their 1968–1969 Maha paddy. Development of environmental situations and external philips, notwithstanding, GPS is not expected to attain its original purpose of securing better-income and economic stability on behalf of nationwide farmers, unless and until MPCS, its procurement agent, will improve its services towards the cultivating farmers and thereby induce them to come, in more number and with increasing loyalty, under its umbrella.

As for onions, the second GPS item, quantities of their production are not big enough in the project-area and its MPCS is not very keen to handle them either; their marketable surplus is wholly disposed of, therefore, through private channels.

(ii) Privately-marketed Items

While the best part of paddy is being sold to the merchants, tobacco - the second most improtant farm-produce of the area - is exclusively sold to the procurement-agent of

M/s Raja Beedi Company. Remaining items such as chilli, vegetables, onions, gingili etc, are marketed in smaller lots to the nearby weekly fairs, either directly or indirectly. By directly, it means their shipment to weekly fairs by bullock-carts and, by indirectly, through sales to petty-collectors who intend to bargain the products in the fairs. In either case, vegetable marketing is being done without any sort of planning; they are all-through sporadic, individually and not collectively.

Weekly fairs where their products are ultimately destined at are traditional markets existing in this courntry since old; out of 346 weekly fairs all over the Island, 3 Districts of Anuradhapura, Kurunegala and Matale have among them 53 weekly fairs and 8 of them are situated within a radius of 15 miles from Dewahuwa, opening everyday of a week by rotation:

Opening day in a week	Place of opening
every Sunday	Dambulla and Melsiripura
" Monday	Yakalla
" Tuesday	Naulla
" Wednesday	Kumbukgeta
" Thursday	Makulgaswewa
" Friday	Andiyagala
" Saturday	Galewela

Weekly fair which stands every Saturday at Galewela is said to be of the biggest scale among all of them and it is only 6 miles away from the project-area. Andiyagala weekly fair on Friday, which is the smallest of all, stands in a tiny settlement adjacent to Tract 8 of Dewahuwa Colony. Galewela weekly fair is as old as 40 years but its present market-place was built by a Moor tobacco-merchant about 15 years ago who charges every person who opens his shop inside the market-place at the rates of Re 1/- under the corrugated-iron roof and Re 0.50 in the open. Every Saturday, the Fair assumes an explosive atmosphere from early morning till about noon-time and, in the meanwhile, some 1,000 dealers (700 merchants and 300 petty-collectors or brokers) deal with a few thousand visitors. Some of these merchants are coming from Kandy, Colombo, Jaffna and Trincomalee, bringing up-country farm-produce, made-up goods, marine products and others and, out of their sales, buy up low-country products. Local villagers get, in return to their farm-produce, dried fish, textiles, earthen wares, metal products and sundries on this occasion. Producing farmers who venture to come to the fairs seldomly participate in retail business; they usually bring their produce right upto the entrance of the fair where wholesale merchants would buy up in bulk. There is a considerable gap between wholesale (bulk) price and retail (small lot) price in and around the Fair:

Kind of Produce	Retail-price/1b.	Wholesale-price/1b.
Snakegourd	Re 0.35	Re 0.15/0.20
Egg-Plant	0.15	0.10
Banana (for cooking)	0.40	0.20
- do - (for table)	Re 0.03/0.05 per pce	Rs 2.50 per hundred
Pumpkin	Re 0.20/0.25 per 1b.	Re 0.10 per 1b.
Polished rice	Rs 1.40 per measure	Rs 1.20/1.30 per measure

2-3-3: *Tenancy Practices in Dewahuwa*

Through enactment of Paddy Land Act of 1958, the tenants' position has been largely strengthened. Their cultivation-rights were made more secured and they came to enjoy protections by the State in various manners. As a principle, however, colonists of Dewahuwa are not authorized to let their land cultivated by tenants, though they are doing so rather extensively and, therefore, existence of tenants is legally denied there. The spirit and letters of the above-said Paddy Land Act cannot be extended towards those cultivators who are actually working under tenancy systems of complexed nature. Forfeiture of cultivation-rights awaits the colonists if and when it is made clear that they are contracting tenancy-terms with other people, hence it was impossible for our team to ascertain exact size of land under tenancy cultivation in the project-area. Tenancy-systems prevalent in Dewahuwa are as follow:

(i) Ande (sharecropping system)

Commonest type of all. Contract is made before cultivation each year and the harvest is shared in paddy between the landlord and the tenant on the threshing-yard (Kamata). Landlord will bear taxes, public charges and seed-paddy in total, plus half the amout of fertilizer and chemicals used for cultivation and one-half of tractor-hirage.

(ii) Bin-ande

This type of contract is usually made between ill-equipped landlord and well-to-do tenants. Excepting taxes and public charges which go to the landlord, all operational cost will be borne by the tenant who instead takes over 75% of the total yield.

(iii) Ugas

Under this system, loanee allows his loaner to cultivate mortgaged land so long as loanee fails to pay off his debt. In this case, no interest will be exacted upon the borrowed money. If loanee happens to have enough labour and equipment, he may negotiate with

his loaner to return the mortgaged land on the basis of Ande system (usufructury mortgage). Rs 200/- is the amount usually financed against a mortgage on one acre of paddyfield.

(iv) Kallaru Badda - (lease system)

Cultivator pays in cash Rs 100/-per acre to his landlord before cultivating the land. Whole operational cost will be borne by the tenant. When crop totally fails that year, the Kallaru-Badda tenant will be allowed to cultivate the same land again in the following year without any additional payment.

v) Vikneema

When tenancy contract specified in (iv) above will be extended for 3 to 20 years at a stretch, with its rent payable in advance, such contract will turn to be almost an outright sales of the land in question. In Dewahuwa where deals in real estate are prohibited, people resort to this type of semi-permanent tenancy-contract when they intend to "sell-off" their land (in fact, they have only cultivation-rights of the land and not land itself). (Vikneema literally means 'sale' in Sinhalese language.)

2-3-4: Living Standards of the People

Original colonists who were formally admitted into so many blocks of Dewahuwa Colony were provided with permanent houses and, for their drinking and irrigation (of upland field) purposes, have had 11 public wells dug for them, plus private wells excepting where it is topographically unabled to obtain underground-water. A glance at the inhabitants's houses will tell whether they are the original colonists' or the squatters'. Bicycle, radio, sewing-machine, pressurized kerosine lamp, clock, children's tricycle etc, owned by the colonists (permit-holders) are more in number compared to an average farmhousehold in other natural villages. Living-standard, if the possession of such durable consumer-goods can be taken as its reliable indicator, comes down from top to bottom in order of: the colonists, their off-shoots, Bulanawewa villagers and the squatters; the last being almost in depressed conditions. (see Table 2-9)

As for their eating-habits, they are better off than the average farmhousehold in the Wet-Zone where people are used to fill their stomach with bread and curry (because they cannot afford to pay for rice). Most of the families in the project-area are enjoying three meals of rice and curry, though with conspicuous deficit in animal-protein and fruits. Among the squatter-families, however, the situations turn rather severe where they eat once or twice a day chapati made of cheap flour, in substitution for rice.

Table 2-9: Durable Consumer-Goods owned by the People

	Original Colonists	Colonists' Off-shoots	Bulanawewa villagers	Sqautters	Total
Number of Families	155	36	30	77	298
1. Bicycle	74	11	8	14	107
2. Radio	21	4	6	4	35
3. Sewingmachine	29	3	4	6	42
4. Pressurized kerosine lamp	85	11	12	12	120
5. Wall-clock	47	5	1	1	54
6. Wristwatch	62	10	15	11	98
7. Umbrella	116	15	19	22	172
8. Electric torch	131	14	22	37	204
9. Children's tricycle	6	2	2	3	13
10. Bed	235	29	53	48	365
11. Chair	818	92	129	158	1.197
12. Table	244	25	42	59	370
13. Bench	56	2	15	13	86
14. Desk	57	5	15	11	88
15. Wardrobe	29	2	8	2	41
16. Others	46	18	19	16	99

The ratio of ceremonial expenditure for such as marriage, funeral, donations to temples etc. among their cost of living is bigger than the case of, for instance, Japanese farm-household. Monthly cost of living of a colonist's family (consisting of 3 adults and 4 children on an average) is made up of the following:

(i) Food

Rice (1 measure x 3 meals x 30 days) = 90 masures			
	Re 1/-	Rs. 90.00	
Dried-fish		21.00	
Meat (only once a month)		3.00	
Vegetables		20.00	
Tea, sugar, condiments etc		16.00	
Miscellaneous		15.00	Rs 165.00

(ii) Clothings

Sarong (4 x 1/12 x Rs 9/-)	Rs	3.00	
Saree (1 x 1/12 x Rs 60/-)		5.00	
Shirts (4 x 1/12 x Rs 12/-)		4.00	
Ledda (4 x 1/12 x Rs 9/-)		3.00	
Foot-wears (2 x 1/12 x Rs 6/-) for schooling		1.00	
Miscellaneous		5.00	Rs 21.00

(iii) Housing

Rethatching of roof (200 leaves x 2 times x 1/12 x Re 0.20)	Rs	3.00
(iv) Education (educational material)		4.00
(v) Fuels		6.00
(vi) Donations to Temple (Rs 100/- x 1/12)		8.00
(vii) Medical & Medicinal Cost		4.00
(viii) Transport		5.00
(ix) Social Expenses		6.00
(x) Unclassified (incl. procurement of durable consumer-goods and savings)		20.00
Total:		Rs 242.00

Sum-total of the above break-down will be Rs 242.00 per month, or Rs 2,904.00 per year, but the amount equivalent to rice which is freely supplied by the Government (365 measures per year) and vegetables which are the self-supplied items from their own garden will have to be deducted. The richer grows the family the more becomes its spending on such items as (by order of): (i) repairing & maintenance of house; (ii) bills for durable consumer-goods, and (iii) social expenses.

About half as many households in the project-area, that is 153 families, are indebted to the aggregate amount of Rs 117,746, a little more than a quarter of which is claimed to be for the productive purposes. It will be safely concluded that the colonist-families endowed with higher solvency are borrowing more money.

2-4: Regime and Institution

2-4-1: Local Administration and Public Institutions

As has been briefed in the above, Dewahuwa Colonization Scheme spreads over two districts of Matale and Anuradhapura but, as far as administration within the Scheme-area is concerned, a Colonization Officer who belongs to the Department of Land Commissioner and is put under the jurisdiction of the Government-Agent of Anuradhapura, is given with a whole responsibility. He administers the Scheme-area in collaboration with District Revenue Officer (DRO) of two Districts and Gram Sewakas under them. Duties concerning election and distribution of rice belong to Gram Sewaka.

Technical Assistant deputed by the Department of Irrigation is held responsible for maintenance of the reservoir and main irrigation channels but, as farmers' complaints are constantly arising in connection with water distribution, he is actually supervising branch-channels and field irrigation facilities as well, with the assistance of about 10 full-time workers under him. As for the agricultural extension services within the area, two Food Production Overseers are working under the general direction of Agriculture Instructor who belongs to the Department of Agriculture. Department of Health is stationing one Health Inspector to look after the colonists' environmental hygiene. One Tractor-Station and one Post-Office are located in the Colony. There are three autonomous local government-bodies called "Village Councils" covering the Colony.

Every year, before Maha cultivation starts, District Agricultural Meeting is called for and, under the chairmanship of the Government-Agent or Assistant Government-Agent, the whole colonists fall in together in this Meeting; officers-in-charge of the Departments concerned also participate it. This Meeting chalks out specific date when issue of tank-water will be commenced for irrigation, time-limit by which harvesting will have to be completed and all other important farm-schedule in between; duties of the colonists such as repairing of levees, enclosing of paddyfield with barbed-wire, night-watch against wild animals from vigil-huts here and there etc, will be assigned among each one of them, together with the details of penalties such as fine payable by those who fail to fulfil their duties.

2-4-2: Cultivation Committee

Cultivation Committee is a statutory body created under the Paddy Land Act of 1958 which, having as its constituent-members the whole populace of cultivators (including tenants also) in the locality, is asked to function as an organization which takes up and solves all the problems pertaining to paddy cultivation democratically and autonomously; its activities are placed under general supervision by the Department of Agrarian Service. Since Dewahuwa consists of State-land alloted among its colonists for their personal cultivation, no tenants are supposed to be existing there. This precludes the actual cultivators who are working as tenants from the membership of the Cultivation Committee. The problems arising from amongst the cultivators being readjusted and solved by the Colonization Officer himself, Cultivation Committee has no important task excepting overseeing water-control along the peripheral irrigation facilities. Cultivation Committee is sanctioned to collect "acreage-levy" amounting to Rs 6/- per acre per season from its members to cover its expenses, but payment of acreage-levy is quite unpopular among the colonists and even the maintenance of peripheral irrigation facilities is now gradually being surrendered to the overall care of the Department of Irrigation.

Organization and function of Cultivation Committee in the project-area has been studied with Cultivation Committee No. 2 with the following findings. Out of 93 member-colonists, 12 Committee-members have been elected. 3 out of these 12 Committee-members failed to attend at its regular meeting for 3 times in succession and were dismissed. Remaining 9 are all Sinhalese, consisting of 1 President, 1 Secretary, 1 Treasurer and 5 Water-Agents (each being allocated with specific territory wherein it is his duty to look after subsidiary irrigation facilities), plus 1 Committee-member without any special assignment. Out of the acreage-levy due to the Cultivation Committee, 20% goes to Water-Agents for their services, 10% as honorarium of other Committee-members including its President, another 10% for office-expenses of the Committee and the remaining 60% is to be put aside in bank-account.

2-4-3: Agricultural Co-operatives

Agricultural Co-operative Organization meant for the whole Dewahuwa Scheme-area was established in the name of 'Co-operative Agricultural Production & Sales Society' in 1950 and was re-organized into 'Multi-Purpose Co-operative Society' (MPCS) in 1958. At that time, it seems that there were three branch-offices in the Scheme-area, besides the head-quarters in the middlestream. With a majority of its members and Managing Committee-members consisting of the middle-stream residents, this MPCS was not so popular in both upper-stream and lower-stream of Dewahuwa basin; cumulative complaints in both areas exploded in 1963 when each one MPCS came to be organized and separately managed in three areas of upper-, middle- and lower-streams.

The Co-operative Organization servicing in the project-area is called 'Dewahuwa-Bulanawewa Multi-Purpose Co-operative Society' (hereinafter abbreviated as DBMPCS) and 120 original colonists agreed to subscribe to its share-capital. According to the team's socio-economic survey, the total number of colonists' families within the project-area comes to 155 and, as some of the remaining 35 are joining middle-stream MPCS, we may assume that a majority of the original colonist-families in the project-area are covered under the Co-op. umbrella. Out of these 120 who committed to subscribe each 2 shares (Rs 50 x 2 = Rs 100/-), only 33 are said to have so far paid up 80% of the amount promised for subscription. And only these 33 are eligible for Paddy-Cultivation Loan through DBMPCS.

As paddy-cultivation is restricted to a single crop during Maha season, Paddy-Cultivation Loan is provided with one-third of the DBMPCS members (two-thirds have so far failed to pay up their share-capital) in October to be paid back with 9% interest by May the following year; interest-rate will be raised to 12% after due and, in case loanee fails to return money within a year, his ration-card will be confiscated. For the last several years, DBMPCS-members have been regularly paying back their loan in time and as the Paddy-Cultivation Loan can be refunded in either cash or kind (in term of paddy), they paid back their 1966–67 Maha Loan all in kind and 1967–1968 Maha Loan, partly in cash (40%) and partly in kind (60%). Paddy-Cultivation Loan is given within a certain prescribed amount under each head of ploughing, transplanting, weeding, harvesting etc and partly provided in kind (fertilizer and farm-chemicals). Their totals amounted to Rs 9,773.50 for 1967–68 Maha season and Rs 18,723.44 for 1968–69 Maha. Loan provided in fertilizer was made up of ammonium-sulphate (242 cwt), culcium-phosphate (76 cwt) and potassium (38 cwt) for 67–68 Maha and that in farm-chemicals, of Endrics (36 bottles) and Agroson (24 bottles), for 68–69 Maha.

Being a multi-purpose co-operative, DBMPCS must be striving at linking-up of Paddy-Cultivation Loan with marketing of paddy through GPS, plus supply services in both producer-goods and consumer-goods among the members. As at present, DBMPCS's credit activities are simply limited to provision of Paddy-Cultivation Loan and savings and deposits of the members are not accepted. As for its marketing side, only a portion of the paddy produced in the area is handled mainly for repayment of the Paddy-Cultivation Loan. Its supply activities are primarily those of Government-agent's in distributing ration-rice and others (wheat-flour, dal, green-pea, onions, dried fish, chilli, salt, sugar, tea, cooking oil, soap, kerosine, cotton-piece-goods etc) among members and non-members alike. As the amount of supplies on ration scarcely meets one-quater of the people's demand, the rest and those not available through ration-system need to be obtained from the merchants or in the fairs, at twice the price. Articles displayed in the co-op. shop are often unattractive because they do not necessarily reflect the keen demands of the farmers and often unsuitable to the tastes of the customers.

2-4-4: Other Organizations

Gram Samwardene Society ('Rural Development Association') was once formed in the area as a villagers' voluntary organization meant for improvement of their own living but, due to a lack of co-operation among its members, no worthy work could have been done. It, therefore, remained as a dormant organization while Government subsidies were used to be given, but once they stopped to come, it did virtually die off.

Mahila Samitiya is another voluntary organization but of female residents of the area for fostering women's social activities but it is regretted that this body is not very active either.

Praja Mandaleya ('Community Centre') established for welfare of youth is mainly concerned with sponsoring of athletic meets and replenishment of library with Rs 200-worth annual subsidies.

2-4-5: Socio-Economic Problems

(i) While strict check is being prescribed against fragmentation of allotee's land, no orientation is being made towards their children (other than the legitimate successors) as to how they can contribute to develpment of Dewahuwa community.

(ii) With the progress of the Community Development Project in this area, many landless peasants around the Scheme-area will flow into it to dilute whatever good results it may gain.

(iii) Bulanawewa village which was excluded from Dewahuwa Colonization Scheme at its outset may better be covered under the forthcoming Community Development Project.

(iv) Dewahuwa Scheme-area is not matured enough to create its own territorial Community with built-in social sanctions and patterns of behaviour as in the traditional natural village; amicable social relations and co-operation are lacking among the residents, particularly between the Sinhalese and Moors as between upper-caste and lower-caste of the former.

(v) Because tobacco is a high income-generating crop and yet its cultivation is banned on the paddyfield, colonists are tempted to divert more of their attention and labour to 'chena' than to their own allotment.

(vi) Measures have to be directed to dissolve the existing tenancy-system but without evicting the peasants actually working as so many tenants need to be adopted in the project-area.

(vii) The rights of "deed-holders" who had paid to the old villagers for the reserved land under the latter's temporary cultivation prior to the implementation of the Colonization Scheme needs to be clarified.

(viii) Paddy-cultivation on the coast of the reservoir or the bottom of the Tank which helps increasing silting of the reservoir needs to be discontinued.

(ix) Liaison between two different but inter-related administrative organs, one in Anuradhapura and the other in Matale, particularly among their local administrators, needs to be maintained in smooth and productive manners.

(x) For the success of the Community Development Project as visualized by Dr. Nasu, it must be of extreme importance to make well-planned and yet flexible approach to the problems so that general upliftment of the people's levels of production and consumption will come to take place in and as a whole, while liquidating the differences among their living-standards which have already advanced to a considerable extent.

(xi) Organizations of the people living in the area, such as agricultural co-operatives and Cultivation Committees which are currently managed at the lowest legitimate ebb, almost for the formality's sake, need to be re-vitalized through necessary structural reforms so that they will not simply reflect the concensus of people's opinions but also establish democratic leadership among the people.

2-5: Actual State of Farmers

An exhaustive survey of all the farmhouseholds residing in Tracts 1 to 4 which consist of our project-area was carried out through house-to-house visit by the interrogaters who filled in answers to questions given on the prescribed form. The number of squatter's families was unexpectedly large and the residents' -roster was incomplete. This made possible our grasping of the total strength of the inhabitants of the area through sheer canvassing, its exact strength coming to be known only in the concluding stage of our survey. Thus, complete survey has been effected with 298 households out of 311 and, with the remaining 13 households which were exclusively squatters', only the number of family-members and the size of land cultivated by them could have been confirmed.

2-5-1: Scale of Management

Farmhouseholds of the project-area have been conveniently categorized into 4 groups, by difference of mode and condition of their settling into this place, as has been explained in 2-2: Sociological Conditions of the present Report. They are: (i) Colonists who were allocated with land according to the Colonization Scheme; (ii) Colonists' children who established

independent families after becoming adults (their families are generally living in huts built on their parents' compound); (iii) Residents of old village of Bulanawewa, and (iv) Squatters who first came into this area as agricultural labourers to offer helping hands to the colonists who could not manage 5 acres of paddyfield and 3 acres of highland with their family-labour alone; they built huts on the reserved-land and gradually established themselves as so many tenants (some of them are still working as agricultural labourers) of the colonists.

The number of households sub-divided into the above 4 categories is as follows:

(i)	Colonists ('Permit-Holders')	152 families (3 families)
(ii)	Colonists' off-shoots	33 families (3 families)
(iii)	Bulanawewa-villagers	28 families (2 families)
(iv)	Squatters'	82 families (8 families)

Note: Figures in brackets denote 'non-agricultural families' with less than 0.5 acres of land under own cultivation. 3 Colonist-families out of 155 are putting out all of their land for tenant cultivation and are, therefore, not treated as farmhouseholds here.

Average size of the total land cultivated by each household is 4.5 acres which compares much bigger than all-Ceylon average (of the farmhouseholds cultivating less than 50 acres) of 2.4 acres and Anuradhapura-District's average of 3.8 acres. Colonist's average is the largest at 6.1 acres and next comes Bulanawewa-villagers' at 4.1 acres; the Squatters' comes down to 3.0 acres and the smallest is the Colonist's off-shoots' at 2.6 acres. None of their average is smaller than All-Ceylon average; those of the Colonists' and Bulanawewa-villagers' are exceeding Anuradhapura-District's average. Breaking down the land under their cultivation into paddy-field and upland-field, the paddyfield portion is always bigger in case of the Colonist', thus enabling them to secure the most favourable position of all. Upland-field operated by the residents is invariably bigger than both all-Ceylon average and Anuradhapura-average. For instance, while Anuradhapura-average of upland-field and orchard are 0.4 acre and 0.3 acre, respectively, the corresponding figures pertaining to the project-area are 1.2 acres and 0.4 acre. Average size of upland-field of any one of the above 4 categories is not smaller than Anuradhapura-average.

In the project-area, and in Dewahuwa Scheme area in general, people give up cultivation of second crop of paddy on the paddyfield in case water left in the reservoir fails to remain above specific level. During Yala season, therefore, subsidiary crops grown on upland-field and high-income generating tobacco and chilli from 'chena' occupy an important position in the residents' household-economy.

Table 2-10: Holdings per Household
(unit = acre)

	Colonists' family	Colonists' Off-shoot	Bulanawewa-Villagers	Squatters' family	Averages		
					Project-area	All-Ceylon	Anura-dhap.
Paddyfield	4.1	1.4	2.2	1.5	2.9	0.9	2.9
Upland-field	0.6	0.3	0.8	0.7	0.6)	0.2	0.4
Chena	0.7	0.7	0.4	0.4	0.6		
Orchards, etc.	0.7	0.2	0.7	0.4	0.4	1.3	0.6
Total	6.1	2.6	4.1	3.0	4.5	2.4	3.8

Note: 1) Number of conconut-trees and banana planted in the project-area has been checked, side by side with their current planting habits. Calculation was thereby made that 70 plants of them would occupy 1 acre of orchard;

2) All-Ceylon as well as Anuradhapura averages were taken from 1962 Census.

2-5-2: Size of Operational Holdings

Development of Dewahuwa Colony was undertaken by the 'Permit-Holders' who were each alloted equal portion of land among themselves. They reclaimed their land, cultivated it and got harvests out of it in accordance with the Government's Development Programme. Among them were some who had been alloted with land less favourable in soil-conditions and irrigation conveniences, while some were given highland only. By and large, however, most of them started with 5 acres of paddyfield and 3 acres of highland any yet, within the lapse of 20 years, size of their individual operational holdings suffered a considerable change: while the biggest is 12 acres, the smallest is 1 acre only. This fact betrays the function of socio-economic stratification, or class-disintegration among the colonists in the meanwhile.

'Allotment of land' meant 20 years ago, as it does even today, distribution of cultivation-rights of a specific sized land and not its ownership. Increase or decrease in the size of the allottee's holdings, therefore, is attributable to a function of tenancy-system which has been going on for years under cover. Tenancy-system is prevalent for cultivation of paddy on the paddyfield alone and, on the upland-field, low fertility does not offer meaningful proposition for tenancy-system there. People rather plant coconut-trees on highland than letting out a portion of it for tenancy cultivation. The root-cause of class-disintegration or class-stratification among the residents is supposed to be the availability of labour, family-labour in particular. In fact, two colonist-families are letting out all of their paddyfield for

tenant-cultivation because they have very little labour of their own. Original allocation of 8 acres in total per colonist-family is adjudged to have been too big in size as is explained by the phenomenon of that agricultural labourers have had to migrate into this region almost simultaneously with 'Permit-Holders'.

The second cause must be unexpected calamities as illness and bad weathers. Illness among the cultivators would have resulted at labour-shortage for more or less length of time and bad weather might have spoilt their investment in term of money and labour either totally or partially. The last 20 years have witnessed 3 occasions of total failure of crop which turned many a cultivators into debtors. Many of them surrendered their land under Ukas (see 2-3-3: Tenancy Practices in Dewahuwa) to obtain ready cash to liquidate their indebtedness. Thirdly, when the colonists' children grew up into adult-age and got married, they claimed for land for their own cultivation to maintain their own families. Not only male child takes over a portion of his father's land but female child also claims for more or less land whose cultivation-right she carries away as a dowry. Diminution of holdings thus takes place.

In case of Bulanawewa-villagers and the squatters, most of paddy-field they cultivate belongs to the colonists where they work as so many tenants or often as agricultural labourers. Average holdings per family is very much limited in size among them. Irrespectively of whether they are colonists, Bulanawewa-villagers or squatters, those who are endowed with more or less capital could enlarge their holdings by undertaking other's land under tenancy contract. One squatter-family is cultivating 10 acres of colonists' paddyfields under tenancy contract. Generally specking, Bulanawewa-villagers and squatters are engaged in unauthorized tillage of reserved-land, 'chena' farming, and cultivation of paddyfields on the lowland as tenants. Newly arriving squatters could hardly find chance to become tenants even and are mostly working as agricultural labourers on the paddyfield. Differences among the size of holdings are more conspicuous on the paddyfield; holdings on the upland-field and 'chena' remain comparatively static.

3 acres of highland allocated to the colonists is utilized for their homestead around which they commonly plant coconut-trees primarily for domestic purpose and only 1/3 of it is diverted into upland-field. As such upland-field is rarely given fertilizers, their productivity is lower than 'chena'. In Dewahuwa, as paddyfield is left unattended during Yala season, its residents naturally try to gainfully utilize their own labour by working on the upland-fields, in the meanwhile. Every farmhousehold is keeping more or less upland-field under cultivation but the availability of underground-water,which they have to carry in a jar from the well for irrigation-purpose,is the restricting factor on the size and intensity of upland-field cultivation during dry-spelled Yala season. Accordingly, the holdings on the upland-field cannot be expanded beyond a certain limit.

Table 2-11: Number of Farmhousehold by Size of Its Holdings

	- ½ ac	½-1 ac	1 – 3 ac	3 – 5 ac	5 – 7 ac	7 – 9 ac	9 ac –	Total
Colonists	(3)	-	13	36	67	29	7	152 (3)
Colonists' off-shoots	(3)	1	23	7	-	-	2	33 (3)
Bulanawewa-villagers	(2)	1	14	10	-	1	2	28 (2)
Squatters	(8)	8	46	19	7	-	2	82 (8)
Total	(16)	10	96	72	74	30	13	295 (16)

Note: Figures in brackets denote non-farming households.

2-5-3: Size of Family and Family-Labour

Total population made up of 295 households is 1,895, each consisting of 6.4 heads. Number of family-members in working-age is 3.2 heads (1.7 males and 1.5 females) per household. Each one of 494 males and 435 females, totalling to 927 actual working population, is cultivating 1.3 acres of paddyfield, upland-field and 'chena' combined (orchard is excluded as it seldomly absorbs intensive labour for its maintenance.) Acreage cultivated per person is bigger among the colonists and it reaches 1.5 acres per head. Judging from the current technical level, work-load for paddy-sowing (either through transplanting or broadcasting of seeds), harvesting of paddy-crops and transplanting of tobacco cannot be digested with family-labour alone. 'Attan' system prevalent among the colonists cannot solve the problem as almost all of them are simultaneously preoccupied with their own work. For their rescue come the squatters and their family-members who offer their labour on wages; labour-shortage which cannot be replenished by squatters has to be covered by the labourers coming from outside. At the busiest season, 1 acre of land is usually looked after by 1 hired labourer.

2-5-4: Means of Production

a) Machinery, Tools & Implements

Just outside our project-area, there is 1 Tractor-Station for the whole Dewahuwa Scheme with 10 Tractors (but only 4 of them are fit for operation) cartering for ploughing, threshing , transport etc on the request of the cultivators on payment of pre-fixed rate. Within the project-area itself, there is 1 colonist who owns 2 Tractors which are being used in the same way as the Government Tractors. 77% of the paddyfield is cultivated by tractors (either for the primary ploughing or secondary tillage) and 40% of the upland-field is also reported to be under tractor-farming. Tools and implements common among the cultivators

are: bullock-carts as means of transport, ploughs drawn by bulls, levellers called "poruwa" also drawn by bulls, "goiralla" - another type of levellers - operated by men, hoes, sickles, sieves, and winnowers. Apart from the primary ploughing and possibly the second tillage, cultivation is almost always done by manual labour. Transport conveniences are the poorest of all: only 8 families out of 100 own bullock-carts. Under these circumstances, goods are mostly carried on human shoulders.

b) Cattles

Cattles such as bulls, cows, buffaloes and goats plus fowls are owned by the residents: bulls are for pulling carts, cows and goats for milk and breeding, and buffaloes for farming. These cattles are commonly left free around the houses and on the paddyfields after harvest, with little care in their reering. Although primary ploughing of paddyfield is generally done by tractors at the beginning of Maha season, buffaloes are called in for the purpose when it is feared if timely ploughing is difficult due to the shortage of tractors. Secondary tillage and levelling is ordinarily done by use of buffaloes. When grown-up bulls, cows and buffaloes (459 cattles in total) will be numerically spreaded over among the total number of households in the area, per-household cattles will be figured at 1.6. In fact, however, the ownership of cattles is rather concentrated: bulls are owned by 7% of the households, cows by 21% and buffaloes by 17% (as buffaloes are owned by only 17% of the households, they are let out on reasonable rent); 29 households out of 100 are owning one or more of any kind of them. Cattle-owning households are thus sharing 5.5 cattles among them.

2-5-5: Farm Economy

a) Colonists

All the colonists, whether of big holdings or of the small, are adhering to the self-same pattern of cultivation: their mode of land-utilization suffers no change by the size of their holdings. As the colonists are best equipped among 4 categories of cultivators in the project-area, income per unit of labour will be the biggest of all. (Even when they let out their land for tenant-cultivation, it is presumed that they will withhold the most productive part for their own cultivation.)

On an average, the colonists' farm-management is based on the following factors:

i) Operational Holdings:

Paddyfield 4.0 acres; Upland-field 0.6 acres; 'chena' 0.7 acres. Total = 5.3 acres. Besides, each one of the colonist-families owns 0.7 acres of highland planted with coconut-trees and bananas primarily for their own domestic consumption and, therefore, not managed on commercial basis.

ii) Family-Labour:

Out of 7.1 family-members, 1.9 male-workers and 1.7 female-workers, totalling to 3.6 working-members.

iii) Domestic Animal:

1 buffaloe

iv) Tools & Implements:

1 plough, 1 'poruwa', 4 sickles, 1 sieve, 2 winnowers and 2 'goiralla'.

v) Farm-produce:

Wet-paddy, upland paddy, chilli, kurakkan, gingili and vegetables during Maha season, and tobacco, chilli and vegetables on the upland-field and 'chena' during Yala season bring each colonist-family Rs 3,260-worth gross-income per year:

Table 2-12: Gross-Income per Crop

Kind of Crops	Acreage under Cultivation	Gross-Income
Paddy	4.0 acres	Rs 2,160
Upland-paddy	0.7 "	220
Chilli	0.3 "	240
Tobacco	0.5 "	400
Gingili Kurakkan)	0.2 "	40
Vegetables	0.6 "	200
Total:	6.4 acres	Rs 3,260

vi) Operational Cost:

Table 2-13: Operational Cost of the Colonist's Family

Items	Value	Items	Value
1. Seeds	Rs. 134	7. Fees & Hire	Rs. 319
2. Fertilizer	33	8. Taxes & Public charges	173
3. Farm-chemicals	32	9. Wages	240
4. Livestock	50	10. Interest-payable	47
5. Implements	49	11. Others	52
6. Other materials	31		

Total = Rs 1,160

Operational cost of Rs 1,160 per year is high compared to its gross-income. Biggest expenditure-item is Fees & Hire: tractor-fee alone cost Rs 40/acre for the primary ploughing and additional Rs 25 per acre for the second tillage of their paddyfield; transport-fee costs Rs 47 for 198 bushels of wet-paddy and upland-paddy they produce (by bullock-cart). Next biggest item is Wage amounting to Rs 240, and Taxes & Public Charges amounting to Rs 173. Rs 240 for Wage has been calculated on the assumption that non-family labour employed for transplanting of paddy at mid-November and for harvesting of paddy as well as tobacco-transplanting at mid-March would consist of 1/3 "attan" and 2/3 outside labour. Taxes & Public Charges are made up of Rs 10/acre as Annual Payment to the Government (*1), Rs 6/ acre of Acreage Levy payable to Cultivation Committee (*2) Rs 5/acre of Water-Rate and Rs 75/ acre as for 'chena' rent (*3)

Other items such as fertilizer, farm-chemical etc are less heavy becuase of their limited consumption and implements cost very little as they are made up of the absolute minimum of semi-primitive kinds.

Note = (*1) Annual-Payment is rarely fulfilled by the colonists and only 2 or 3% of them paid it during 1968. Our calculation does not ignore it;

(*2) Payment of Acreage-Levy to Cultivation Committee is likewise widely sabotaged by the colonists

and

(*3) Official-rent for 1 acre of 'chena' is Rs 5 only for those who obtain formal license from the authorities, but 'chena' available to the cultivators in the area is usually sub-let by the intermediaries who charge such a high rent as Rs 75.

vii) Farm-Income

Gross-income (Rs 3,260) minus operational cost (Rs 1,160) is an average income, that is Rs 2,100 per colonist-family. Colonist-family can enjoy additional income of Rs 100 as tenant-fee for each one acre of paddyfield under tenancy-system (calculated on the basis of Kallaru-Badda). Deducting Rs 10 annual payment and Rs 5 water-rate therefrom, Rs 75 remains to be added to its regular income. Utimately, it would become Rs 2,175.

b) Bulanawewa-Villagers & Squatters

Excepting that their holdings are generally smaller than that of the Colonists', Bulanawewa-villagers and Squatters are following the same pattern of cultivation, raising almost same kinds of products. On an average, the former is cultivating 4.1 acres and the latter, 3.0 acres. (It is to be reminded here that as the gap between the biggest and the smallest holders is very big among Bulanawewa-villagers, their simple average may be misleading.) Gross-income of Bulanawewa-villagers is Rs 2,280 and that of the squatters with small holdings, Rs 1,620. (As operational cost could not have been studied, we assume their cost would be somewhere around 65% of that of the Colonists'.) Farm-income will be Rs 1,500 among Bulanawewa-villagers and Rs 1,000 among Squatters. Both of them get Rs 100 to 300 as wages, making their total income Rs 1,600 to Rs 1,700 among Bulanawewa-villagers and Rs 1,200 to Rs 1,300 among the Squatters.

2-5-6: Aspirations of the Farmers

In our socio-economic survey conducted within the project-area, aspirations of the farmers for production-increase were fathomed in both positive and negative directions. The method adopted for this purpose was to ask them to select 2 issues which they feel most relevant, for both paddyfield operation and upland-field farming. Its results are as follow:

Relevant Issues	Paddyfield operation	Upland-field farming
1. Expansion of arable land	102	26
2. Mechanization	171	26
3. Improvement of farm-roads	6	1
4. Improvement of water-channels	131	59
5. Better drainage	10	16
6. Lack of operational capital	95	120
7. Lack of modern technique	11	36
8. Shortage of labour	10	6
9. Marketing difficulties	4	204
10. Introduction of new items of product	-	14
11. Obtaining more cattles	1	-
12. Others	1	4
Total =	542	512
No answers avilable from:	(16)	(31)

As for paddyfield operation, the top-priority is given for Mechanization and 60% of the farmers are seriously desiring to mechanize their cultivation. Since establishment of Government Tractor-Station in the Colonization Scheme area, primary ploughing which had been done by use of buffalos is now undertaken by tractors on 77% of total paddyfield. Demand for labour-saving machinery is thus very strong. Next most desired issue is water-channel improvement which reflects the cultivators' serious concern for stabilization of paddy-production which is the biggest source of their income, in consideration of the fact that even during Maha season paddy-cultivation is often handicapped by lack of irrigation water as much and as timely as required.

Irrespectively of their status, even ratio of farmers belonging to 4 different categories are desirous of "more supply of capital", while "expansion of arable land" is badly wanted by non-colonists. "Labour-shortage" stopped to worry cultivators as enough number of squatters has settled down within this area.

As for upland-field farming, 80% of cultivators are desirous of better marketing of their produce, and nearly one half of them are complaining about lack of working capital. 20% of them want "improvement of water-channels", probably for better irrigation at the time of sowing during Yala season. They are quite rational in selecting "modern technique" to be introduced for upland-field farming than simple expansion of land if better farming is to come and develop there.

Kinds of crop which they commonly aspire to expand their acreage are paddy for Maha season and tobacco for Yala season; both are staple crops of the area with stabilized price. Chilli is another crop they wish to grow more, with passing references to kurakkan and gingili.

2-6: Current Agricultural Technique

The following observations are based on hearings from the cultivators on the mode of cultivation, supplemented by soil-tests and sample crop cutting surveys.

2-6-1: Pattern of Cultivation

(1) Paddy-Cultivation

In the project-area, paddy is cultivated on almost 100% of its paddyfield during Maha season but it lies fallow completely during Yala season. Since 1950, paddy was planted during Yala season on 1/3 of the total Dewahuwa Scheme (approx. 2,300 acres) area on two occasions but proved to be failure in both cases. Along the river-beds in the neighbourhood of 14/3 and 16/3, paddy-cultivation is taken up during Yala season only, as an exceptional case. Paddy is not, or rather cannot be, cultivated during Yala season simply because of the absolute shortage of irrigation-water. Utilization of paddyfield for other subsidiary crops is technically feasible but it is not at all practised in the project-area. A strong desire to cultivate tobacco on the paddyfield during Yala season seems to be common among the residents there but they are discouraged to do so under the Government's Food Production Policy.

(2) Upland-field Farming

Highland distributed among the colonists is 3 acres in size but 2/3 of it is usually occupied by the colonists' homestead and home-garden and the remaining 1/3 or 1 acre is being used as upland-field. Upland crops grown on the field, home-garden and home-stead are as follow:

(Fruits)	(Vegetables)	(Cereals & Cash-crops)
Coconut	Taro	Upland-paddy
Banana	Egg-plant	Manioc
Mango	Chilli	Sweet-potato
Lime	Pumpkin	Kurakkan
Orange	Cow-pea	Gingili
Pomegranate	Tomato	Ground-nut
Papaw	Ginger	Green-pea
Jack-fruit	Onions	Coffee
Pineapple	Carrot	Tobacco
Areca-nut	Red-turnip	Pepper
	Okra	Betel

The above are primarily for the cultivators' domestic consumption and marketed in small quantities only when any surpluses are available, excepting tobacco which is cultivated exclusively for sales and upland-paddy, mungata and chilli are mainly for sales.

Planting season of the principal upland crops is as follows:

(Maha season)	throughout the year.....	(Yala season)
Upland-paddy		Tobacco
Kurakkan		Onion
Green-pea		Carrot
.....	Chilli	
.....	Egg-plant	
Tomato		Red-turnip
Pumpkin		Tomato

Some of them are grown among coconut-trees and banana plants, and tomato, egg-plant, chilli etc are often grown mixed. Intercrop vegetables are said to give desirable effects upon coconut-trees and banana-plants and not vice-versa (inter-crop vegetables are not to get any particular benefits, for instance, protection under the shadows of coconut-trees and banana-plants, or any other sorts). Order of their cultivation does not seem to have any definite rule, excepting that solanum crops should be cultivated before tobacco and never vice-versa, and the length of fallow shall be 2 years for tobacco. Nevertheless, harms from repeated cultivation of tobacco seem to be apparent though it could not have been confirmed because our survey took place after tobacco had been harvested in the project-area, and chilli is almost entirely affected by the virus-diseases.

(3) 'Chena' Cultivation

'Chena' is usually opened by burning jungles either in February or August and is continuously exploited for about 5 years. Upland-paddy and kurakkan are usually grown there during Maha season and tobacco is its main crop, with chilli, gingili, etc. as its inter-crops, during Yala season.

'Chena' is generally exploited in the above rotation, resulting at gradual deterioration of yield with upland-paddy and tobacco through increasing harms from their repeated cultivation on the same plot of land, so that in the 5th year people convert the 'chena' for coconut-trees and banana. Upland-paddy and tobacco are commonly grown on 'chena' repeatedly because they are the crops promising comparatively better income to their cultivators.

2-6-2: Varieties & Cultivation-Techniques

(1) Paddy-Cultivation

a.- Time of Planting

When the reservoir-water level attains a specific height (17 feet) in the early part of Maha season, a meeting constituted by the responsible members of the Cultivation Committee will decide upon the date when the tank-water shall be discharged for irrigation-purposes. This heralds the beginning of paddy planting season which falls sometimes in October and sometimes in November. Tank-water may happen to be discharged only in December, depending on the yearly rainfall. Planting season is thus rather unstable and its delay is said to result at poorer harvest.

b.- Direct-Sowing vs. Transplanting

Two methods are concurrently adopted in the project-area with yearly fluctuation in their extents. As for 1968–69, acreage under transplantation has been adjudged to have extended to approx. 45% of the total paddyfield there. It has been observed that transplanting practices are steadily spreading among the cultivators. Commonly-practised broadcast-sowing is as follows: After puddling the paddyfield, cultivators build drainage-grooves and then level the surface of the field. On the wet floor of the field, they broadcast germinated seed-paddy (2 bushels of dried seeds per acre). Transplanting takes place like this: After preparing nursery-bed in the similar way as with paddyfield under broadcast-sowing, on which young plants will be grown for the period of 3 weeks or so. 2 to 3 plants per stump - 24 to 43 stumps per $9'^2$ (29 to 51 stumps per square-metre) - is the commonest density of paddy-transplantation.

Broadcast-sowing and transplantation take place almost simultaneously, side by side. Three factors of irrigation-water, tractor and labour, if combinedly available in time, cultivators are induced for transplantation as it brings more yield with less lodging.

c.- Varieties

Varieties widely used in the project-area are Murungakayan-302 (which is said to be 4-month maturing variety), H-4, H-8 and Sanba. Murungakayan-302 and H-4 together represent almost 70% of total seed-paddy used there, with 20% of H-8. IR-8 which is supposed to be a variety with high-fertilizer-response is rarely used there. Murungakayan-302 and H-4 are used for both direct-sowing and transplantation. No definite reason for such selective use of seed-paddy has been studied, but it is supposed that H-8 fails to attain even formation of ears if sown directly.

Extension of knowledge as for the varieties of seed-paddy comes through Cultivation Committee, while seed-distribution is made through agricultural co-operatives. Once specific seeds are adopted, cultivators seldomly worry about their renovation until new varieties will come to be introduced. In case seeds are raised individually, no special care is paid for the paddy meant for sowing; any left-over of the paddy held for family-consumption is freely used.

d.- Nursery-Bed

Nursery-bed is carefully prepared (½ acre for 5 acres of paddyfield) on which seed-paddy is sown with the density of 1.3 lbs of seed-paddy (when in dried condition) per 100 sq. feet. 1 bushel of seed-paddy is generally used for 1 acre of paddyfield. Young plants are grown on the nursery-bed for 3 weeks before trans-planted onto the field.

e.- Application of Fertilizers on Paddyfield.

Dosage of fertilizer-application, as information goes among the cultivators, is less reliable as people often failed to identify the kind of fertilizer they used last year:

Table 2-14: Fertilizer-application by Cultivators
(unit = cwt/acre)

	No fertilizers given	Application of Fertilizers Done				Total
		Total	Initial application	15-20 days after transplantation	During flowering period	
Number of Farmhousehold	8	4	3	4	3	12
Ammonium-sulphate			0	½ – 2	1 – 1½	½ – 2
Urea			0 – ¼			-
Concentrated Superphosphate			0 – 1			0 – 1
Muriate of Potash			0 – ½			0 – ½

Many farmers are doing without fertilizer: in our survey, for example, 8 farmhouseholds out of 12 enquired are using no fertilizer at all. Fertilizer-using farmers are trying to adhere to the Government specifications in both dosage and timing:

Government Specifications as for:

	Dosage	Timing		
Ammonium-sulphate:	2 cwt/ac	Initial application	15 days after transp.	During flowering ing
Concentrated superphosphate:	1 cwt/ac	Concentrated superphosphate	Ammonium suphate	Ammonium sulphate
Muriate of potash:	½ cwt/ac	1 cwt/ac plus Muriate of potash ½ cwt/ac	½ cwt/ac	1½ cwt/ac

Reasons for non-application of fertilizer are primarily the lack of capital and, secondarily, in fear of bad weather and resulting water-shortage which turns investment in terms of fertilizer input (which they usually do on credit) into high-interested fixed debt.

f.- Water-Control

Primary ploughing takes place as soon as soil will be softened by rain-fall or discharge of tank-water; immediately after ploughing, bunding of levee will be hurriedly done to keep water inside the field and clod-breaking takes place in the innundated field; puddling will follow before the field is sown either directly or transplanted with young plants.

Direct-sowing takes place on the field drained of water and no pitching of water before the seeds grow into tender plants 10 cm in length (it takes 8 days or so after sowing). Afterward, water 2 cm in depth will be kept in the field, into which tank-water flows for 2 days out of 6 (in case of rotation) until harvest-season; no intentional drainage of water is made in the meanwhile. Trans-planting takes place on the field innundated by 3 cm deep water; after transplantation, field is kept with 5 cm deep water until about 10 days before harvesting when water is drained out of the field. In the meanwhile, 2 days irrigation out of 6 continues.

The above is the routine water-control as told by the cultivators themselves; inspite of intensive care at the initial stage of paddy-cultivation, after-care of water-control seems quite loose as has been witnessed during our survey: most of the paddyfields where the plants had not yet formed ears at mid-March had its outlets cut open and its

levees spiked with innumerable holes made by crabs so that water was freely running through outlets and crab-holes on the side of levees and one-day cut of water would invite drought conditions onto the fields. Their ridges and levees were covered with 30-cm tall grasses, showing least sign of cultivators walking on them for proper water-control work. Enormous loss of water is thus over-looked by the cultivators in the project-area.

g.- Weeding

On the field where seeds are directly sown, weeding is done by hands and, in case it is not enough, weedicide is used, about 1 month after sowing. In case of transplantation, the field is kept innundated for 15 days following transplantation to prevent growth of weeds; if weeds still grow, weedicide is applied. Innundation of field to prevent weed-growing seems to be well known among the cultivators; in the marginal fields where water does not reach in full, growth of weeds is so rampant that paddy-plants are sparcely mingling among the overgrown weeds such as sedge. People can easily discern from afar even where paddy was sown directly and where transplantation was made among the fields cultivated by self-same person, from the over-abundance of weeds in the former.

h.- Control of Pests & Diseases

During our survey period, it was impossible to ascertain the prevalence of pests and diseases and the cultivators' counter-measures for such. Traces of neck-rot, brown-spot and bacterial leaf blight could have been discerned but slightly only. On the field of one cultivator, however, acute case akin to Ufra disease was discovered.

(2) Upland-field Farming

Cultivation-techniques for highly commercialized crops such as tobacco, chilli and upland-paddy have been observed.

a.- Tobacco

Tobacco cultivated in the project-area is meant for beedi and not for cigarette. Seeds are sown on the nursery-bed during mid-February and early-March; it takes about a month (1½ months in case the nursery-bed is not properly manured) for young plants to grow big enough for transplantation onto the field (mid-March to April); harvesting takes place during end-July and end-August.

Tobacco is solely grown during Yala season, because Maha season is too wet for its drying and humidity would send it to decay. People usually burn hay or straw on the surface of the nursery-bed and sowing takes place after careful soil-preparation. Young plants grown on the nursery-beds are extremely uneven but cultivators pick up the biggest

of them for transplantation. No ridge is built on the field and transplantation is made in lows with the density of 3,000 – 6,000 plants per acre. Ammonium-sulphate is applied during the plants' seedling stage on the nursery-bed, and after the plants are transplanted onto the field, 1.5 cwt of ammonium-sulphate per acre is given in addition. Tobacco-cultivators are very much fertilizer-minded.

Earthening-up is effected twice (in the course of covering the tobacco roots with soil, weeding purposes are simultaneously attained). Meticulous cares are given including disbudding and defloration. Farmchemicals are also used against pests and diseases. 1 tobacco-plant bears 9 to 12 leaves, weighing some 1,000 lbs per acre.

b.- Chilli

Chilli is grown all-through the year excepting two rainy months of November and December. Once planted, it continues on yielding for full one year. People generally enplant chilli during March and May in Yala and replant at the close of Maha, because it brings the best crop. They say that those enplanted during Maha do not bear good crop during Yala season. Chilli seeds are sown on the nursery-bed at the beginning of February to be transplanted at early-or mid-March and given up in February–March the following year. For transplantation onto 1 acre of land, nursery-bed measuring 42 sq.ft is prepared on which approx. ¼ lb. of seeds are sown. Young plants grown on the nursery-bed are rather uneven but, as cultivators select the biggest one of them at the time of transplantation, their growth on the field is made uniform. Still, most of the plants are lacking primary cluster probably due to rough handling. As seeds are taken out of the crop raised year after year, marketable products lack standardization.

No ridges are built on the field where 2 seedlings are transplanted per stump with the intervals of 2-1/6 x 2 feet, in lows. 1.5 cwt/acre of ammonium-sulphate is applied 30 – 35 days after transplantation. Intermediate cultivation-cum-weeding and earthening-up take place once a month or more frequently during rainy season. Harvesting begins about 2 months after planting, bringing more yeild during Maha than Yala, but harvest during Maha accompanies drying-difficulties. 1.5 cwt or so is generally harvested per acre and partly consumed by the cultivators and their families. Large-sized chilli sells better but seldomly grown in the project-area as it consumes more fertilizer.

c.- Upland-paddy

Upland-paddy is cultivated only during Maha season. Generally sown during end-October to November and harvested during end-January to end-February. Varieties used are Murungakayan-302, Godawee and H-4. H-8 is not welcome because of its nature such as poor drought-resistence, uneven ear-formation and late-maturity.

Two methods of sowing are adopted: one is called 'kekulan' (dry-sowing) broadcasting dry seed-paddy on dry field, and the other is 'madhataihinawa' (wet-sowing) sowing germinated seed-paddy on the soil given moisture after first rains. The former method is used during October in expectation of November rain and the latter is adopted in November after rain comes. Cultivators use two methods probably to evenly distribute their labour. Quantity of seed-paddy measures 3 bushels per acre in dry conditions. After seeds are sown, people till the soil thinly with hoe, or cover the seeds with soil by use of rake or lawn-harrow. After that is over, no particular care is paid excepting application of weedicide when weeds over-grow on the field.

Yield depends on the rain, harvesting 20 bushels/acre in good year but even less than that spent for seeds in bad year. Repeated cultivation on the same land reduces its yield to 10 bushels or even less per acre.

2-6-3: Method of Cultivation

1) Paddy-cultivation

a.- Primary ploughing is widely done by use of tractors. 75% of the paddyfield is said to be tractor-ploughed in the project-area. Ford-Dextor and Furgason-135 are the types being used there. They are hired out from Government Tractor Station as well as from the private owners. They charge Rs 45 – 50 for the primary-ploughing and Rs 20 – 25 for secondary tillage, per acre. Remainder of paddyfield is ploughed by buffaloes. Reasons raised against employment of tractors are:

(i) tractors are not available in time due to their absolute shortage;

(ii) in the marginal fields away from water-channels, people can not expect stabilized crop so much so tractor-charges are often turned into debts.

Primary-ploughing takes place after first few rains or water discharged from the Tank will soften the soil of the field and the second tillage, 10 to 15 days after the primary-ploughing. Tyne-cultivator with 2" tynes set at 12" intervals is used in both cases. Tractor undertakes two cross-ploughings for the first time and two cross-tillage or a single ploughing for the second time. Its tillage is considerably rough attributing for uneven growth of paddy-plants thereupon.

b.- Puddling is done by buffaloe-drawn 'poruwa' (leveller) made of wood. 'Goiralla' is also used for levelling field-surface prior to broadcasting of seeds. It requires streneous labour on the part of the cultivators.

c.- 5 acres of paddyfield is being parcelled up into as many as 100 tiny plots, requiring enormous labour for levee-bunding. Enlargement of plots, on the other hand, requires another heavy labour for their levelling and cultivators find agreement of opinions at parcelling of 1 acre into 8 to 10 plots.

d.- Transplantation is done by hand but extraordinarily large number of labourers are employed for the purpose according to the statement of the cultivators. Detailed analysis into this problem will be worthwhile.

e.- Pests & diseases control is done by use of shoulder-type hand-operating sprayers but other details are unknown.

f.- Excepting for application of weedicide about 1 month after sowing or transplanting, no weeding practices by using implements are known.

g.- Reaping is done by use of teethed sickle but most of the sickles have blunt edge.

h.- Threshing takes place by using tractors or buffaloes for trampling the ears till the seeds drop out on the mats placed on 'kamata' (threshing yard). People encircling 'kamata' remove the threshed bundles of straw throwing them out over their shoulder. One man uses a winnowing-basket made of bamboo to drop threshed paddy in a constant flow of grains from the height of his shoulder, while another man winnows the flow of grains by fanning it with another winnowing-basket. It is a very dusty job and takes place during night-time.

i.- Threshed grains of paddy are carried on people's head or by use of bullock-cart. Tractor is also used but not commonly.

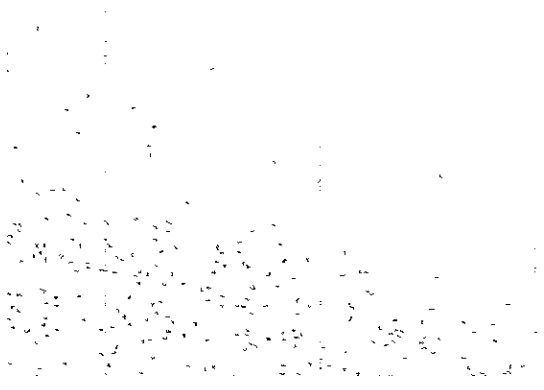


Table 2-15: Work-Order & Labour required for Paddy-Cultivation

Transplantation Method			Direct-Sowing Method		
Work-Load	Timing	Labour-input (manday/ac)	Work-Load	Timing	Labour input (manday/ac)
Preparation of Nursery-Bed: Seed-soaking) Bed-preparation) Levee-bunding) Groove-making) Sowing) Fertilizing)	end-October to early-November		Soaking of Seeds for Germination	mid-November	
Primary-ploughing (tractor)	early- & mid-Nov.	0.4	Primary-ploughing (tractor)	early- & mid-November	0.4
Levee-bunding	mid-Nov.	6 – 8	Levee-bunding	mid-November	
Second-tillage (tractor)	mid- & late-Nov.	0.2	Second-tillage (tractor)	mid- & late-Nov.	0.2
Puddling (buffalo)	– " –	1.0	Puddling (buffalo)	– " –	0.3
Picking-up of Seedlings	end-November	3.0	Drainage-groove & levelling	– " –	6.0
Transplanting	– " –	24.0	Sowing	– " –	0.15–0.2
Additional fertilizing (twice)	December to February		Additional fertilizing (once)	December	
Weeding			Weeding	end-December	
Irrigation & Drainage			Irrigation & Drainage		
Pest-Control			Pest-Control		
Harvesting	mid-March to April	10.0	Harvesting	mid-to end-March	7.0
Threshing	– " –	5.3	Threshing	– " –	10.0
Winnowing			Winnowing		

Note = Timing and labour-input for some works have not been confirmed. They are left in blank on the above Table.

2) Upland-field Farming

Tractors are partially used in ploughing the fields meant for tobacco and chilli but seldomly for those of upland-paddy because of its unstabilized yield. All other upland-field farming is done by hand:

Table 2-16: Work-Load & Labour required for Upland-Farming

Tobacco			Chilli			Upland-paddy		
Work-Load	Timing	Labour	Work-Load	Timing	Labour	Work-Load	Timing	Labour
Nursery-Bed:			Nursery-Bed:					
Bed-making Sowing Watering	mid-Feb to early March		Bed-making Sowing Watering	mid-Feb.				
Fertili-zer	early-March to late Mar.							
Ploughing of Field	Jan – Feb.		Ploughing of Field	early March		Ploughing of Field	Oct-Nov.	17
Clod-breaking	early March		Clod-breaking	early March		Seed-soaking for germi-nation	– " –	
Transplan-tation	mid-Mar to early-May	20	Transplan-tation	early-Mar to late-May				
Irrigation			Irrigation			Sowing	– " –	
Fertili-zing			Fertili-zing					
			Inter-cultivation & weeding	or more Maha=1/month Yala=1/month				
Harvesting	Late-Jul to late-August	2–10	Harvesting	early-May to March		Harvesting	late Jan. to late-Feb.	
Drying			Drying			Threshing		
						Winnowing	– " –	
Total		100						

2-6-4: Yeild of Wet-Paddy

During our survey at mid-March 1969, 10 farmhouseholds were selected out of those engaged in paddy-harvesting and 3 unit-acreage sampling surveys were effected with each one of the selected farmhouseholds (30 sample crop-cutting-surveys in total, with samples collected from 9 sq.ft each time). Paddy reaching its ripening period at mid-March represented about 1/5 of all; while some of the remaining 4/5 were observed to be in superior conditions than those surveyed; conditions in the marginal field in Tract 3 were miserable, threatening for quasi-total crop-failure.

The results of our sample crop-cutting-surveys, therefore, cannot be immediately used for estimating average yield of paddy in the project-area as a whole but, nevertheless, they are useful in supplying us information, for instance: (i) transplanting generally brings better yield, and (ii) unexpectedly good crops are being raised without using fertilizer. Sampling results are given on Table 2-17 (as for yeild in grains) and Table 2-18 (on conditions of cultivation and growth).

Table 2-17: Sampling Survey Results (Yield in Grains)

Allotment No.	Survey No.	Weight of samples collected from $9'^2$ (in grains in) (gram)	Estimated yield per acre (in grains in) (kg)	Applicable extent in percentage	Average yeild per acre (in grains in) (kg)
(Tract No.) 1-11	1	516.2	6174	30	4464
	2	324.8	3885	40	
	3	294.9	3527	30	
2-2	1	308.7	3692	30	
	2	233.0	2787	30	
	3	397.0	4748		
3-5	1	259.1	3099	20	2476
	2	342.5	4096	20	
	3	144.6	1729	60	
3-15	1	360.9	4316	30	4490
	2	311.9	3730	30	
	3	433.9	5189	40	
3-26	1	283.0	3385	20	3065
	2	253.2	3028	40	
	3	246.0	2942	40	
3-29	1	312.0	3731	20	2731
	2	179.6	2148	60	
	3	290.9	3479	20	
3-75	1	318.9	3814	20	3197
	2	292.0	3492	20	
	3	242.0	2894	60	
3-82	1	330.5	3953	40	3417
	2	318.1	3804	20	
	3	224.7	2687	40	
3-96	1	245.2	2933	10	
	2	174.6	2088	20	
	3	144.4	1727	70	
4-5	1	223.2	2669	60	
	2				
	3				

Table 2-18: Sampling Survey Results (Conditions of Cultivation & Growth)

Allotment No.	Sample No.	Varieties	Time of Sowing	Time of transplant-ing	Number of stumps per M^2	Fettilizer – Application		Stalk	Ear	Number of Ears per M^2	Degree of Lodging
						Initial	Additional				
1-11	1	Murungakayan-302	early-November	late-November	37	none	none	105	24.1	249	fulllodging
	2	"	"	"	42	"	"	76	22.9	167	no
	3	"	"	Broadcasting	-	"	"	62	15.8	427	no
2-2	1	Murungakayan-302	16-18 November	Broadcasting	-	none	none	79	18.6	322	½
	2	"	"	"	-	"	"	82	14.6	407	full
	3	"	late-October	25 November	51	"	"	78	22.2	272	no
3-5	1	Murungakayan-302	late-November	Broadcasting	-	Concentrated superphop. 1 cwt/ac	21 days after trans-planting: ammon. sul: ½ time of ear-formation: ammon sulph: 1.5 cwt	86	17.0	331	full
	2	"	"	"	-	"	"	76	18.5	345	½
	3	"	"	"	-	"	"	64	14.7	422	no
3-15	1	H-4	14 November	30 November	29	? 1.5 cwt/ac	14 days after transp: ? 1.0 cwt/ac time of ear-formation ? 1.0 cwt/ac	74	23.8	190	no
	2	H-4	"	"	38	"	"	71	21.0	217	no
	3	Sanba	"	"	37	"	"	101	16.2	295	full
3-26	1	Murungakayan-302	22 November	Broadcasting		none	none	80	15.8	513	full
	2	"	"	"	-	"	"	77	17.7	338	½
	3	"	"	"	-	"	"	77	19.4	436	no
3-29	1	Murungakayan-302	mid-November	Broadcasting	-	none	none	84	19.0	394	full
	2	"	"	"	-	"	"	65	15.5	391	no
	3	"	"	"	-	"	"	72	16.8	451	½
3-75	1	H-4	late-November	Broadcasting	-	none	none	74	18.4	302	full
	2	"	"	"	-	"	"	67	16.1	435	½
	3	"	"	"	-	"	"	59	15.7	523	no
3-82	1	H-4	December 12	Broadcasting	-	none	none	77	18.1	322	full
	2	"	"	"	-	"	"	62	19.0	308	½
	3	"	"	"	-	"	"	62	17.3	325	no
3-96	1	Murungakayan-302	late November	Broadcasting	-	none	none	84	15.0	453	full
	2	"	"	"	-	"	"	56	12.5	494	½
	3	"	"	"	-	"	"	55	14.8	323	no
4-5	1	PK-1	15 November	25 November	42	none	none	71	16.0	251	no
	2	Sanba	"	"	39	"	"	73	20.6	269	no
	3	"	"	"	44	"	"	71	21.6	231	no

2-6-5: Interrelations of Technique and Management

Agricultural technique in the project-area is understood to have been kept stagnant primarily due to an absolute shortage of irrigation-water and the annual fluctuations of its availability. Water discharged from Dewahuwa Tank during Maha season (October to March) since 1951-52 is given on Table 2-19.

Table 2-19: Water-Discharge from Dewahuwa Tank (October - March)

Year	Water-Discharged	Commencement of Discharge	Remarks
1952	8,576 ac.ft	November	November: 2,130 ac.ft
1953	0	-	
1954	7,776 ac.ft	November	November: 236 ac.ft
1955	17,450 ac.ft	October	October: 79 ac.ft
1956	10,645 ac.ft	November	November: 727 ac.ft
1957	5,210 ac.ft	December	
1958	9,152 ac.ft	November	November: 973 ac.ft
1959	0	-	
1960	7,689 ac.ft	January	
1961	11,143 ac.ft	October	October: 705 ac.ft
1962	*14,162 ac.ft	November	* Nov.-Apr. total November: 222 ac.ft
1963	15,923 ac.ft	October	October: 4,521 ac.ft
1964	*13,134 ac.ft	February	* Feb-Jun. total Oct-Mar: 6,902 ac.ft
1965	3,943 ac.ft	December	
1966	12,415 ac.ft	November	November: 2,352 ac.ft
1967	21,975 ac.ft	October	October: 523 ac.ft
1968	17,551 ac.ft	November	November: 3,574 ac.ft

Discharge of water was completely suspended in two years and in one year discharge was made but in less than 5,000 ac. ft. This endorses the cultivators' laments that "we have had 3 miserable years during the last 20 years."

Water-discharge was also made with fairly big yearly fluctuations such as: 5,000 to 10,000 ac. ft in 5 years, 10,7000 to 15,000 ac. ft in 5 years and 15,000 ac. ft and above in 4 years. Water was discharged from varying points of time in varying quantities. Even when water started to be discharged from October, the quantity discharged during the same month remained below 1,000 ac. ft excepting in 1963. This-much water discharged during October makes no practical difference on the part of the cultivators between water-discharge commencing in November. In fact, water-discharge has been mostly started in November. In 4 years when discharge was commenced in November, the quantity thus discharged did not reach 1,000 ac. ft which is the minimum necessary duty of water for paddy-cultivation. In 5 years out of 17, water was discharged from the Tank only in December. This means that in 9 years out of 17, no paddy-cultivation was allowed during November.

They say in the project-area that delayed planting brings poor harvest. The relationships between time of planting and amount of yield in the project-area need to be analyzed both physiologically and ecologically to confirm their statement. But the amount of available water has obvious bearings on yield. In those years when Tank-water was discharged in later period of time, the quantity of water held in the reservoir itself was limited which means the total quantity of water available for irrigation was correspondingly less. The above Table shows the interrelationships between the delay in water-discharge and less availability of total water discharged between October and March. Delay in commencement of water-discharge does not mean corresponding delay in the time of its suspension. Even when discharge starts rather late, water stops to come in April and, if it is at all available, not more than 500 ac. ft. It is almost clear that this-much scarcity of irrigation-water, particularly during the later growing period of paddy-plant, adversely affects upon its yield.

Thus, availability of water plays an important - almost fatal - part on the yield of paddy and, accordingly, on the economicality of its cultivators. Whether the colonist was allocated paddyfield along the main-channel or at the peripheral corner far away from the channel is synonymous to whether he was promised with prosperity or doomed for poverty. Social stratification or class-disintegration among the colonists during the last 20 years was accelerated, if not wholly, by this sheer logic of fact.

Water-conditions as briefed in the above are also providing manifold pressures upon the work-load of the cultivators. Under the prevailing circumstances, cultivators have to make best use of rain or tank-water as soon as it happens to come to their field but majority of them lack efficient means of production due to poor or no capital accumulated, and run for tractors to have their field ploughed in good time. Number of tractors belonging to the Government Tractor Station or those privately owned by individuals are too few to satisfy the clients coming all at once within a limited time, if thoroughness of duty is kept in mind. Rough and tough services offerable by tractors can hardly attain the purpose of soil-preparation meant for bumper crop. Still, those cultivators who can afford to hire tractors are better off than those who cannot: these people have no money to pay for tractor or else are afraid of incurring loss or indebtedness by sending for tractor to plough their marginal fields which do not promise stable crop at the end of the season. In either cases, the primary ploughing will have to be delayed. Better-off cultivators enjoying tractor-services more freely than others can also pay for labour-force required for timely transplanting, while the less resourceful have to take resort to direct-sowing; they know they cannot hope for high fertilizer-response through direct-sowing and also keep in mind that their marginal land may fail to bring adequate harvest due to insecurity of irrigation-water there. They thus find little merit in putting full dosage of fertilizer which may happen to turn to the fixed debts on their shoulders. In the latter case, vicious-cycle of little input bringing less yield starts operating in paddy-cultivation.

Many cultivators turn their attention towards 'chena' and tobacco-cultivation on it to cover up such low-yield and insecurity of paddy-crops on the lowland. As soon as first rain comes, they forget about their paddy-field and run to 'chena' keeping themselves busy in sowing upland-paddy as ante-crop of tobacco there. This helps making the demand for labour more acute in Maha planting season. Upland-paddy will be ripened on 'chena' by January (if sown in October) and in February (if sown in November). Following its harvest, tobacco needs to be cultivated in February/March. This coincides with later-growing-period of their paddy standing on their field and, while they are busy attending at 'chena' farming, weeds simply grow rampantly on ridges and levees on the paddyfield and crabs make many more holes through which seepage of irrigation-water is intensified: water-shortage is thus made more and more serious for proper paddy-cultivation.

Weather-sensitive crops or crops income from which is ruled by weather-conditions seem to be meted out with minimum input both in term of capital and labour, receiving only simplified methods of cultivation. For instance, no tractor is called for in case of upland-paddy farming, no fertilizer is given nor any sort of meticulous care.

On the contrary, cultivators hire tractor, use plenty of fertilizer and take minute care in case of tobacco and chilli which grow comparatively free from the influences of weather and yet bring better return. However, as such weather-free and particularly drought-resistent crops are naturally limited in their kinds, are apt to be cultivated in repetition for years with accompanying harm becoming more manifest.

In this way, we may be able to compare the availability of irrigation-water for paddy-cultivation to an axis around which two cycles are being put in motion but in opposite directions: cultivators fortunately endowed with better irrigation conveniences for their paddy-cultivation are going on 'virtuous-cycle' of better capital-accumulation → intensification of farm-technique → more income . . . ., while those less favoured with irrigation-water are doomed for 'vicious-cycle' of low-yield → less income → less intensive farming .....

It will not be too bold an observation that not more than 20 in the area are in the 'virtuous-cycle' and all the rest are not only confined in the 'vicious-cycle' referred to in the above but they are driven for careless water-control, deprived farming and devastation of their own land, thus deterring general socio-economic development of the whole area.

2-7: Availability of Water-Resources

Water-source of Dewahuwa Colonization Scheme is Dewahuwa Tank which was completed by the Department of Irrigation in 1951, with its embankment heightened twice by 2 feet each time, in 1955 and 1956. Dimensions of Dewahuwa Tank are given on Table 2-20.

Table 2-20: Dewahuwa Tank Data

Length of Bund	1,914 ft.
Top Level of Bund	604.75 ft.
Bund top width	18.00 ft.
Free board	4.60 ft.
Full supply level	597.50 ft.
Catchment area	25.5 sq. miles
Capacity at F.S.L.	8,800 ac. ft.
Area at F.S.L.	980 ac.
Type of Spill	Clear over-fall, Concrete & natural rock with crest wall.
Crest level	597.50 ft.
Spill discharge of flood	10,630 cu. ft/sec.

FIG. 2-4

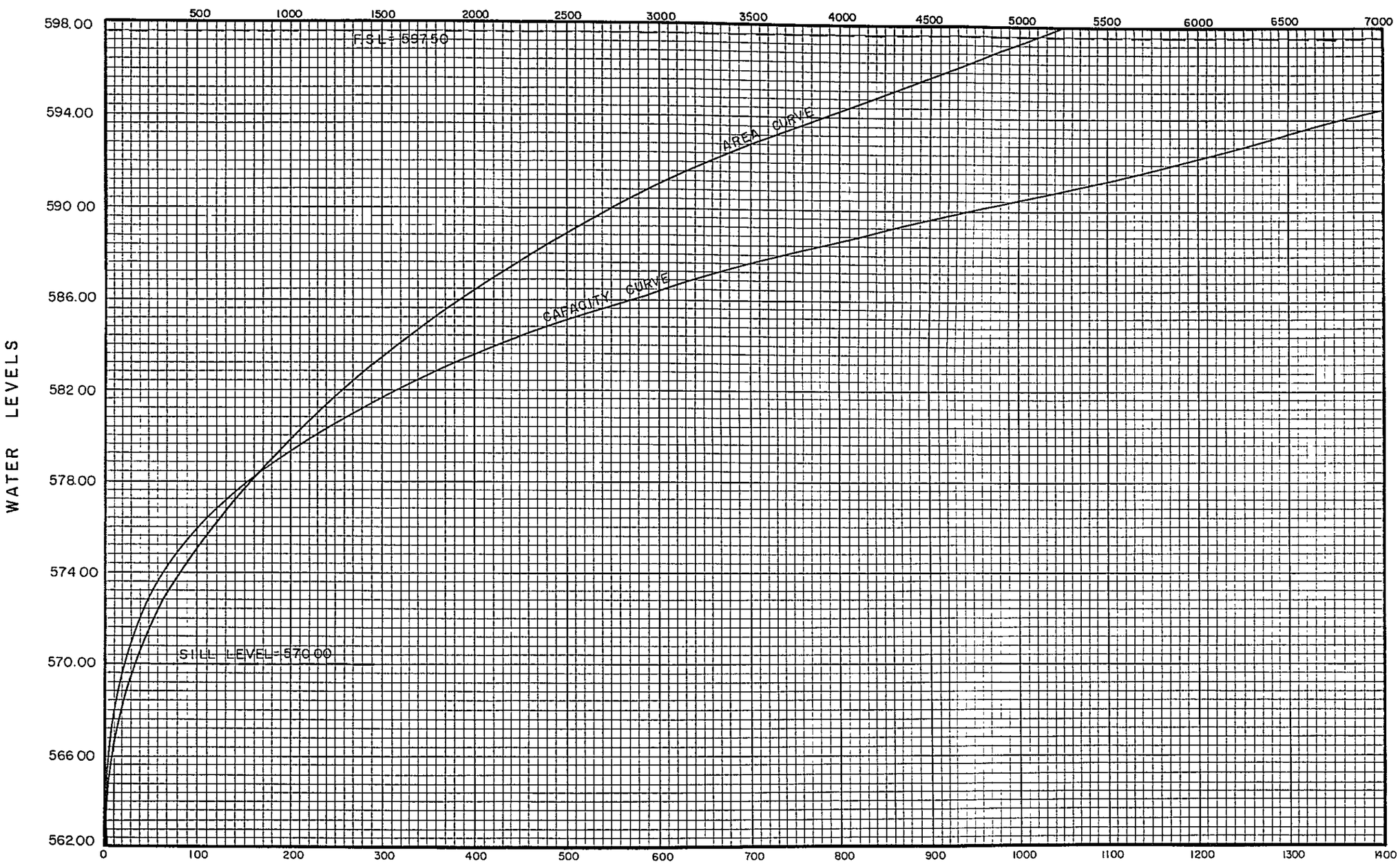


FIG 2-4 DEWAHUWA TANK-CAPACITY IN AC-FT

1/5 (1·65 x 6 70)

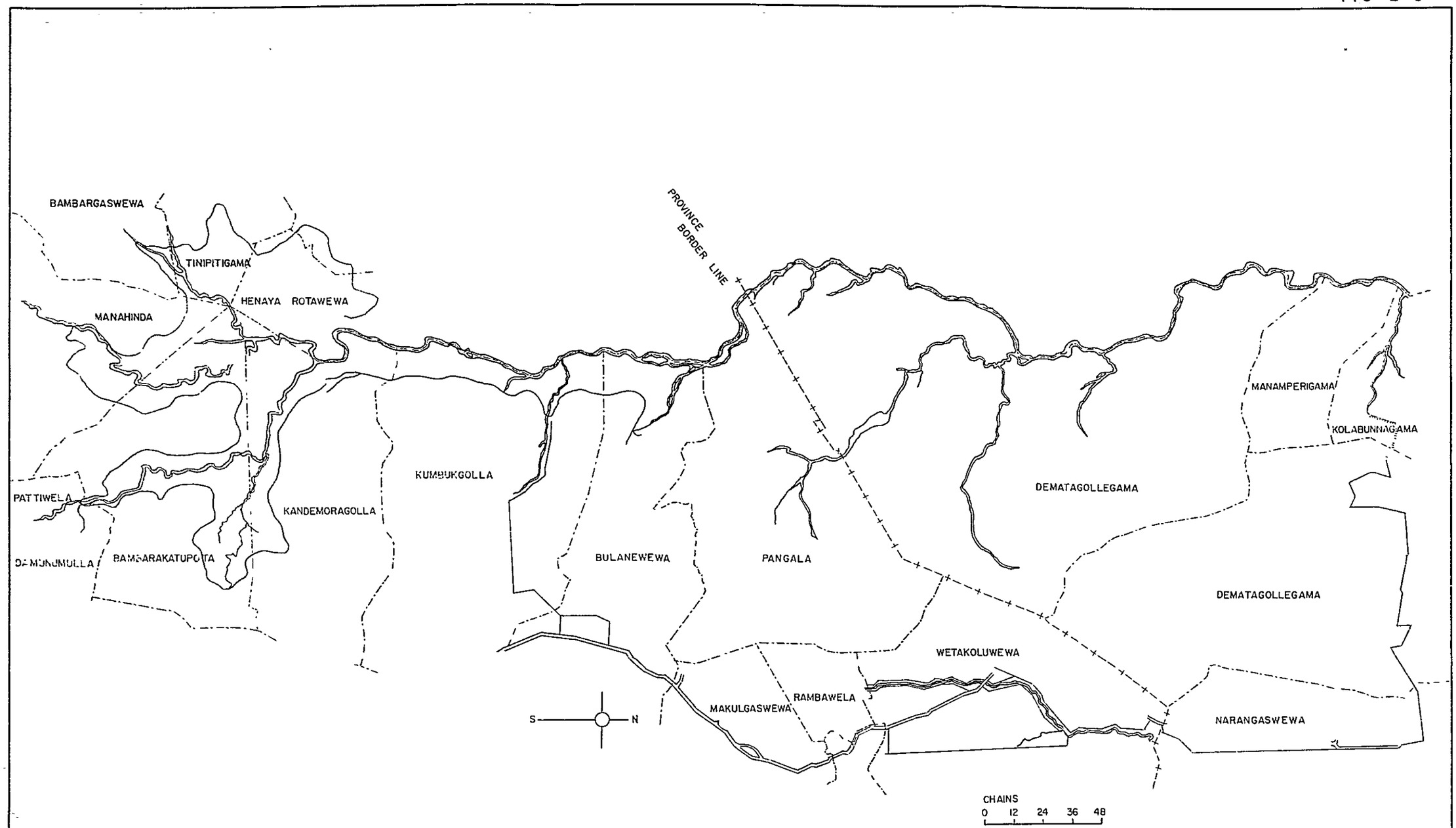


FIG 2-5 VILLAGE BOUNDARY BEFORE THE ESTABLISHMENT OF THE COLONIZATION SHEME

SCALEOF 12 CHAINS TO AN INCH

Type of sluice	Hume-pipe & tower sluice
Size of opening	36 " dia.
Spill level	570.00 ft.
Head of water	27.50 ft.

Facing of the embankment is reinforced by concrete and stone pitching. Behaviour of the Tank for the last 17 years (1951-52 to 1967-68) is described on Table 2-21, from which we find out that it failed to discharge water twice in Maha season and 26 times in Yala season. Non-flowing through its spill-way was experienced 7 times in Maha season and 13 times in Yala season. We may conclude that this Tank is not supplying enough irrigation-water to its beneficiary area and providing good reason for the complaints among the cultivators there.

Table 2-21: Behaviour of Dewahuwa Tank (Unit = ac.ft.)

Year	October – March (Maha season)				April – September (Yala season)					
	Storage at beginning of Season	Issue	Spill	Total inflow	Area culti-vated	Storage at beginning of Season	Issue	Spill	Total Inflow	Area culti-vated
1951–52	818	8576	19636	33296		4350	4416	Nil	2892	
1952–53	1354	Nil	Nil	1592	Nil	2150	2827	Nil	1523	Some
1953–54	124	7776	5744	20015		5350	5236	13342	15610	
1954–55	706	17450	39080	61073		3700	6225	3992	10171	
1955–56	1880	10645	Nil	9690		380	Nil	Nil	207	Nil
1956–57	270	5153	Nil	-		834	4281	Nil	2013	Nil
1957–58	1550	9094	-	-		6730	3851	Nil	-	
1958–59	754	Nil	Nil	Nil	Nil	3605	121	Nil	-	Nil
1959–60	4080	7689	3946	16032		6535	5107	3145	7422	
1960–61	3335	11143	-	-		6480	7020	Nil	2393	
1961–62	550	12317	Nil	15877		2890	1947	Nil	8979	Some
1962–63	7250	15923	8089	26248		7458	5426	3188	3004	
1963–64	564	6902	40307	51786		3650	6446	Nil	3933	
1964–65	500	3945	Nil	6170	Some	1910	61	Nil	3103	Nil
1965–66	3290	12415	11827	24659		1730	616	Nil	1955	Nil
1966–67	2000	21975	7310	33009		3740	2547	Nil	468	Some
1967–68	380	17551	15701	35727		1330	Nil	Nil	1727	Nil

Note = *1 = 1st of October *2 = 1st of April
- = unknown (not Nil)

Catchment Area:	25.5 Sq. Miles		
Capacity:	6650 Upto Oct. '55, 7650 Upto Oct. '66		
	8800 After Oct. '66		
Full Supply Depth:	23.5	25.5	27.5

The fact that the flow of Hevanella Oya which collects drainage-water from the project-area is unproportionately big in comparison to the volume of water discharged from Dewahuwa Tank, measuring at its extreme end of the project-area to some 70 - 80% of the Tank's discharge-water, seems to betray: (i) percolation from the Tank; (ii) seepage from water-channels and (iii) defective irrigation methods in the field, thus resulting at a considerable wastage of irrigation-water. It is, therefore, necessary to prevent wastage of water reserved in the Tank, through better water-control and good irrigation methods.

Gravity supply of irrigation-water to highland is made difficult from the Dewahuwa Tank and people are dependent on rains and well, there.

2-8: Agricultural Infra-Structure

2-8-1: Irrigation Facilities

The length of water-channels constructed by the Department of Irrigation in 1951 is as follows:

Table 2-22: Length of Channels in Dewahuwa Scheme Area

	Total Dewahuwa Area	Project-Area
Main Channel	10 miles 300 ft.	4 miles 1500 ft.
Branch Channel	6650 ft.	4300 ft.
Field Channel	92990 ft.	29310 ft.
Drainage Channel	34960 ft.	8390 ft.

They are all earth-channels, with concrete flumes and drops here and there. Dimensions of the main channel in its upper-most part are given on Table 2-23.

Table 2-23: Main Channel Date (Upper-Part)

Bottom width	13.50 ft.
Depth	2.13 ft.
Side slope	0.5:1
Gradient	0.0029
Discharge	47.0 cu. ft./sec.

Water-channels, the main-channel in particular, are not maintained in their original form from erosion and silting along almost all its length. Seepage is adjudged to be considerable, too. To ensure planned flow with minimum seepage, over-all de-silting and bank-protection is deemed necessary.

Field channels are not necessarily constructed in accordance with the original plan and not functioning satisfactorily due to heavy silting and over-growth of grasses. Concrete-walls of the drops there are partly cracked or else suffering from erosion.

Location of branch-channels and the outlets from the main-channel, their types and irrigation-areas are as shown on Table 2-24, supplied by the Department of Irrigation.

Table 2-24: Outlets from Main-Channel in the Project-Area

	Location	Type	Irrigation-area	Remarks
1.	0 ML 0.64 CHS	6" ϕ pipe outlet	12.0 ac	
2.	0 " 10.60	6" ϕ "	15.0 "	
3.	0 " 26.75	9" ϕ "	30.0 "	
4.	1 " 2.60	6" ϕ "	12.9 "	
5.	1 " 33.40	12" ϕ controlled sluice	45.6 "	
6.	1 " 45.40	4" ϕ pipe outlet	5.5 "	
7.	2 " 13.80	2 bays 3' x 16"	447.0 "	Divide to Br. ch.
8.	2 " 15.90	12" ϕ pipe outlet	90.9 "	– " –
9.	3 " 0.11	9" ϕ sluice	15.3 "	
10.	3 " 12.00	4" ϕ pipe outlet	2.5 "	
11.	3 " 35.78	12" ϕ sluice	41.0 "	
12.	4 " 4.23	6" ϕ pipe outlet	20.0 "	

In the project-area, water-distribution is being arranged from the main channel to the field channels through all the outlets excepting No. 7 & 8; from main channel to branch channels, through outlets No. 7 & 8; and from branch channels to field channels, almost

always through pipe outlets. Minimum irrigation-area per outlet is 5 acres, which is made into 1 block serviced by 1 intake-entrance.

Most of the outlets are suffering from serious seepage due to poor maintenance and some of them were intentionally broken. In the last Maha season, the whole Dewahuwa Colonization Scheme area has been sub-divided into 3 blocks, each drawing water for 2 days out of 6 days, on rotation. This experiment did not function as satisfactorily because of seepage along the channels and at their outlets, poor water-control, and maldistribution of water by the cultivators' self-seeking practices; many marginal fields were thus left uncovered by irrigation-water.

The main channels, branch channels and branch-channels' outlets are being maintained by the Department of Irrigation, while field-channels and their outlets are looked after by the Cultivation Committees. Officers in charge of the Department of Irrigation and the members of local Cultivation Committees meet every year before cultivation to decide upon the arrangement for maintenance of the Tank and other irrigation facilities in the beneficiary area and also rotation-system.

Most of the drainage channels lost their traces due to heavy silting.

2-8-2: Farm Road

All the roads running in the project-area are those constructed as per Dewahuwa Colonization Scheme. Main-road starting at the right side of the Tank runs along the main-channel from Tract 1 to Tract 9, and also around the High Steep Ground in Tract 3. The main road running on the left bank of the channel is 4 feet above the paddyfield which is spreading on its left. This is for transport of farm-produce, passage of tractors and bullock-carts, connections among the villages and for maintenance of irrigation facilities. It has 15 feet width and is generally in good conditions, though un-metalled.

Branch-roads are running from the main-road into some parts of the field. It has 10 to 15 feet width but, due to poor drainage condition and lack of proper maintenance, some parts do not allow easy passage of vehicles.

Farm-roads running from the branch-roads into the fields are generally in dilapidated conditions.

2-8-3: Paddyfield

Each block of 5 acres was allocated among the colonists vide Colonization Scheme in 1951. Présent pattern of blocking is not exactly a copy of the original plan. Each block is being parcelled up into more than 100 plots averaging at 0.05 acre, the smallest being 0.015 acre. Farm-operation is, therefore, very much handicapped. The difference in height between upper block and the lower is 0.2 - 2.0 feet. And the differences in height adjoining both sides of the block are about 0.2 feet.

Ridges are 1 foot in height, generally built in big enough size but unevenly, with many holes bored by crabs which help worsening seepage of the irrigation-water. They are not properly maintained, making it rather difficult for the cultivators to walk on them through the field.

Plot-to-plot irrigation in the block is meant to bring water from the higher field down to the lower but because field inlets are generally left in dilapidated conditions, water kept in each plot seldomly maintains proper depth. Surface-storage-capacity of the plot is, therefore, very much discounted.

Soil is made of sandy-clay in reddish-brown colour, with the depth of not more than 5": down below this sandy-clay is spreading sub-soil layer which shows no sign of having been ploughed in the past. There exists scarcely any farm-road inside the block available for introduction of farm-machinery and transport of goods. All this is made very much cumbersome because of the absence of farm-road.

Chapter III : Farm-Management Improvement Plan

3-1: Guiding Principles

3-1-1: At present, wet-paddy is the basic crop, and will remain so for a foreseeable future, in the project-area. This Plan aims at strengthening of farm-economy in the project-area through stabilized growth of paddy-yield, in its first stage, and, in the later stage, at expansion and development of farm-management through introduction of commercial crops on the paddyfield during Yala season as well as on the upland-field.

3-1-2: For the stabilized growth of wet-paddy production, it is imperative to improve irrigation and drainage facilities through more or less engineering work but such engineering work will be in vain if no rationalization of water-management and control through more intensive method of cultivation will not follow.

3-1-3: Cultivators in the project-area are generally inadequately equipped with the means of production so that the work-load which would fall upon them during a comparatively short planting season, due to tight water-arrangements, cannot be properly dealt with. This is the rootcause of manifold disadvantages such as the postponement of the time of planting, the abandonment of more rewarding transplantation-method, the aversion to the use of fertilizer and the negligence of water-control. Reinforcement of the means of production, especially an introduction of suitable machinery meant for cultivation and harvesting, is badly needed.

3-1-4: Through strengthening of the means of production, paddy-cultivation techniques will no doubt be intensified, and introduction of suitable crops onto the paddyfield during Yala season and improvement of uplandfarming techniques will also be made less difficult.

3-1-5: In the initial stage of capital-accumulation, each individual cultivator cannot equip himself with improved means of production and, in fact, they do not need to do so. Limited number of modern farmmachinery can be made use of more effectively and economically, if they are put for the use of a group of cultivators who will also learn advanced methods of paddyfield operation and systematic use of irrigationwater much more thoroughly through joint-farming than by working in isolation. It will also enormously save the expert's troubles in extension of modern technology in paddy-cultivation among the cultivators.

3-2: Labour-Saving Equipment

3-2-1: Judging from the prevailing conditions of the farm-road and an average size of the plot, intoductio n of large-sized machinery seems to be both inadequate and undesirable.

Power-driven cultivators to be replenished to the present means of production will preferably be medium-sized ones ranging between 10 – 15 HP.

3-2-2: If we assume October 20 as the date when primary cultivation of paddyfield will be started and the end of November as the closing date for transplantation, the paddy-planting season in the initial stage of Maha lasts for 35 days. The acreage cultivable by use of a medium-sized powerdriven cultivator (10 – 15 HP) within the said period of time is estimated at around 25 acres.

3-2-3: Assuming that 1 power-driven cultivator (10 – 15 HP), 1 powerthresher plus automatic sprayer will be furnished per 25 acres of paddyfield as a unit, their combined cost (including depreciations) per acre will be calculated at approx. Rs 100/year (See Table 3-1: Annual Cost for Operation & Maintenance of Farm-Machinery). This represents a modest amount of expenditure easily bearable by the cultivators, as their yearly spending in term of rent and hire of the facilities required for ploughing and harvesting is amounting to more or less same figure. Cost of power-operated farm-machinery as a set will turn less than the tentative figure given in the above, because they are useful for upland-farming in addition to paddyfield-cultivation.

3-2-4: The progress of the Plan will realize, in due course of time, betterment of cultivation-method and, if it will be coupled by corresponding improvements in varieties, the lodging of the paddy-plant will be minimized; then - possibly in the last year of the Project (5th year) - some power-operated Harvesting Machines may also be introduced into the area.

3-2-5: Automatic Transplanting Machinery may likewise be introduced in the last year of the Project, if levelling-technique will be further refined and cultivators will come to attain higher standards of paddy cultivation technique in general.

Table 3-1: Annual Cost for Operation & Maintenance of Farm-Machinery

Kind of Machinery	Quantity	Value	Durable Year	Repair per Year	Fuels				Cost per Unit of Joint-Farming			
					Kind	Working Hours	Fuel consumption	Unit fuel cost	Annual depreciation	Annual repair cost	Annual fuel cost	Total
Cultivator	1	350	5	10%	Light oil	600	2.5 l/h	25 ¥/l	70	35	37.5	¥142.5
Thresher	1	80	5	5%					16	4	-	20.0
Trailer	1	35	5	5%					7	1.75	-	8.75
Sprayer	4	30	3	5%	Gasolin	100	1.2 l/h	51 ¥/l	40	4.5	29.12	40.62
Total												¥211.87

Note = Value of Machinery & Cost per Unit of Joint-Farming is in ,000 Yen

Annual Cost for Operation/Maintenance per Unit of Joint-Farming = ¥212,000 (equivalent to Rs. 3,530/-)

Cost per acre (25 Maha-acres + 16 Yala & Upland-acres = 41 acres)= ¥5,170 (equivalent to Rs. 86/-)

3-3: Pattern of Cultivation

3-3-1: In the initial stage, technical improvement of paddy-cultivation on 100% of the field will be aimed at; with betterment of irrigation facilities and replenishment of the means of production, gainful utilization of paddyfield during Yala season will be taken up in an increasing scale.

3-3-2: In the initial stage of the Project, though dependent on the degree of intensification of the means of production and general improvement of the cultivators' techniques, Yala utilization of paddyfield will be feasible on a pattern of: 1/3 under paddy, 1/3 under chilli, and remaining 1/3 in fallow.

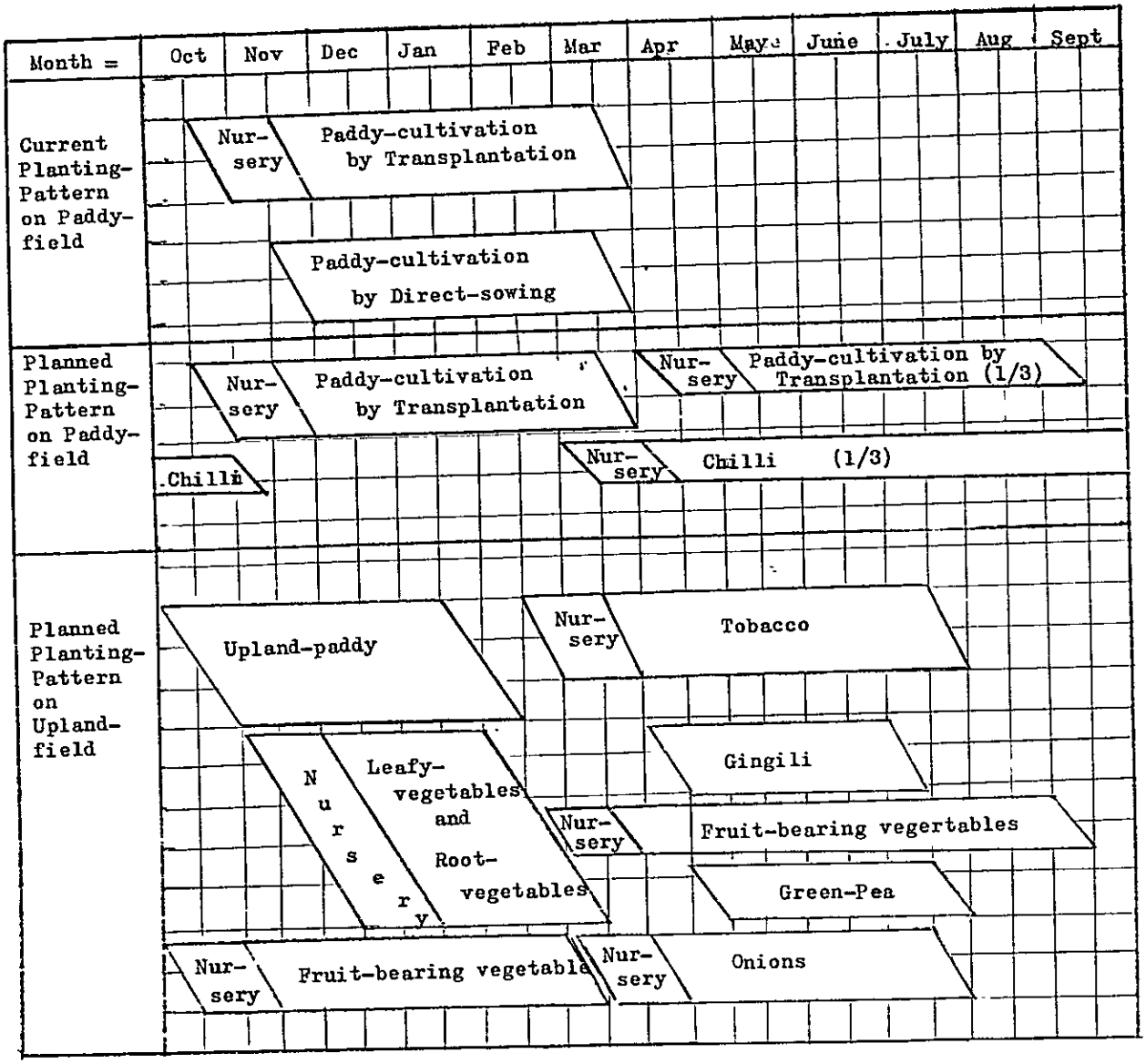
3-3-3: It may well happen that irrigation-water available in the project-area is too small, even during Maha season, for extensive cultivation of paddy; on such an occasion, paddy-cultivation might better be abandoned and the field be instead utilized for cultivation of chilli and egg-plants.

3-3-4: Imminent task for upland-farming improvement lies in discovery and establishment of an adequate planting-order or rotation to minimize those harms attributable to the repeated cultivation of specific crops on the same plot of land.

3-3-5: Proper kinds to be cultivated during Maha season would be upland-paddy, cabbage, turnip, and tomato and, during Yala season, tobacco, gingili, green-pea, onions and cucumbers; chilli, egg-plant and tomato may be grown all through the year.

3-3-6: Planting Programme for the initial stage of the Project will be tabulated as follows:

Table 3-2: Rotation Programme in the Initial Stage of Plan



3-4: Varieties & Cultivation Techniques

3-4-1: Paddy-Cultivation

Through implementation of the Project, the present yield of paddy (around 45 bushels per acre) will be doubled into approx. 90 bushels within 5 years. Improvement of varieties and cultivation-techniques along the undermentioned directions will be imperative for attaining this goal:

(i) Varieties

Cultivation-technique will primarily be based on such varieties as recommended by the Government Agricultural Experimentation Station as H-4, H-8 and Murungakayan-302. With the renovation of irrigation facilities, variety of higher fertilizer-response like IR-8 will be increasingly introduced.

(ii) Cultivation-Pattern

Transplantation-method is spreading over some 45% of the paddyfield; acreage under this method will be gradually expanded to 90% of the whole paddyfield. Utilization of Automatic Transplanting Machine will be experimented in the Pilot Farm.

(iii) Fertilizer-Application

According to our observation, 2/3 of the paddyfield are not given any fertilizer at the moment. Enlargement of acreage applied with fertilizer as specified by the Government of Ceylon will be endeavoured for, on the following pattern. Total amount of fertilizer-input in the project-area will be further increased in the closing period of the project, in response to the increasing popularity of the varieties of higher fertilizer-response.

Table 3-3: Fertilizer-Standard per Acre of Paddyfield (Unit=Lbs)

Kinds of Fertilizer	Total Input	Initial application	Additional Application		Factor-Combination		
			2 weeks after transplanting	during flowering period	N	P_2O_5	K_2O
Ammonium-sulphate	224	-	56	168	44.9		
Concentrated Superphosphate	112	112	-	-		38.1	
Muriate of Potash	56	56	-	-			33 0
Total					44.9	38.1	33.0

(iv) Weeding

Use of weedicide is made impossible at the moment due to rough levelling of the paddyfield; as betterment of levelling method will follow by use of Cultivator, with resulting improvement in fineness of levelling, weedicide will come to be used even in the initial stage. In the meanwhile, use of weedicide at both beginning and in later stage will be encouraged, according to the following formula:

Table 3-4: Dosage of Weedicide Application

Degree of Levelling Fineness	Kinds of Weedicide	Dosage per Acre
Finely levelled field	PCP (Granular)	56 lbs.
Less-finely levelled field	PAM(")	56 lbs.

(v) Pests & Diseases Control

Pests & diseases are little menaceful at the moment and their control is almost unknown in the project-area. Extension of their control-methods and techniques shall become an order of the day as the use of fertilizer will be increasing. To start with, disinfection of seed-paddy before sowing will be encouraged.

(vi) Maintenance of Ridges/Levees & Water-Management

Seepage in the field should be prevented by expelling crabs out of the field and repairing its ridges and levees. Intensified water-management is imperative particularly during the later paddy-growing period. Seepage-control will necessitate better water-management to prevent crumbling-down of ridges and levees. Pilot-Farm in the project-area will attend at its study.

3-4-2: Upland Farming

(i) Standardization of varieties is urgently required for harvesting highly marketable produce. Pilot-Farm for Upland-Farming in the project-area will carry out necessary work for selection and maintenance of superior varieties.

(ii) For better vegetable production, supply of organic matters through ploughing-back of straw, for instance, which is simply burnt off at present, will have to be encouraged. Supply of organic matters is desirous not only in the upland-field but also in the paddyfield

which is going to be utilized for fruitful cropping during Yala season, too.

(iii) Establishment of Fertilizer-Standard for upland crops is what is acutely required. Pilot-Farm will study on it with principal crops.

(iv) Extremely uneven seedlings, due to careless nursing method, are being used for transplanting chilli, tomato etc. Preparation and maintenance of Common Nursery-Beds will be an answer to this problem. Common Nursery will supply wholesome seedlings of those crops needful of transplanting and will also serve quite effectively for extension of intensive methods of upland-crop cultivation among the farmers.

3-5: Pattern of Farm-Management

3-5-1: Sub-division of paddyfield into extremely fragmented plots is far from inducive to rational farm-management. The farm-operation on these plots will, therefore, be merged together, for the sake of joint-farming by their cultivators, into that on a unit of 25 acres as a minimum. Not each individual plot but a unit of 25 acres made up of a number of tiny plots shall be the smallest theatre of operation of the Farm-Management Improvement Plan described in this Chapter.

3-5-2: The concept of 'Joint-Farming' as a unit, combining 25 acres of paddyfield with a group of people to work upon it, is a contrivance to solve many-sided problem at a stroke: (i) to offer the common cultivators who are deprived of modern means of production a good chance to enjoy the benefits of labour-saving devices at the cost which will be least difficult for them to pay off; (ii) to carry on an effective guidance on modern method of paddy-cultivation by the minimum strength of resource-persons among the maximum number of cultivators; (iii) to foster co-operative mind and mutual-aid spirit among the residents of the area.

3-5-3: Joint-Farming Group shall be a team of actual tillers of the land put under its charge: minute care is required for its formation so that the best harmony as a team will be maintained among its members inspite of many differences in their origin, caste, religion etc. as well as their status and position in production-relations (such as tenants, agricultural labourers vs permit-holders and their family-members).

3-5-4: Operation and management of the Joint-Farming Group shall be the function of the team-members' autonomous decision and co-operative efforts; it shall never be a simple gathering of submissive cultivators but a body which develops within itselt a system of democratic leadership, chosen on sheer merits and tested through trials and errors; Group-leaders will thus take up full responsibility for planning, management and operation of the unit of acreage whose cultivation is put under its charge.

3-5-5: Joint-Farming Group will be organized, to begin with, as an organization of the cultivators on the above-said 25 acres of land for common-use of the farm-machinery and joint-use of fertilizer and farm-chemicals. They work in unison, particularly in operation of farm-machinery, and, even for other kinds of work, they will co-ordinate and co-operate among each other.

3-5-6: As a principle, Joint-Farming Group and its members will get everything they require for both production and consumption purposes through their co-operatives which, in turn, will try its best in developing Joint-Farming Group as its spearhead-platoons in its war against Poverty, Ignorance and Cruelty in the project-area.

3-6: Economics of Improved Farm-Management

3-6-1: Strategy

The present Project means to be a type of Community Development Project aimed at over-all socio-economic development among the people living in the project-area, as a Pilot-Scheme meant for whole Dry-Zone of Ceylon. The economic part of the project will be focused at bringing about preliminary conditions for 'Taking-off' of the economy of the project-area, which is primarily agriculture-based, by attaining 3 basic objectives as given below. Attainment of these basic objectives is visualized through combination of 4 factors: (i) rational use of water; (ii) increased input of fertilizer; (iii) introduction of farm-machinery, and (iv) revitalization of farmers' organizations.

(i) Paddy-yield during Maha season which averages at around 45 bushels today will be increased to 90 bushels, per acre;

(ii) During Yala season, the paddyfield which is currently left in fallow will be planted with wet-paddy on 1/3 of the acreage and with chilli on another 1/3; average yield of wet-paddy in this case will be expected to be around 60 bushels/acre, and

(iii) Irrigation facilities will be extended to highland for steady growth of upland-crop production during both Maha and Yala seasons; the quantity of irrigation-water made available there and its distribution-loss among upland-fields taken into consideration, the upland-field which will be benefitted by irrigation facilities may be limited to approx. 100 acres allocated to the Colonists.

Joint-Farming among the cultivators of 25 acres of paddyfield as a unit is both the prime-mover and channel through which the above 3 objectives will be striven for achievement. It is also the function of this Joint-Farming to reorganize the current system of farm-management and operation into more viable ones which, by taking full advantage out of the above

achievements, will help increase farm-income by at least 2-times. This much income-increase is feasible by raising its gross-income by 2.5 times, while keeping the cost and expenditure at a modest incremental rate of 1.5 times. Distribution of increased income will be made far more equitable among those people who offer real contributions for the success of the project.

The effects of Farm-Management Improvement Plan on the farm-economy of the project-area may be explained by taking the farm-economy of the standard farmhousehold (that of the average Colonist's family) as a model.

3-6-2: Gross-Income

While the standard famhousehold in the project-area is getting Rs 3,260 per year as a gross-income from its operation of 6.4 acres of land in total (made up of 4.0 acres of paddy-field, 0.6 acre of uplandfield, plus 0.7 acre of 'chena'), its annual gross-income will be augmented to Rs 8,120, without expanding its arable land but through more intensive use of it (its total operational holdings will be enlarged from 6.4 acres to 7.8 acres even excluding 'chena'). Table 3-5 is given below to be compared with Table 2-12 on Page 39 under (a) Colonitst, 2-5-5: Farm Economy:

Table 3-5: Gross-Income of Standard Farmhousehold

Operational Holdings	Kind of Crops	Extent of acreage sown	Gross-Income(*1)
Paddyfield			
Maha season:	Wet-paddy	4.0	Rs 4,320
Yala season:	Wet-paddy	1.3	930
"	Chilli	1.3	1,710
Upland-field (under irrigation)			
Maha season:	Upland paddy plus vegetables	0.5(*2)	660
Yala season:	Vegetables & others	0.5	430
Upland-field (non-irrigated)	Vegetables for home-consumption	0.2	70
Total		7.8	Rs 8,120

Notes. (*1) = Current price ruling in the project-area for the farm-produce marketable at the cultivators' homestead has been used for calculation of the above,

(*2) = Out of 0.6 acre of upland-field held by the Colonist's family, 0.5 acre is assumed to enjoy irrigation through our Highland Irrigation Scheme.

3-6-3: Cost & Expenditure

To increase yield per unit of acreage under operation by two times and also to introduce double-cropping on the paddyfield, cost and expenditure will naturally be expanded. Remarkable increase in input of fertilizers and farm-chemicals will follow side by side with better utilization of labour-saving farm-machinery.

Table 3-6: Cost & Expenditure for Operation

S/No.	Items	Value
1.	Seeds & Seedlings	Rs 107
2.	Fertilizers	514
3.	Farm-chemicals	668
4.	Farm-machinery & implements	1,043
5.	Productive materials	96
6.	Wage	800
7.	Taxes & public-charges	210
8.	Interest payable	118
9.	Others	174
	Total	Rs 3,730

Notes:

(1) Seeds & seedling, apart from seed-paddy, are estimated to equal to 3% of gross-income:

(2) & (3) = Fertilizers & farm-chemicals are calculated in local distribution prices;

(4) Machinery-part of the cost is taken from Table 3-1: Annual Cost for Operation & Maintenance of Farm-Machinery (Rs 94/acre × 7.8 acres = Rs. 733);

(5) Productive materials as per local price;

(6) Wage has been calculated, purely for the sake of convenience, at Rs 4.00/manday;

(8) Interest payable is made equal to 10% of (2) + (3)

(9) Other cost & expenditure correspond to approx. 5% of the total cost & expenditure.

3-6-4: Income

Gross-income minus operation-cost equals to farm-income which is calculated in this case at:

Rs 8,120 – Rs 3,730 = Rs 4,390

If the current tenancy-system will remain unliquidated, additional Rs 75 will be accruing from tenant-fee.

The above, as already explained, is a tentative calculation on the current basis and does not mean that this project will benefit only the colonists in the name of standard farmhouse-holds. Joint-Farming proposed in our project intends to bring about new pattern of operation with more equitable distribution of its proceeds among all classes of cultivators.

3-7: Agricultural Mechanization Center

3-7-1: Aims of the Centre

Farm-machinery to be introduced into the project-area under Farm-Management Improvement Plan for the planned use by Joint-Farming groups need to be kept in the best possible operational conditions through constant check and careful maintenance. For major repairing and overhauling of engines etc, the machinery may well be sent over to the work-shops in cities like Kurunegala but the conveniences for day-to-day maintenance of machinery and replacement of parts and accessories must be locally available. Cultivators must also get proper training and education on mechanism and operation of the machinery for their effective use. Agricultural Mechanization Centre is meant for these purposes in close operative tie with the Government Tractor Station located in the Scheme area. The Centre will also undertake the duty of maintenance and minor repairing of the farm-machinery attached to the Pilot-Farms both in the paddyfield and for the highland.

Its assignment will, therefore, be as follows:

(1) Repairing of farm-machinery and agricultural implements on behalf of the cultivators in the project-area;
(2) Education and training on maintenance and minor repairing of the farm-machinery to the cultivators, and
(3) Maintenance and minor repairing of the farm-machinery attached to the Pilot-Farms in the project-area.

3-7-2: Location

The Centre will be located at an elevated place in the southeastern corner of the Upland Pilot-Farm, facing the road.

3-7-3: Establishment & Facilities

The Agricultural Mechanization Centre will have the following facilities:

(1) Repair-Shop

Steel-framed, slate-roofed (partly) building with concrete-floor. Both sides will be partitioned by light-weighted shutters, 6' x 12' each. Machine-tools and universal tools will be kept here.

(2) Parts Store-Room

Steel-framed partly slate-roofed building with concrete-floor. Equipped with shelves and drawers for spare-parts, accessories and tools.

(3) Class-Room

Steel-framed, partly slate-roofed building with concrete-floor. Equipment of desks, chairs, blackboard and movie-set.

3-7-4: Supplies

(1) Shelves and drawers for storage of spare-parts and accessories of the farm-machinery;

(2) Machine-tools and tools for repairing farm-machinery and agricultural implements and also for replacement of parts and accessories;

(3) Educational equipment and material including movie-set, and

(4) Office equipment for administrative purposes.

3-7-5: Rental System of Farm-Machinery

Cost for maintenance and operation of the farm-machinery which will be kept in the best working conditions on behalf of the Joint-Farming Groups in the project-area will be recovered out of the proceeds of the Joint-Farming Groups on rental basis. Receipt from this rental system will be set apart in a Special Account for procurement of new sets of farm-machinery to be utilized both inside the project-area and outside where similar Community

Development Project may be initiated. Rental system of farm-machinery of this kind will definitely accelerate the speed, and expand the scope, of agricultural mechanization in the region as a whole.

3-8: Equipment & Supplies for Farm-Management Improvement Plan

3-8-1: Power-Driven Machinery

The following farm-machinery will be introduced as 'labour-saving equipment' in 3-2 above:

Table 3-7: Power-Driven Farm Machinery

Time of Input	Kind of Machinery	Quantity
In the initial stage	Power cultivator 14 HP	40
	Power Thresher 500 m/m	40
	Trailer (1 ton)	40
	Power Sprayer (shoulder-type)	40
	Replacement Parts of the above	1 set (20%)
In the later stage	Automatic Transplanting Machine	120
	Binder (harvesting machine)	40
	Replacement Parts (20%)	1 set

3-8-2: Fertilizers & Farm-Chemicals

Fertilizers and farm-chemicals will be supplied in two stages as follows:

(1) Initial Input

Table 3-8: Initial Inputs of Fertilizer
(Unit = Ton)

Kind of Fertilizers	Paddy (Maha) (770 ac)	Paddy (Yala) (250 ac)	Chilli (Yala) (250 ac)	Upland Field (Maha) (100 ac)	Upland Field (Yala) (100 ac)	Total
Ammonium sulphate	103	30	51	22	11	217
Concentrated superphosphate	52	15	26	9	5	107
Muriate of potash	26	8	15	8	4	61

Table 3-9: Initial Inputs of Farm-Chemicals
(Unit = kg)

BHC 6% (Granular)	9,792	4,896	-	-	-	14,688
Sumithion (pulv)	19,584	9,792	-	864		30,240
Kitazin (")	19,584	9,792	-	864	-	30,240
Asozin (")	9,792	4,896	-	432	-	15,120
EPN (emulsion)	-	-	240 [1]	64 [1]	128 [1]	432 [1]
Endrin (")	-	-	240 [1]	54 [1]	109 [1]	403 [1]
Dithane (waterable) (powder)			120	64 [1]	128 [1]	312 [1]
Uspulun	30	10	1	1	-	42

Table 3-10: Initial Inputs of Weedicide
(Unit = kg)

PCP (granular)	3,264	1,632	-	-	-	4,896
PAM(")	6,528	3,264	-	-	-	9,792
CAT (water-soluble pulv)			120	28	16	164

(2) Later Input

Table 3-11: Later Inputs of Fertilizers

Kind of Fertilizer	Maha season (770 acres)	Yala season (250 acres)	Total
Ammonium sulphate	38	12	50
Concentrated Superphosphate	19	6	25
Muriate of Potash	9	4	13

Chapter IV : Infra-Structural Improvement Plan

4-1: General Approach

As mentioned in the above, the project-area is equipped with minimum basic irrigation-facilities such as the dam, the irrigation and drainage channels, the outlets, the farm-roads and the paddyfields. Ravages of time during the last 20 years, however, are apparent on the slopes of the channels which are crumbling down here and there and the outlets allowing a considerable seepage of water. On and above this, negligence on the part of the people at water-control is responsible for an acute shortage of irrigation-water on the marginal fields. Road conditions are neither quite satisfactory: even on the main road, some parts are un-jeepable and the traffic on the paddyfield is hardly possible along the ridges and levees, without any path serviceable for passage of farm-machinery. On the paddyfield, an allotment of 5 acres is sub-divided into more than 100 plots due to a sharp gradient there and mechanization of farming is thereby made rather difficult. Paddyfield is irrigated by so-called 'plot-to-plot' flow system in a very wasteful manner and loss of water through seepage along the ridges and levees is considerable.

Our general approach to the problem, therefore, will be as follows:

4-1-1: Water-shortage in General

The present capacity of the dam (FSL 8,800 ac. ft) can hardly be augmented after 2 times heightening-up of its embankment in 4 total feet. However, irrigation extending to the remotest part of the paddyfield will have to be made possible through applying proper irrigation management technique, the improvement of water-channels and minor irrigation facilities on the field so that water can be adequately supplied all over the project-area.

4-1-2: Road

Roads will have to be either fully repaired or newly constructed to allow free passage of farm-machinery (for instance, cultivator) onto the paddyfield.

4-1-3: Paddyfield

Consolidation of exceedingly sub-divided plots into a block of a reasonable size will have to be made to facilitate for effective use of farm-machinery. Innundation of the paddy-field with proper depth of water needs to be assured through prevention of seepage along the ridges and levees as well as through setting up of more field-notches.

4-1-4: Main-Channel

Water-control along the whole length of the main-channel from Tracts 1 to 9 is necessary for the assurance of proper water-management in the project-area which consist of Tracts 1, 2, 3 & 4 only. However, our Renovation Plan will cover the total length of the main-channel as far as check-gates and outlets are concerned.

4-1-5: Low-invested Renovation-Works

Good care will be taken to keep its total cost at the minimum by making best use of the existing facilities all through our above renovation-works; otherwise, it will make the similar renovation-work financially prohibitive in other regions.

4-2: Paddyfield Irrigation-Drainage Programme

4-2-1: Irrigation Scheme

(1) Effecive Rainfall

The view expressed in FAO's "Mahaweli-Ganga Irrigation and Hydro-Power Survey" Volume VI: IRRIGATION, will be adopted.

Table 4-1: Effective Rainfall

Rainfall (R)	Effective Rainfall (Re)
R < 0.125"	Re = 0
0.125" < R < 1.0"	Re = R
R continuing > 1.0	
First day	Re = 1.0"
Second day	Re = 0.5"
Third day	Re = 0.2"
Fourth day and after	Re = 0

(2) Irrigation-Area

Table 4-2: Irrigation-Area

Tract No.	No. of Lots	Paddyfield acreage
1	13	67.9
2	10	51.1
3	107	537.9
4	23	114.2
sub-total	153	771.1 = project-area
5	65	331.3
6	52	258.8
7	63	315.0
8	96	481.6
9	35	178.7
sub-total	311	1,565.4
Total	464	2,336.5

The immediate target of our Renovation Plan shall be the area covered by Tracts 1 to 4, extending to 771 acres as per Land-Plan of Dewahuwa Scheme, 1949.

(3) Unit Duty Water

As for the duty of water for each growth-period, data for Kala-Oya adjacently situated to our project-area as shown in FAO's "Mahaweli-Ganga" Report, will be relied upon.

Table 4-3: Standard Total Duty Water for Paddy

Terms	Items	Kalawewa Basin	
		Maha (Oct-Feb)	Yala (Mar-Jul)
1. Preparation of Paddyfield:	Water required for: tilling & puddling	$2^{mm} \times 10^{days} = 20^{mm}$	$3^{mm} \times 10^{days} = 30^{mm}$
	Levelling & maintaining	$10^{mm} \times 15^{days} = 150^{mm}$	$10^{mm} \times 15^{days} = 150^{mm}$
		170^{mm}	180^{mm}
2. From sowing to heading:	Standing water:	$25^{mm} \times 3^{times} = 75^{mm}$	$25^{mm} \times 3^{times} = 75^{mm}$
3. From sowing to harvest:	Transpiration	$340 \times 910^{kg}/10^{a} = 309^{mm}$	$450 \times 910^{kg}/10^{a} = 410^{mm}$
	Evaporation	$3.3^{mm/day} \times 100^{days} \times 0.5 = 165mm$	$6.5^{mm/day} \times 110^{days} \times 0.5 = 358mm$
4. From sowing to harvest:	Percolation, seepage & Dyke-leakage	$3^{mm/day} \times 100^{days} = 300^{mm}$	$3^{mm/day} \times 100^{days} = 300^{mm}$
5. Total consumption:		$1,019^{mm}$ 40.0^{ins} $3^{ft}4^{ins}$	$1,323^{mm}$ 52.1^{ins} $4^{ft}4.1^{ins}$

(4) Calculation of Cross-Section of Water Channels

Duty of water arises to its maximum during May 21 and June 5. Unit duty water in the meantime is 0.56 ins/day. Duty-water per acre will be:

$$43{,}560^{sq.ft} \times \frac{0.56^{ins}}{12} \times \frac{1}{86{,}400\ sec} = 0.00260^{cub\text{-}ft/sec}$$

Gross duty-water covering loss upto 40% will be $0.00433^{cub\text{-}ft/sec}$.

For designing of water-channels, the following standard design value will be used:

$0.00433^{cub\text{-}ft/sec}$ x Control-area

or

$1.09^{l/sec}$ x Control-area

(5) Maximum Duty of Water

Acreage controlled by each Outlet along the Main-Channel (as per data available from the Department of Irrigation) and its maximum duty of water will be as per Table 4-4: Maximum Duty of Water per Main-Channel Outlet.

Table 4-4: Maximum Duty Water per Main-Channel Outlet
(21 May – 5 June)

No.	Distance	Area	Duty-water	No.	Distance	Area	Duty-water
1	0M 0.64	12.0ACS	0.05	25	18.45	119.10ACS	0.52
2	10.60	15.0	0.07	26	19.60	5.10	0.02
3	26.75	30.0	0.13	27	22.58	4.90	0.02
4	1M 2.60	12.9	0.06	28	24.15	4.50	0 02
5	33.40	45.6	0.20	29	38.32	10.0	0.04
6	45.40	5 5	0.02	30	52.45	47 4	0.21
7	2M 13.80	447.0	1.94	31	7M 8.20	54.0	0.23
8	15.80	90 9	0.39	32	11.30	216.2	0.94
9	3M 0.11	15.3	0.07	33	21.50	13.4	0.06
10	12.00	2.5	0.01	34	29.40	10.8	0.05
11	35.78	41.0	0.18	35	30.90	20.6	0.09
12	4M 4.23	20.0	0.09	36	46.00	14.2	0.06
13	11.58	247 8	1.07	37	51.70	426.1	1.83
14	20.55	5.0	0.02	38	8M 1.00	30.6	0.14
15	27.00	16.8	0.07	39	11.24	5.3	0.02
16	42.18	5.2	0.02	40	24.15	9.7	0.04
17	45.54	35.1	0.15	41	37.50	5.1	0.02
18	5M 8.65	15.5	0.07	42	45.50	21.3	0.09
19	16.03	11.1	0.05	43	9M 4.20	21.6	0.09
20	27.12	2.4	0.01	44	14.90	75.4	0.33
21	29.12	4.2	0.02	45	19.30	5.1	0.02
22	38 45	7.6	0.03	46	31.00	20.2	0.09
23	50.65	10.0	0.04	47	39.50	30.0	0.13
24	6M 4.90	46.0	0.20				

4-2-2: Reestimation of Dewahuwa Tank's Capacity

The area irrigable by Dewahuwa Tank has been studied using as its materials data pertaining to one Standard Average Year and two Standard Dry Years. 1963-64 has been selected as the Standard Average Year because its rainfall is the nearest to 70.28 inches which stands for the mean annual rainfall during the last 17 years and 1958-59 and 1964-65 were picked up as the Standard Dry Years since rainfalls during these two years are approaching to 52.71 inches or 75% of the mean annual rainfall for the same period of time.

Table 4-5: Annual Rainfall (1953-54/1967-68)

Water Year	1953 – 54	1954 – 55	1955 – 56	1956 – 57	1957 – 58	1958 – 59	1959 – 60	1960 – 61
Rain-fall	93.77	99.28	30.05	66.83	110.45	(*=1) 51.42	77.77	65.66
Water Year	1961 – 62	1962 – 63	1963 – 64	1964 – 65	1965 – 66	1966 – 67	1967 – 68	Average
Rain fall	71.01/	69.96	(*=2) 69.86	(*=1) 52.40	64.98	72.72	65.94	70.28

*=1 : Standard Dry Years
*=2 : Standard Average Year

Our balancing has been made on the following conditions:

(1) Planting season: About 130 days beginning at early October for Maha, and about 140 days beginning at early March for Yala;

(2) Duty of Water for each Growth-Period: As per Table 4-3;

(3) Prevention of Seepage: On the assumption that seepage at the outlets and percolation along the ridges and levees would be controllable upon completion of the Irrigation-Drainage Renovation Plan;

(4) Perfect Watercontrol: As its proposition, an effective distribution of irrigation-water and its efficient use on the field must be done;

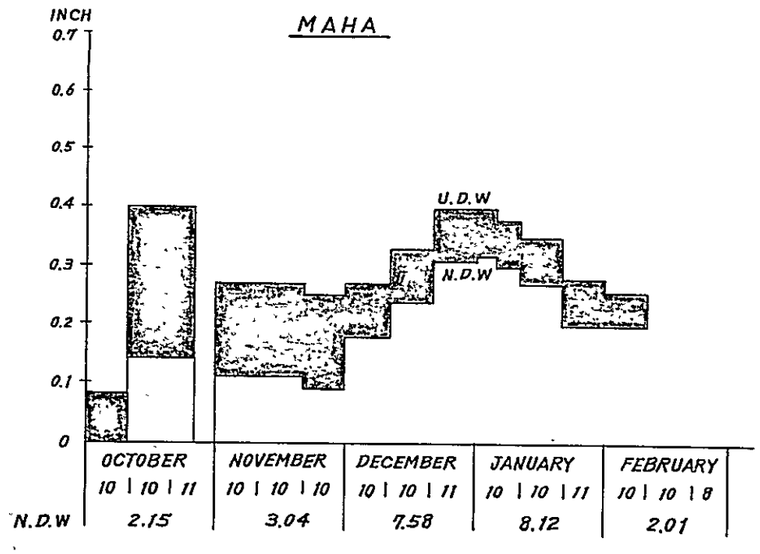
(5) Water-Losses: Total of water-losses on the field, along both branch and main-channels as well as through its distribution will be estimated at 40%. Accordingly, gross duty of water will be:

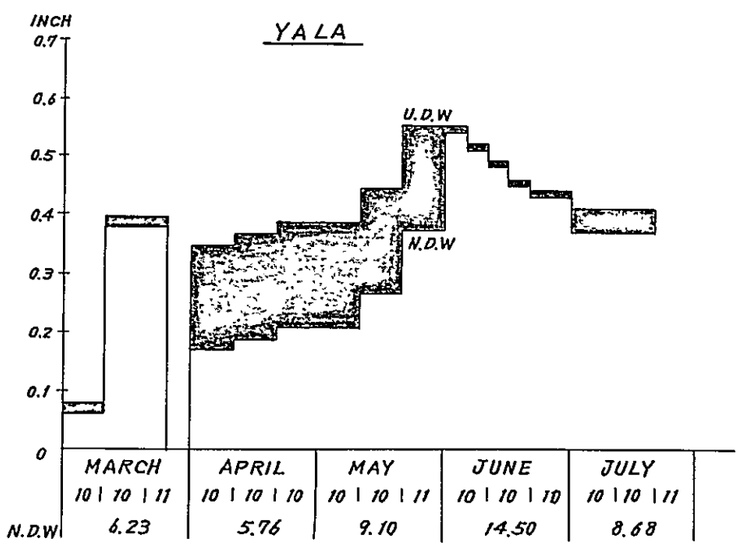
$$\text{Net duty of water} \times \frac{1}{1 - 0.4}$$

Table 4-6: Water Balance of Dewahuwa Tank (1) 1958–59 (S. D. Y.)

Month	(1) Rainfall (inch)	(2) Run-off (inch)	(3) Run-off Discharge (acre-ft.)	(4) Unit dury of water (inch)	(5) Effective rainfall (inch)	(6) Net-duty of water (inch)	(7) Gross-duty of water (inch)	(8) Gross-duty of water (acre.ft)	(9) (3) - (8) (acre.ft)	(10) (13) +(12) (acre.ft)	(11) Discharge over Spill	(12) Evapo-seepage losses (ac.ft)	(13) Reservoir storage (acre.ft)	Remarks
Sept.	0.10	0.02	28	-	-	-	-	-	28	28	0	1	27	Irrigation area = 2,337 ac. 2,33'
Oct.	10.67	3.21	4520	6.8	6.43	2.15	3.58	694	3826	3853	0	154	3699	
Nov.	5.29	1.06	1492	7.9	4.86	3.04	5.07	983	509	4208	0	168	4040	
Dec.	6.81	1.36	1915	10.4	2.81	7.58	12.63	2450	- 535	3505	0	140	3365	Result: Irrigable area = 100%
Jan.	4.17	0.63	8887	10.5	2.37	8.12	13.53	2625	-1738	1627	0	65	1562	
Feb.	1.64	0.25	352	2.6	0.59	2.01	3.35	650	- 298	1264	0	51	1213	
MAHA=	28.68	6.53	9194	38.2	17.06	22.90	38.16	7402			0	579		
Mar.	0.72	0.11	155	6.8	5.57	6.23	10.38	671	- 516	697	0	55	642	Irrigation area: $2{,}337^{ac} \times 1/3$
Apr.	9,39	1.88	2647	11.1	5.34	5.76	9.60	621	-2026	2668	0	213	2455	
May	7.63	1.53	2154	14.6	5.46	9.10	15.17	981	1173	3628	0	290	3338	
Jun.	0.81	0.12	169	14.8	0.21	14.50	24.16	1562	-1393	1945	0	156	1789	
Jul.	1.51	0.23	324	9.4	0.72	8.68	14.47	936	- 612	1177	0	94	1083	Result: Irrigable area: = 40%
Aug.	0.34	0.05	70	-	-	-	-	-	70	1153	0	92	1061	
YALA=	20.40	4.02	5519	56.7	17.48	44.27	70.10	4771			0	900		

FIG. 4-1 NET DUTY OF WATER AT DEWAHUWA 1958/'59





NOTE U.D.W UNIT DUTY OF WATER
N.D.W NET DUTY OF WATER
EFFECTIVE RAINFALL

Table 4-7: Water Balance of Dewahuwa Tank (2) 1964–65 (S. D. Y.)

Month	(1) Rainfall (inch)	(2) Run-off (inch)	(3) Run-off Discharge (acre-ft.)	(4) Unit duty of water (inch)	(5) Effective rainfall (inch)	(6) Net-duty of water (inch)	(7) Gross-duty of water (inch)	(8) Gross-duty of water (acre.ft)	(9) (3) - (8) (acre.ft)	(10) (13) +(12) (acre.ft)	(11) Discharge over Spill	(12) Evapo-seepage losses (ac.ft)	(13) Reservoir storage (ac.ft)	Remarks
Sept.	1.97	0.30	422	-	-	-	-	-	422	422	0	17	405	Irrigation area: 2,337 ac.
Oct.	7.20	1.44	2028	6.8	4.18	3.50	5.83	1131	897	1302	2	52	1250	
Nov.	8.45	1.69	2380	7.9	7.39	0.52	0.87	169	2211	3461	0	138	3323	
Dec.	5.90	1.18	1661	10.4	4.58	5.81	9.68	1878	- 217	3106	0	124	2982	
Jan.	5.06	1.01	1422	10.5	3.99	6.49	10.82	2099	-1677	1305	0	52	1253	Result: Irrigable
Feb.	7.22	1.44	2028	2.6	1.48	1.12	1.87	363	1665	2918	0	117	2801	
MAHA=	35.80	7.06	9941	38.2	21.62	17.44	29.07	5640			0	500		
Mar.	4.58	0.69	972	6.8	2.48	4.52	7.53	486	286	3087	0	247	2840	Irrigation area: $2337^{ac} \times 1/3$
Apr.	5.20	1.04	1464	11.1	4.98	6.12	10.2	658	806	3646	0	292	3354	
May	3.95	0.59	831	14.6	2.86	11.71	19.52	1260	- 829	2525	0	202	2323	
Jun.	0.74	0.11	155	14.8	0.55	14.32	23.87	1544	-1389	934	0	75	859	
Jul.	0.28	0.04	56	9.4	0	9.40	15.67	1012	- 956	- 97	0	-	- 97	Result: Irrigable Area: 30%
Aug.	3.76	0.56	788	-	-	-	-	-	-	-	0	-	-	
YALA=	18.51	3.03	4226	56.7	10.87	46.07	76.29	4960			0	-		

Table 4-8: Water Balance of Dewahuwa Tank (3) 1963–64 (S. A. Y.)

Month	(1) Rainfall (inch)	(2) Run-off (inch)	(3) Run-off Discharge (acre-ft.)	(4) Unit duty of water (inch)	(5) Effective rainfall (inch)	(6) Net-duty of water (inch)	(7) Gross-duty of water (inch)	(8) Gross-duty of water (acre.ft)	(9) (3) - (8) (acre.ft)	(10) (13) + (12) (acre.ft)	(11) Discharge over Spill	(12) Evapo-seepage losses (ac.ft)	(13) Reservoir storage (ac.ft)	Remarks
Sept.	1.26	0.19	268	-	-	-	-	-	268	268	0	11	257	Irrigation area: 2,337 ac
Oct.	8.66	1.73	2436	6.8	3.18	4.10	6.83	1325	1111	1368	0	55	1313	
Nov.	17.69	5.31	7476	7.9	11.70	0	0	0	7476	8689	0	348	8341	
Dec.	15.77	4.73	6660	10.4	11.55	0.19	0.32	62	6598	14939	6139	352	8448	
Jan.	6.00	1.20	1690	10.5	2.85	7.63	12.72	2468	- 778	7670	0	307	7363	Result: Irrigable area: 100%
Feb.	3.26	0.49	690	2.6	0.74	1.86	3.10	601	89	7452	0	298	7154	
MAHA=	52.64	13.65	19220	38.2	30.02	13.78	22.97	4456			6139	1371		
Mar.	1.58	0.24	338	6.8	1.23	5.58	9.30	902	- 564	6590	0	527	6063	Irrigation area: 2,337 ac
Apr.	4.98	0.75	1056	11.1	3.16	7.95	13.35	1295	- 239	5824	0	466	5358	
May	2.74	0.41	577	14.6	1.00	13.57	22.62	2194	-1617	3741	0	299	3442	
Jun.	1.30	0.20	282	14.8	1.11	13.76	22.93	2224	-1942	1500	0	120	1380	Result: Irrigable area: 55%
Jul.	4.25	0.64	901	9.4	1.98	9.02	15.03	1458	- 557	823	0	66	757	
Aug.	1.66	0.25	352	-	-	-	-	-	352	1109	0	89	1020	
YALA=	16.51	2.49	3506	56.7	8.48	49.88	83.13	8073			0	1567		

(6) Run-off: Monthly run-off into the reservoir has been checked; its Monthly Runoff Coefficient as per Table 2-8:

Monthly Rainfall (Rm)	Monthly Rainfall Run-off Coefficient (Re)
Rm $\leqq$ 5"	Re = 0.15
5" < Rm $\leqq$ 10"	Re = 0.20
10" < Rm	Re = 0.30 .

(7) Loss at the Reservoir: Evapo-Seepage Losses of the Tank-water will be estimated at 4% of the reservoir-storage, during Maha season, and 8% during Yala season.

The results of our balancing are shown on Tables 4-6, 4-7 and 4-8.

Findings:

a.- During 1958-59 which has been chosen as the Standard Dry Year, no sowing is reportedly made during both Maha and Yala seasons, and some sowing during Maha but none during Yala, in 1964-65; according to the information supplied by the Department of Irrigation, runoff into Dewahuwa Tank during these two years (that during Maha and Yala combined) was between 8,000 and 9,000 acre-feet, considerably less than 14,000 acre-feet used for our balancing; closer check on the amount of discharge will be needed in future. Even when we accept the runoff figures supplied by the Department of Irrigation, it is assumed that sowing could have been effected by 50% during 1958-59 Maha (with 3,800 acre-feet) and by 100% during 1964-65 Maha (6,200 acre-feet), since gross duty of water for Maha stands for 6,000 to 7,000 acre-feet. Again, not less than 20% could have been irrigated during Yala seasons in both years, because gross duty of water for the same season is around 5,000 acre-feet.

b.- On the other hand, discharge figures of the Department of Irrigation for 1963-64, that is our Standard Average Year, far exceed that used for our balancing purpose; checking of the discharge amount is also required here. Irrigable areas during this year could have been 100% during Maha and 50% during Yala.

Conclusions:

Provided that -

(a) Wasted water will be made nil,
(b) Water-control will be perfected, and
(c) Rain will be effectively made use of . . . . . .

It is assumed to be quite feasible that:

(i) 2,337 acres of paddy-area of Dewahuwa Scheme will be 100% irrigated during Maha, and 30% during Yala, even in the Standard Dry Year which corresponds to 'one-in-ten probability' drought year

and

(ii) In the Standard Average Year, 100% during Maha and 50% during Yala is irrigable.

4-2-3: Outline of Irrigation-Drainage Works

(1) Dam: As far as dam and intake facilities are concerned, there is found no special defect to be improved upon. They shall be kept intact in our Renovation Plan.

(2) Main-Channel: Because the main-channel is earth-channel, erosion all along the channel is causing heavy silting; in our plan, the work will be limited to protection of slope where it is in critical conditions, aprt from general desilting work along the full length of the main-channel. For the maximum stabilization of the intake-water level of the outlets, about 10 check-gates will be installed along the total length of the main-channel, with an interval of 1 mile or so. The check-gate will be the Hand-operated Radial-Gate as per Fig. 4-2.
Simple-beam bridges will be built, each 5 feet in its width at the minimum, for safe passage of cultivators. For the convenience of traffic within the project-area, 5 crossing-bridges as per Fig. 4-3 will be built over the main-channel.

(3) Main-Channel outlets: Outlets along the main-channel are equipped with concrete-shutter causing a lot of leakage when shut. 50 outlets or so along the full length of the main-channel will be renovated to assure better water-control. Renovation shall be done as per Fig. 4-4 and a rectangular metal weir will be built in the lower-stream for the purpose of flow-check.

(4) Field-Outlets: Outlets along the branch-channels are open-type and not controllable. Their structure will have to be amended so that control will be made.

(5) Branch-Channels: General readjustment will be done all along the branch-channels without re-sorting to major reconstruction works, excepting for Tract No. 3 where little water is available even during Maha season. In Tract No. 3, two new channels will be excavated for easy distribution of the water.

FIG. 4-2 MANUAL RADIAL GATE WITH OVER-FLOW TYPE WEIR

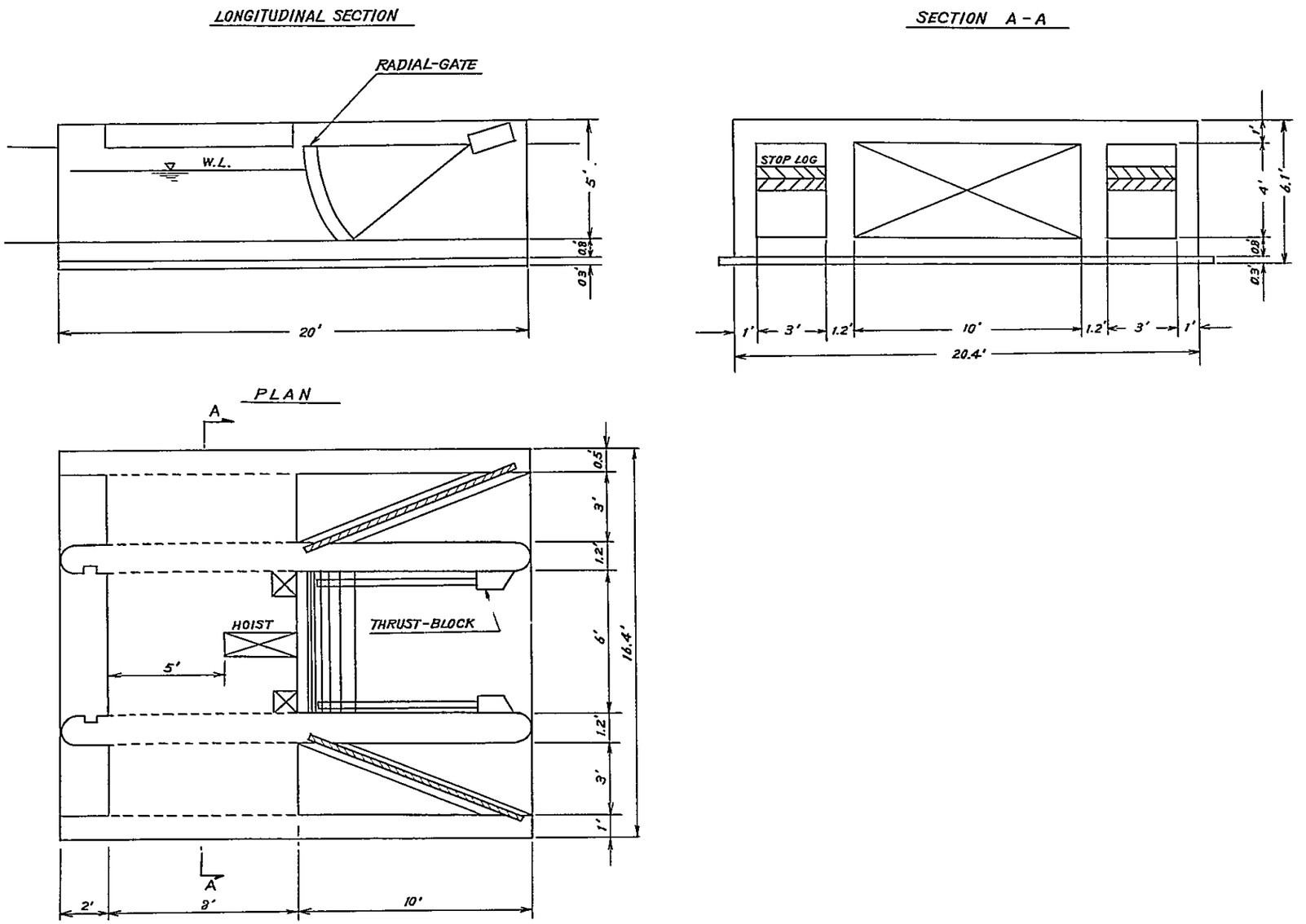
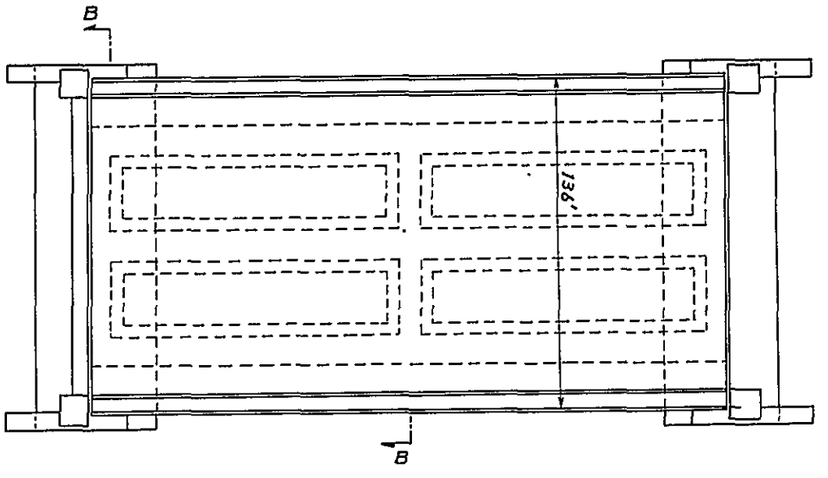


FIG. 4-3 : CROSSING-BRIDGE OVER MAIN-CHANNEL

(PLAN)



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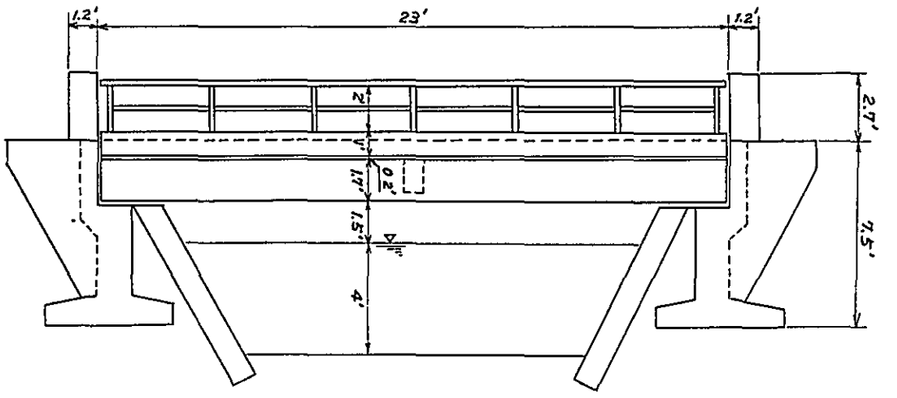


(CROSS-SECTION)

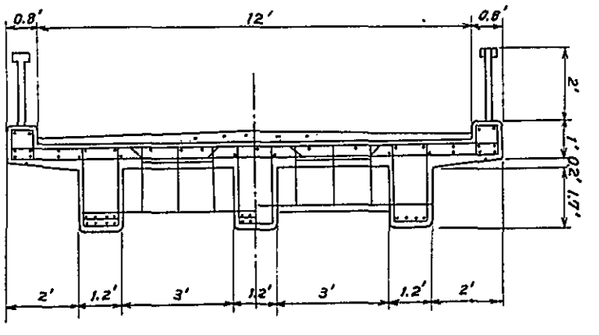
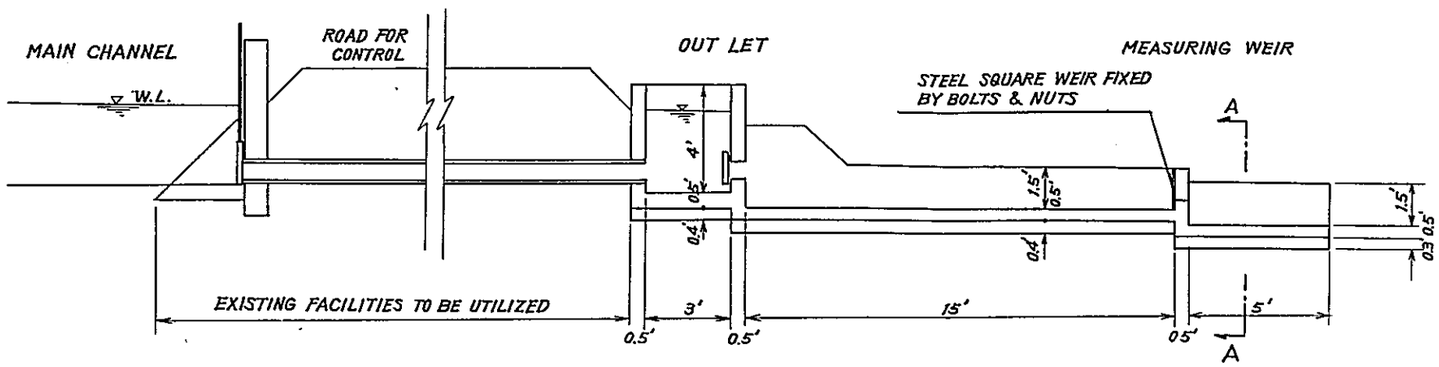
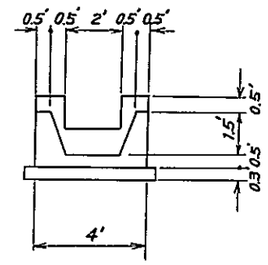


FIG. 4-4: IMPROVEMENTS UPON MAIN-CHANNEL OUTLETS

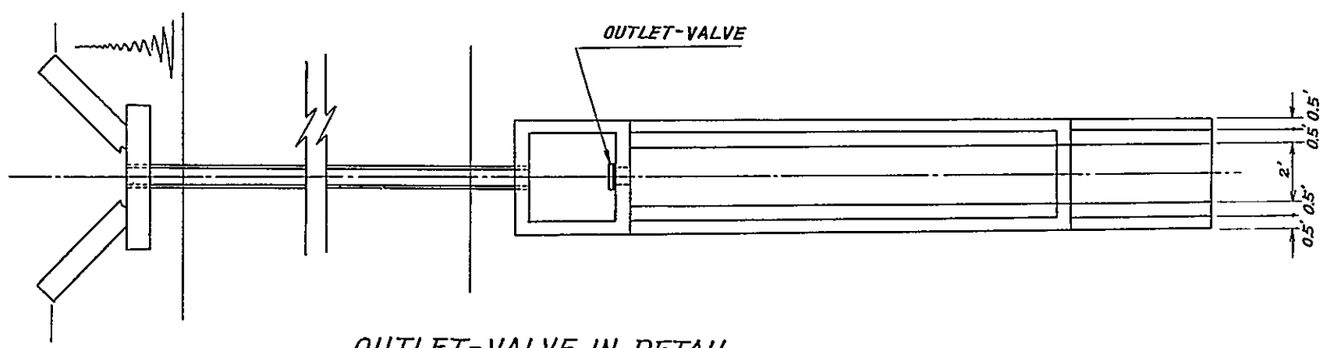
LONGITUDINAL SECTION



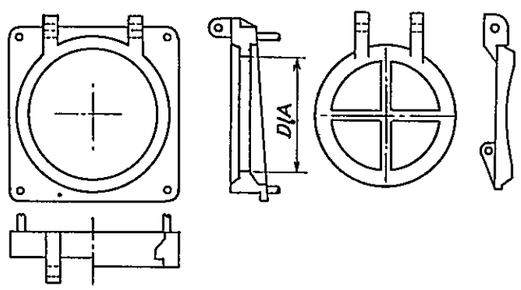
SECTION A-A



PLAN:



OUTLET-VALVE IN DETAIL



(6) Flow-observation: Each 1 Automatic Readable Water-Gauge will be established at:

(i) Nearby intake-tower in the reservoir; (ii) Heading part of the main channel; (iii) Lower-stream of Tract No. 4, and (iv) mouth of the river flowing into the Tank.

(7) Drainage-Work: Adjustment of drainage-channel for its full length of 6,600 feet will be undertaken in the Plan.

4-2-4: Amount of Irrigation-Drainage Works

S/No.	Kind of Work	Quantity
1.	Outlets, main-channel	50 outlets
2.	Outlets, Tract No. 3	5 "
3.	Outlets, Tract No. 3 – Newly made	25 "
4.	Outlets, Field – improvement of	150 "
5.	Measuring Weir (54 cusec)	2 weirs
6.	- do - (18 cusec)	3 "
7.	- do - (1 cusec)	50 "
8.	Control-Gate	10 gates
9.	Channels, Tract No. 3 – newly built	3,600 feet
10.	Crossing-Bridge on the main-channel	5 bridges
11.	Main-channel slopes, protection of	5,000 feet
12.	Desilting, main-channel	10 miles
13.	– do - branch-channel	4 miles
14.	Drainage-channel, readjustment of	6,600 feet

4-3: Upland-Field Irrigation Plan

4-3-1: Duty of Water for Irrigation

There is available little data for determining the unit duty of water for upland-field irrigation in Ceylon. However, due to tentative study, the duty of water will be fixed at $0.2^{inch/day}$ at the peak season. With 50% loss, the gross duty of water will be:

$$0.2^{inch} \times \frac{1}{0.5} = 0.4^{inch/day} \ (= 10.16^{mm/day})$$

Duty of water per acre will be:

$$Q = 43{,}560^{sq.ft} \times \frac{0.4^{in}}{12} \times \frac{1}{86{,}400 \text{ sec}} = 0.0168 \text{ cusec}$$

Duty of water for 100 acres of upland-field will, then, be:

$$Q = 0.475^{l/sec} \times 100 = 1.68^{cusec} = 100^{cuft\text{-}min.}$$

Assuming the running-hours of the Pump as 12 hours/day, the capacity of the Pump shall be $200^{cuft/min.}$

4-3-2: Outline of Upland-Field Irrigation Work

(1) Water-Source:

A new Regulating Pond will be constructed by a combined type of concrete and gates which is 150 ft. in length, 14 feet in height, and 16 acre-feet in capacity, at a site about 1½ miles downstream of Dewahuwa dam. This Pond will collect Havanella Oya water, seepage-water from Dewahuwa Tank, drainage-water from Tract No. 1 and natural inflow from other riverlets, and such water will be pumped up to the highland to irrigate upland-field there, by approx. 100 acres during Maha and half-as-much acreage during Yala. The gates will be equipped with two roller-gates, 7 feet in height and 5 feet in width.

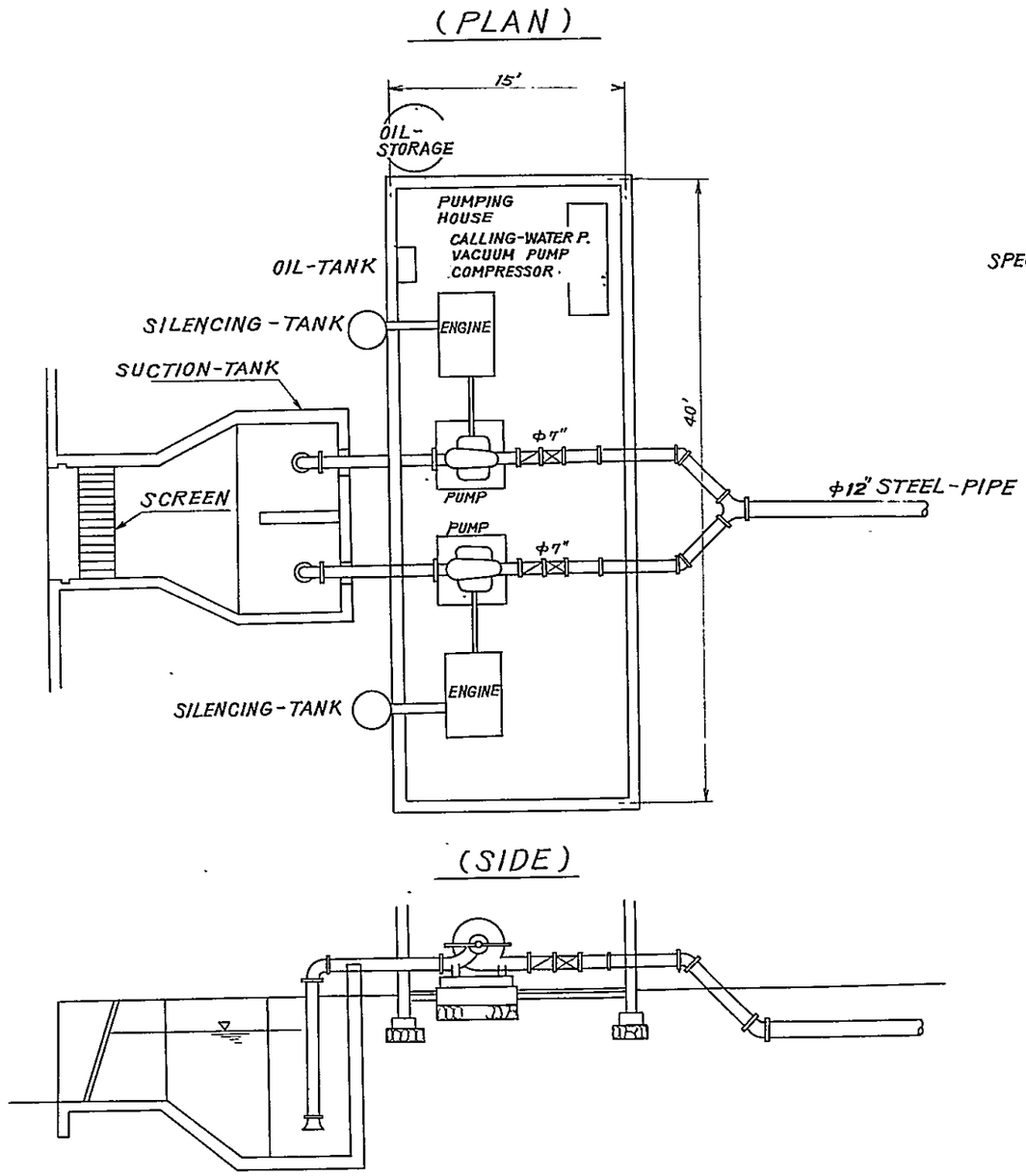
(2) Pumping-Station:

A pumping station will be located on the right bank of the dam. Its intake-entrance and suction-tank will be connected by open-channel. Sketch of the Pumping-Station is given as Fig. 4-5. Two double-suction volute-pumps, each 7^{inches} in diametre and 40 HP in capacity, shall be commissioned on duty for 12 hours. Delivery-pipe, 12 inches in diametre, runs for 4,500 feet to reach the Water-tank and Distribution-pipe (9,000 feet for the main and 5,000 feet for the branch) will be of plastic-made.

(3) Extent of the Work:

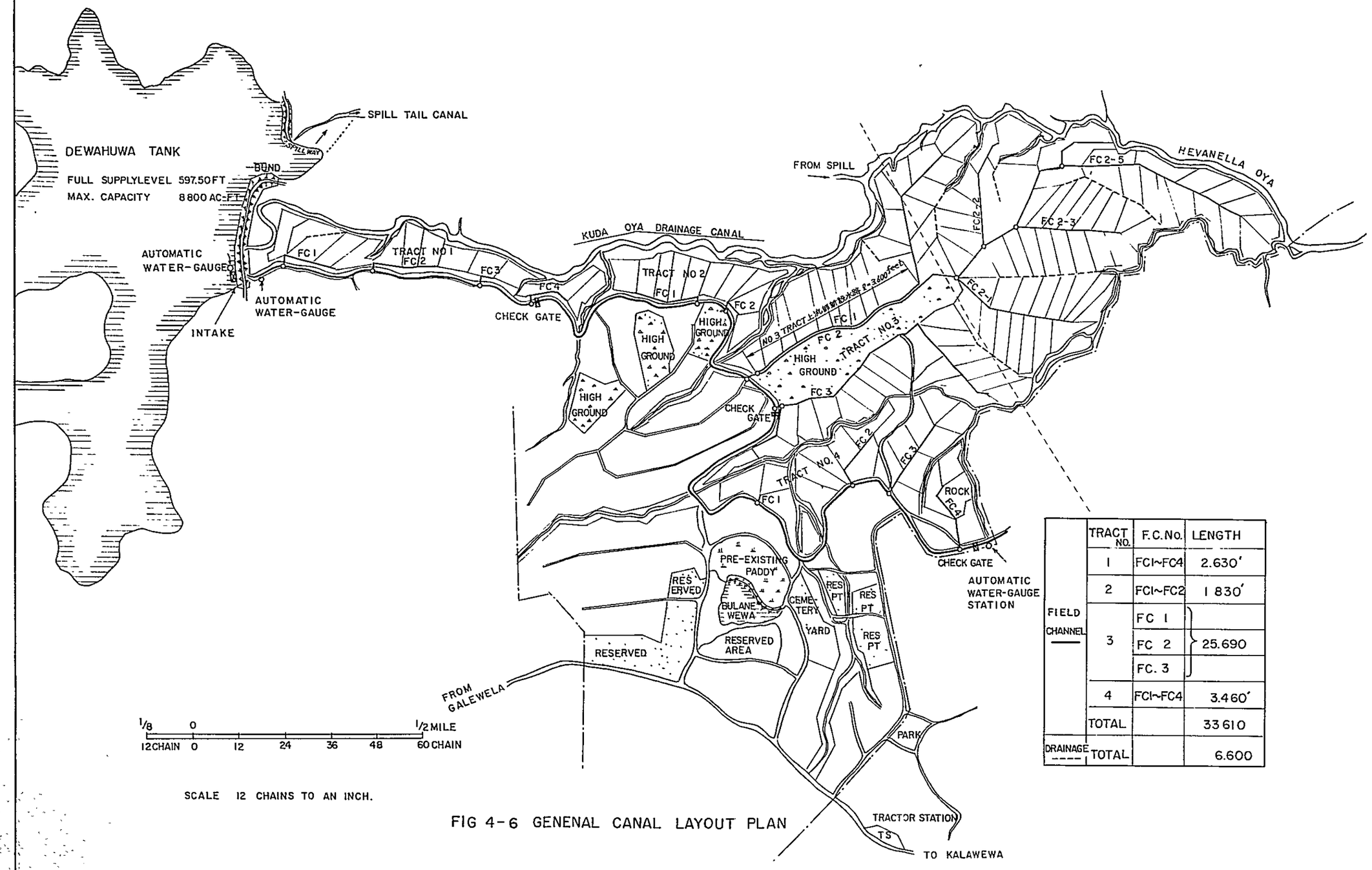
The terminal facility shall be the Delivery-outlets which will be so constructed as are convenient for distribution to earthen irrigation furrows.

FIG. 4-5 SKETCH OF PUMPING-STATION



SPECIFICATIONS OF THE PUMP:

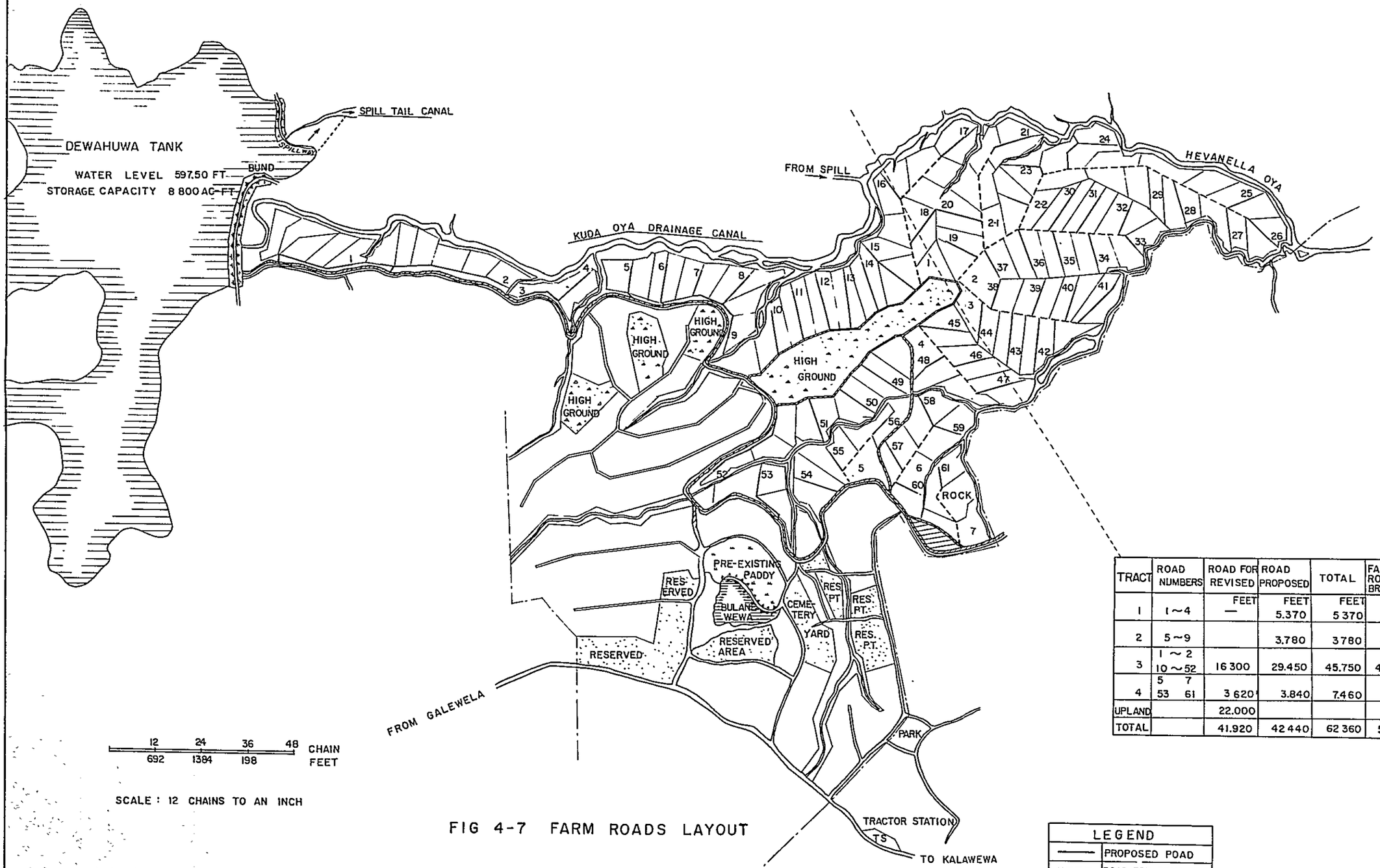
DOUBLE-SUCTION VOLUTE-PUMP	= 2
DIAMETRE	7"
TOTAL HEAD	120'
CAPACITY	200 cuft-min
ENGINE	40 HP × 2



	TRACT NO.	F.C.No.	LENGTH
FIELD CHANNEL	1	FC1~FC4	2.630'
	2	FC1~FC2	1 830'
	3	FC 1	25.690
		FC 2	
		FC. 3	
	4	FC1~FC4	3.460'
	TOTAL		33 610
DRAINAGE ----	TOTAL		6.600

SCALE 12 CHAINS TO AN INCH.

FIG 4-6 GENENAL CANAL LAYOUT PLAN



TRACT	ROAD NUMBERS	ROAD FOR REVISED	ROAD PROPOSED	TOTAL	FARM ROAD BRIDGE
		FEET	FEET	FEET	
1	1 ~ 4	—	5.370	5 370	2
2	5 ~ 9		3.780	3780	4
3	1 ~ 2 10 ~ 52	16 300	29.450	45.750	43
4	5 7 53 61	3 620	3.840	7.460	9
UPLAND		22.000			
TOTAL		41.920	42 440	62 360	58

LEGEND	
	PROPOSED POAD
	ROAD FOR RENOVATION
	EXISTING ROAD

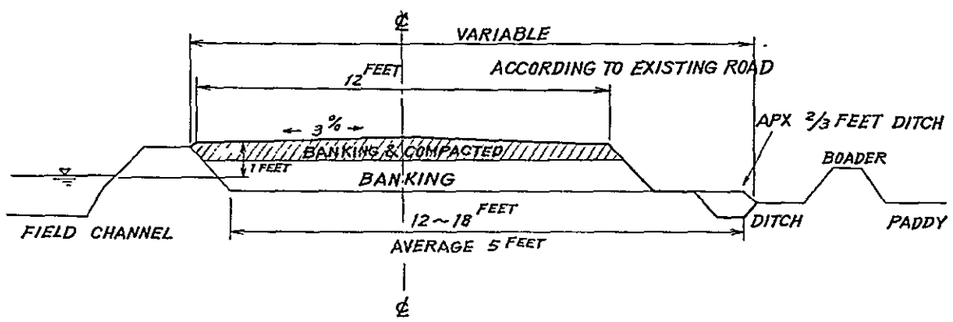
12 24 36 48 CHAIN
692 1384 198 FEET

SCALE : 12 CHAINS TO AN INCH

FIG 4-7 FARM ROADS LAYOUT

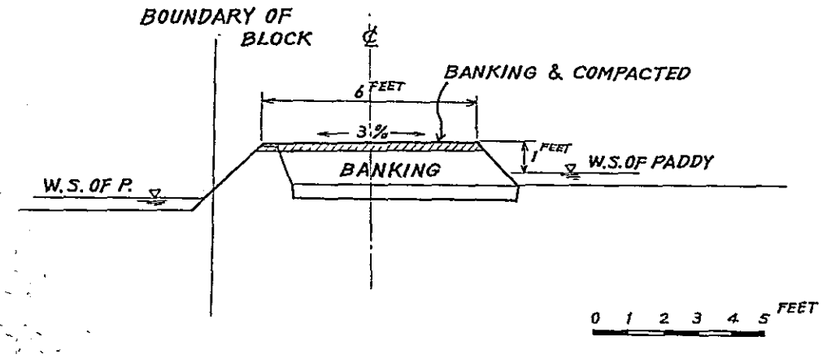
FIG. 4-8

BRANCH ROAD CROSS SECTION 1



ITEMS	QUANTITY	BRANCH ROAD
BANKING	16 SQ FEET	$12.3^{F} \times 1.3^{F} = 16$
CUTTING	1	$AP \times 1^{F2}$
COMPACTING	5	$16 \times 1/3$
SMOOTHING	12 FEET	

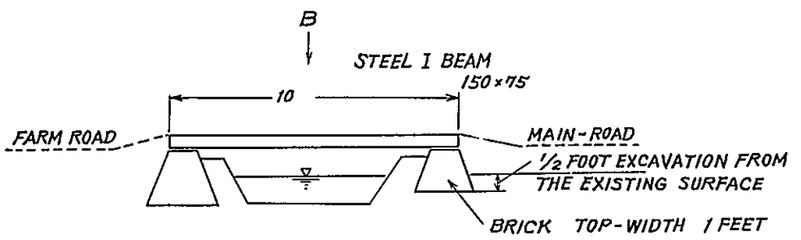
FARM ROAD CROSS SECTION 2

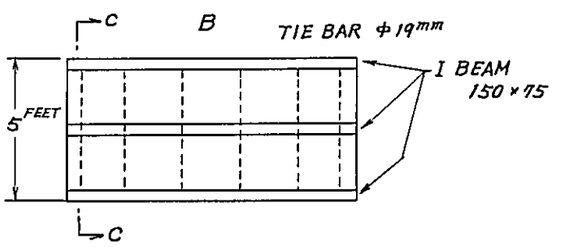


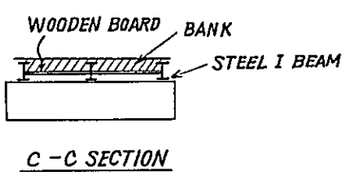
ITEMS	QUANTITY	FARM ROAD
BANKING ※	9.8 SQ FEET	6.1 × 1.6
CUTTING	3.0	6 × 0.5
COMPACTING	1.8	6 × 0.3
SMOOTHING	NIL	-

FIG. 4 - 9

FARM ROAD BRIDGE







C - C SECTION

0 2 4 6 FEET

FARM ROAD BRIDGE		
MATERIALS	SIZE	QUANTITY
I BEAM	STEEL 150×125	30 FEET
TIE BAR	STEEL Φ 19mm	30 FEET
BOARD	WOOD t = 1 INCH	40 SQ FEET
BLICK		23 CU FEET
BANK		10 CU FEET

4-4: Road Improvement Plan

4-4-1: General Approach

(1) Main Road:

No improvement will be made with the existing road as it is wide enough for two-way passage of half-sized trucks and its surface-conditions are not so bad.

(2) Branch-Road:

a.- Their outlay shall remain the same but improvement-works will follow as mentioned in the below.

b. Width of the branch-road shall be sufficient for two-way passage of cultivators (2-wheel tractor).

c.- Better drainage and roller-compaction of its surface shall be effected for good maintenance of the road.

(3) Farm-Road:

a.- One additional farm-road for each 2 allotments will be constructed to allow each allottee to enter his field as and when he likes.

b.- The width of the farm-road shall be big enough to allow passage of a single cart.

c.- Drainage work for better maintenance of its surface is required.

d.- At the crossing over the branch-channel, farmroad-bridges will have to be spun.

4-4-2: Determination of Dimensions of Roads

(1) Improvements of Branch-Roads

a.- Width of the Branch-Roads

The maximum width of the cultivator to be used is 4 feet. For a safe passage of two cultivators simultaneously, one foot interval is necessary. One foot will be enough for berme (shoulder) margin.

The width of the branch-road, therefore, will be:

4' x 2 + 1' + 1' x 2 = 11 feet < 12 feet

b.- Height of Road-Level

Foundation of the road and its borrow-pit is made up of reddishbrown sandy-clay earth which is believed to form a satisfactory foundation but in dry conditions. The height of the road-level shall be atleast 1 foot above the paddyfield for maintaining good drainage condition.

c.- Road-Surface

A-layer of the foundation (½ foot in thickness) will be compacted by bulldozer. The surface shall have 3% cross-sectioned slope towards both sides. Through proper care for drainage and roller-compaction of its surface, no metalling will be required. Growth of weeds on it will also be prevented thereby.

d.- Drainage

Drainage will be made by constructing drainage-ditch on either one side or both sides of the road.

e.- Banking Earth

It will be taken from nearby High Steep Ground designated as the Researved-Land in the Scheme area.

(2) Construction of New Farm-Roads

a.- Width of Road

Berme-margin of 1 foot and 4 feet for the cultivator will make the width of the farm-road as follows:

Width of Cultivator + Berme-margin = 4' + 1' x 2 = 6 feet

b.- Height of Road-Level

Same as (1)-b, above.

c.- Road-Surface

A-layer of the foundation (½ foot in thickness) will be compacted by man-power. Cross-sectioned slope of 3% towards paddyfield. No metalling of the surface is required.

d.- Drainage

Towards the paddyfield on the lower side.

e.- Banking-Earth & Foundation-Treatment

As the earth forming the foundation of the paddyfield is made up of reddish-brown sandy-clay, it can be used as banking-earth. Surplus earth obtainable through cutting of the paddyfield for its readjustment work can be made use of.

(3) Farmroad Bridge

Width shall be 5 feet and its lowest part shall be ½ foot above the highest water-level. I-beam will be used as its main beams.

4-4-3: Amount of Road Improvement Works

(1) Branch-Road (Renovation of the existing roads)
Width: 12' Length: 8 miles Earth-amount: 11,800 cub-yds.

(2) Farm-Road Construction
Width: 6' Length: 8 miles Earth-amount: 15,400 cub-yds.

(i) General Channel Layout ..... Fig. 4-6
(ii) Farm Road Layout ..... Fig. 4-7
(iii) Standard Cross-Sections of Branch-Road & Farm-Road ..... Fig. 4-8
(iv) Design of Farmroad Bridge ..... Fig. 4-9

4-5: Paddyfield Rearrangement Plan

4-5-1: General Approach

(1) Consolidation of plots into a sizeable field (3 to 4 plots into 1 consolidated plot) to facilitate for mechanization of paddy-farming.

(2) Arrangement will be made for an easy admission of cultivators into the consolidated plots.

(3) Percolation through crab-holes on the ridges and levees shall be prevented and field-notches are to be improved for maintenance of adequate depth of innundation and economy of water in the paddyfield.

(4) New irrigation furrows will be excavated in the allotment where irrigation-water does not reach its marginal field, thus the area under 'plot-to-plot' irrigation will be cut into half.

4-5-2: Determination of Dimensions of Paddyfield

(1) Consolidation of Plots:

The type of cultivator to be used (10-15HP), current pattern of sub-division of the allotment, difference of field-levels and other factors taken into consideration, $30^{ft} \times 60^{ft} \sim 45^{ft} \times 45^{ft}$ would be the minimum standard for consolidation of plots.

(2) Difference of Field-Levels

The difference in level between two fields shall be less than 2/3 foot for an easy passage of cultivator, from one to another.

(3) Seepage-Proof

To prevent seepage through ridges and levees, seepage-proof corrugated plastic sheets (height: 1 foot, thickness: 0.16 inch) will be used along the border towards the lower-stream.

(4)1 Field Outlet Blocks

Concrete-made field-outlet blocks will be used for maintenance of adequate innundation-depth and proper flow of irrigation-water.

4-5-3: Amount of Main Works

S/No.	Kind of Works	Quantity
1.	Plots, consolidation of	770 acres
2.	Ridges & levees, improvement of	770,000 feet
3.	Outlets, establishment of	7,000 outlets
4.	Water-channels, inside the paddyfield	210,000 feet

(i) Paddyfield Rearrangement Plan ..... Fig. 4 - 10
(ii) Detailed Design of Field Structures ..... Fig. 4 - 11

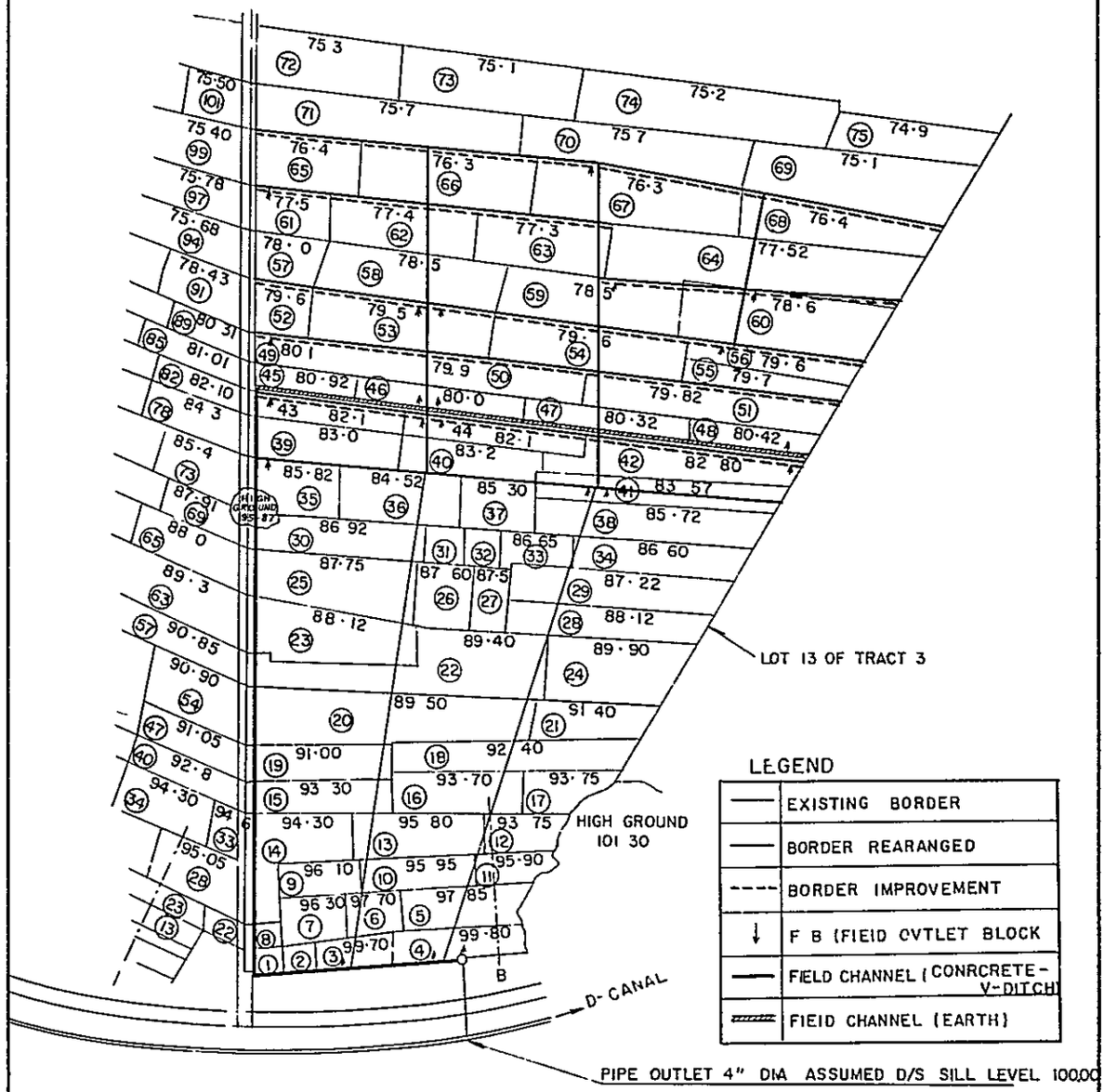
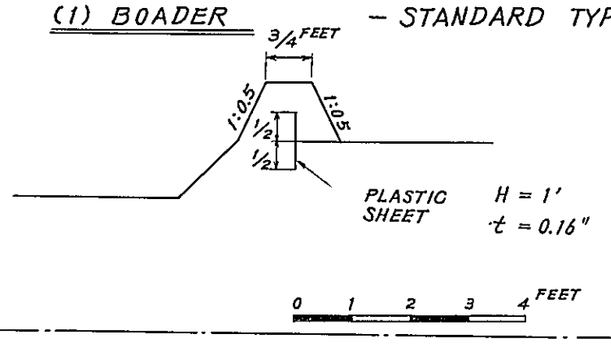


FIG 4-10 GENERAL PLAN OF
PADDY FIELD REARRANGEMENT

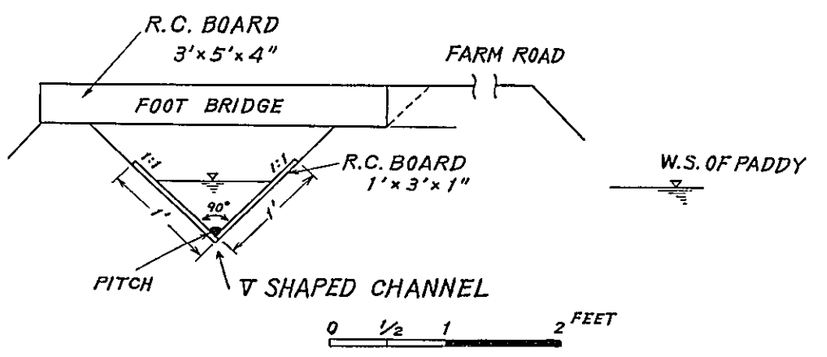
FIG. 4-11

FIELD STRUCTURE DETAILS

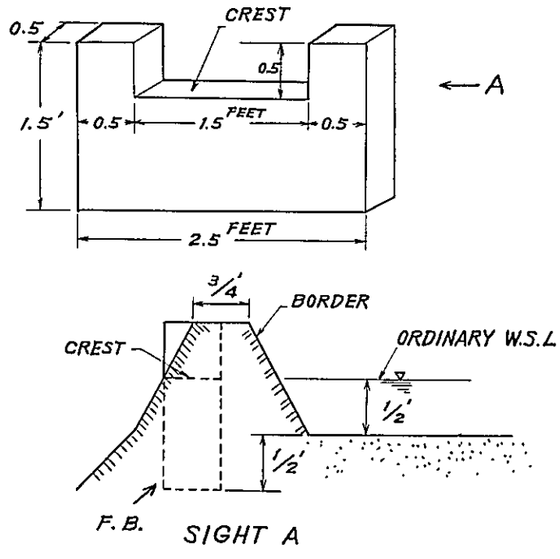
(1) BOADER — STANDARD TYPE —



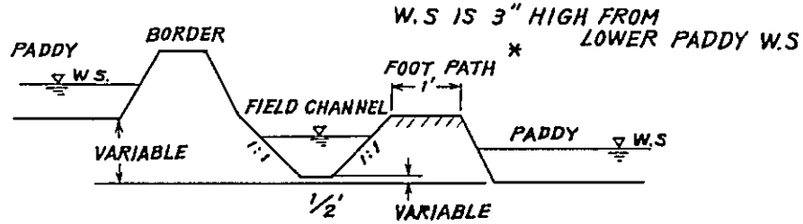
(2) FIELD CHANNEL



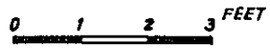
(3) F. B. — STANDARD TYPE —



(4) FIELD CHANNEL (EARTH)



* AT SOME PORTION. SET OPEN CUT



Chapter V : Pilot-Farm Scheme

5-1: Assignment

New technology little known and scarcely practised in the past will be introduced into this area through implementation of the project. Farmers there should appreciate it before they would wish to adopt it. Tests on their adaptability in the project-area will have to be taken up at the same time. Pilot-Farms to be established in the project-area are to meet with these demands and below-mentioned works are supposed to be their chief assignments.

5-1-1: Extension of Technical Trainings among the Farmers and Development of Demonstration-Farms

(1) Training on water-control in the paddyfield:

Farmers in this area have been rather careless about water-control and management on the paddyfield. Side by side with infrastructural renovations, particularly in irrigation and drainage facilities, they need to learn how to save water through intensive water-control and how to use it more effectively through proper water-management.

(2) Training on Operational Techniques of Farm-Machinery:

Tillage and ploughing as well as threshing by use of tractor has been known in this area for the last several years but it was purely on hire and farmers themselves do not know how to operate farm-machinery by their own hands. With introduction of farm-machinery, they need to be trained in handling farm-machinery. It is most desirable that necessary number of farmers will trun qualified operators by themselves.

(3) Education on Application of Fertilizers & Farm-Chemicals:

Farmers accustomed to the traditional farming are not using fertilizers and farm-chemicals in the most effective ways. Many of them are not using them at all. They need to be shown what is the proper use of fertilizers and farm-chemicals and their effects on the demonstration-farms.

(4) Development of Demonstration-Farm for Upland-Farming:

Upland-crops in the area were primarily for the cultivators' own domestic consumption, excepting tobacco and chilli. Continuous cultivation of solanum crops as a main is causing conspicuous harms. Desirable crop-rotation patterns will have to be demonstrated to them.

5-1-2: Experimentation and Research on Technical Problems confronting Farmers and Adaptability of New Techiniques

(1) Appraisal of 'Kekuran' (Dry-Sowing Method)

Current practices of direct-sowing on paddyfield are supposed to be the outcomes of unhappy combination of: (i) insecurity of irrigation-water; (ii) non-availability of tractor, and (iii) shortage of labour, converging upon a considerable number of cultivators there. Even after good efforts are concentratedly made with more or less success in bringing about a happy combination of (i) water and (ii) cultivator, the problem of merits and demerits of direct-sowing will still remain in connection with the question of availability of labour (which is currently divided among paddyfield, upland-field and 'chena') during Maha season. As cultivation of wetpaddy is solely dependent on Tank-water, one can expect only one crop during Maha. If he can successfully make use of the first rains for early planting of paddy (through 'Kekuran' method) and of Tank-water for its later growth, he will be able to harvest his paddy while Tank still keeps enough water to raise another crop on the same paddyfield, either in term of paddy or less water-consuming subsidiary food-crops, depending on the storage of water in the Tank at mid-Maha. This idea of double-cropping during Maha depends on: (i) timely arrival of rains with normal precipitation; (ii) good preparation of the soil before first rain comes, and (iii) Speedy harvesting of the first paddy crop to allow timely sowing of second crop during Maha.

All these questions must be studied on experimental basis in Paddyfield Pilot-Farm. An important task of the Pilot-Farm for Upland is to establish stabilized method of dry-sowing of upland-paddy in the highland.

(2) Experimental Use of Automatic Transplanting Machinery:

The use of paddy-transplating machinery will have many-sided benefits to the cultivators such as: (i) economization of labour which will allow its diversion to other gainful employment and diminuition of external labour almost to nil; (ii) prevention of delay in planting so to assure stabilized yield of paddy, coupled by adequate supply of water, inputs of fertilizers and farm-chemicals, as well as general improvement of paddy-cultivation techniques. Introduction of paddy-transplanting machinery is possible only when all the related techniques of such as border-bunding, breeding of seedlings on the nursery-bed, levelling of paddyfield and ferrilizer-application will make an even development.

(3) Studies on Paddy Harvesting Methods:

Utilization of paddyfield for cultivating subsidiary food-crops during Yala season which is envisaged under the present project will require efficient and speedy harvesting of standing paddy so that cultivators can make proper use of rains falling at the beginning of

Yala. For this purpose, introduction of harvesting machine will be studied in the Pilot-Farm, side by side with studies on the varieties of paddy and cultivation-techniques accompanying these problems.

(4) Multi-Purpose Use of P.C.P.

Weedicide currently used for paddy is mainly D.C.P.A, but its effectiveness is not necessarily verified yet. P.C.P. and its usefulness against weeds as well as crabs which bore countless number of holes along ridges and levees (thus causing a considerable water-loss) will be experimented.

(5) Drying of Chilli during Maha Season:

Rains which Maha brings over the area help increasing the yield of chilli but, on the other hand, the humidity ruling during the same season works adversely upon its quality due to difficulties in its proper drying. Studies on safe and efficient drying methods of chilli during Maha season will be worthwhile.

(6) Irrigated Cultivation of Chilli during Yala season:

Chilli cultivation during Yala season is generally done with little artificial irrigation, resulting at poor yield. Through betterment of irrigation facilities which will allow proper irrigation on the paddy-field for secondary cropping during Yala and irrigation even to highland through lift-irrigation system, increased production of chilli will also turn true during Yala, thanks to this lift-irrigation.

(7) Cultivation of Tobacco suitable for Cigarette:

Tobacco currently cultivated in the project-area is meant for beedi; improvements upon varieties sown and cultivation-methods will help production of higher-qualitied tobacco suitable for cigarettes.

(8) Cultivation of Cucumbers:

Upland crops now sown are dominantly solanun crops but with extensive harms resulting from their continuous farming year after year. Productive crop-rotation will be established through introduction of cucumbers under irrigation.

(9) Technique of Crop-Rotation on Paddyfield and Upland-field in Turn

In the project-area, paddy-production is not stabilized as water-supply is far from stabilized even during Maha season. Water-supply may happen to be insufficient for 100% irrigation of its paddyfield in years to come. From the studies meant for establishment of proper crop-rotation system through most productive utilization of land in both paddyfield

and upland-field, cultivators will come to learn good means to utilize paddyfield for production other than paddy and even get higher return in drought or semi-drought years in future.

(10) Adaptability-Study of Four-Wheeled Tractors:

Possibility of more intensive use of paddyfield (through consolidation and amalgamation of many tiny plots into a moderate-sized block of paddyfield) comes as a logical sequence of betterment of irrigation-system and water-control techniques. On such a stage, four-wheeled tractors bigger in size than cultivators may prove more useful. Introduction of larger tractors and cultivation-system centerring around them may stand for a very useful study to be undertaken by the Pilot-Farms.

5-2: Establishment and Facilities

In our project, two Pilot-Farms: one for Paddyfield and the other for Upland, are to be developed. They will be controlled jointly by one Central Establishment comprising of the following facilities (see Fig. 5 - 1, Fig. 5 - 2 and Fig. 5 - 3):

(1) Machinery-Depot

10^{yd} x 40^{yd} in size for keeping farm-machinery in good order. Steel-framed, slate-roofed, with concrete-floor (4" thickness). Two sides of the building will be equipped with light-weighted shutters, 2^{yd} x 4^{yd} in size. Lighting arrangement inside the building.

(2) Seed Repository

10^{yd} x 6^{yd} in size for storing seeds. Steel-framed and slate-roofed. Its floor-space is to be wood-planked, 1 foot above the ground; ceiling and walls will be made of galvanized iron-sheet; double-window of screen and glass, to be made as air-tight as possible.

(3) Fertilizer-Shed

10^{yd} x 10^{yd} in size for keeping fertilizers and farm-chemicals. Steel-framed, slate-roofed, with concrete-floor. 2 large-sized ventilation-fans on the upper part of the walls. Wooden partition inside the building, with wood shelves for storage of farm-chemicals.

(4) Store-Room

10^{yd} x 12^{yd} for storage of sundry goods. Steel-framed, slate-roofed and concrete-floored.

(5) Granary

10^{yd} x 12^{yd} in size for temporary storage of farm produce. Steelframed, slate-roofed, wood-planked floor 1 foot above the ground with 2 large-sized ventilation-fans on the upper part of the walls.

(6) Working Space

For threshing, polishing, winnowing and other works of paddy and sorting etc. of upland crops. 14^{yd} x 23^{yd} in size, steel-framed, slate-roofed and concrete-floored. Both sides are left open.

(7) Office

7^{yd} x 8^{yd} in size for administrative work on behalf of both Paddyfield Pilot-Farm and Upland Pilot-Farm. Steel-framed, slate-roofed (with heat-absorbent board under the roof), wood-planked floor 1 ft. above the ground, walls and ceiling also of wood-plank, double window of screen and glass, lighting arrangement inside the room.

(8) Measuring Room

7^{yd} x 8^{yd} in size for measuring of samples collected. Steel-framed, slate-roofed (with heat-absorbent board under the roof), wood-planked floor 1 ft. above the ground, wood-planked walls and ceiling, with double-window of screen and glass; 2 large-sized ventilation-fans at the upper part of the walls, lighting arrangement inside the space.

(9) Washing Yard

For washing farm-machinery. Concrete-floored, equipped with watertank, pump and drainage facilities (with precipitation-tank).

(10) Power-Room

For diesel generator. 4^{yd} x 4^{yd} in size. Steel-framed and slate-roofed.

(11) Fuel Store

2^{yd} x 4^{yd} in size for storage of gasoline (in drums), steel-framed and slate-roofed.

(12) Fuel Tank

Underground Tank with the storage capacity of 10 kilo-liters of light-oil.

(13) Pavement

For passage, 4^{yd} in width, with mild cross-sectioned slope towards the external side to prevent innundation of water inside the buildings.

5-2-2: Supplies and Material

(1) Farm-Machinery and Agricultural Implements;
(2) Fertilizer, Farm-chemicals, Fuels and other consumptive material;
(3) Generator, Desks and furnitures and other administrative needs, and
(4) Others

Details will be known from Table 10-2: Detailed Break-Down of Estimated Cost.

5-3: Construction Scheme

5-3-1: Paddyfield Pilot Farm

(1) Location and Size:

Left bank of the main-channel Mile 4, in Tract No. 4 (old Allot No. 20). 4 acres of paddyfield to be reclaimed from approx. 6 acres of land.

(2) Shape of the Pilot-Paddyfield and Number of Plots:

3 plots each of 100^{ft} x 300^{ft} (0.7 acre in size) plus 9 plots each of 100^{ft} x 100^{ft} (0.2 acre in size). Ref. Fig. 5 - 4.

(3) Road:

12' – wide farm-road will run along the entire length of the Pilot-Farm on one side and a centre-road dividing the two fields.

(4) Irrigation-Drainage Channels:

Water taken from the outlet to be newly constructed along the main-channel will be sent through pipe running along the farm-road. Drainage-channel will run on the opposite border of two fields and be connected to outside drainage-channel.

(5) Construction-Work:

After draining the innundated water through the drainage-channels, both inside and outside the Farm-site, the shallow portion will be reclaimed by the earth available from the abandoned bund, to prepare 4 acres of paddyfield.

5-3-2: Upland Pilot-Farm

(1) Location and Size:

Reserved-land on the right bank of the main-channel Mile 3.3, in Tract No. 4; approx. 10 acres will be developed out of 17 acres of highland.

(2) Shape, Pattern and Road:

No definite shape nor pattern will be pre-fixed. It will depend on the kinds of crops grown there and the types of irrigation. Road with dimensions equal to the branch-road in the project-area will run in the central part of the Pilot-Farm.

(3) Upland Irrigation:

Two types of irrigation, viz: furrow-irrigation and sprinkler-irrigation will be tried. Sprinkler-irrigation will take place in 2 acres nearby the main-channel.
Water-source is looked for from the riverlet running at the left corner of the Pilot-Farm, to be supplemented by the main-channel. By checking the flow of the riverlet at its lower-stream, a river-bed reservoir of about 3 ac.ft. will be constructed: the irrigation-water comes primarily from this pond. Water pumped up from this pond will be directed for both furrow-irrigation and sprinkler-irrigation.
Head and duty of water for each pump is:
For furrow-irrigation: Head = 20^{ft} Capacity = 12.6 cuft-min.
" sprinkler- " Head = 150^{ft} Capacity = 3.2 cuft-min.
Both pumps will be volute-type.
Furrow-irrigation water will be conducted by 1' x 1' concrete V-shaped gutter, and sprinkler-irrigation will be fed through pre-cast pipe with 3" diametre. Distribution-pipe for sprinkler-irrigation shall be portable.

5-4: Amount of Main Works

5-4-1: Paddyfield Pilot-Farm		Bottom-width	Height	Length
(1)	Drainage-channel (inside the Farm):	2 ft	4 ft	300 ft
(2)	Drainage-channel (outside the Farm):	1 ft	4 ft	1,000 ft
(3)	Intake-entrance (3" in diametre)			1 place
(4)	Irrigation-channel (3" in diametre/concrete V gutter)			600 ft.
(5)	Area under Construction Work			4.2 acres

5-4-2: Upland Pilot-Farm			
(1)	Construction of Pond (3 ac.ft in storage)		1 place
(2)	Pumping House	Head = 20 ft. Capacity = 12.6 cuft-min.	1 story
(3)	- do -	Head = 150 ft. Capacity = 3.2 cuft-min.	1 story
(4)	Irrigation-channel	Pre-cast pipe 3" diametre	700 ft.
(5)	- do -	Concrete V-shape gutter 1' x 1'	1,300 ft.
(6)	Road Construction	12 feet in width	1,600 ft.
(7)	Soil-improvement	(undertaken by Farm-Management Improvement Plan)	10 acres
(8)	Control-Room	(attached to Agricultural Mechanization Centre)	1 story

FIG. 5-1: UPLAND PILOT FARM BUILDING-CUM-AGRICULTURAL MECHANIZATION CENTRE (PLAN)

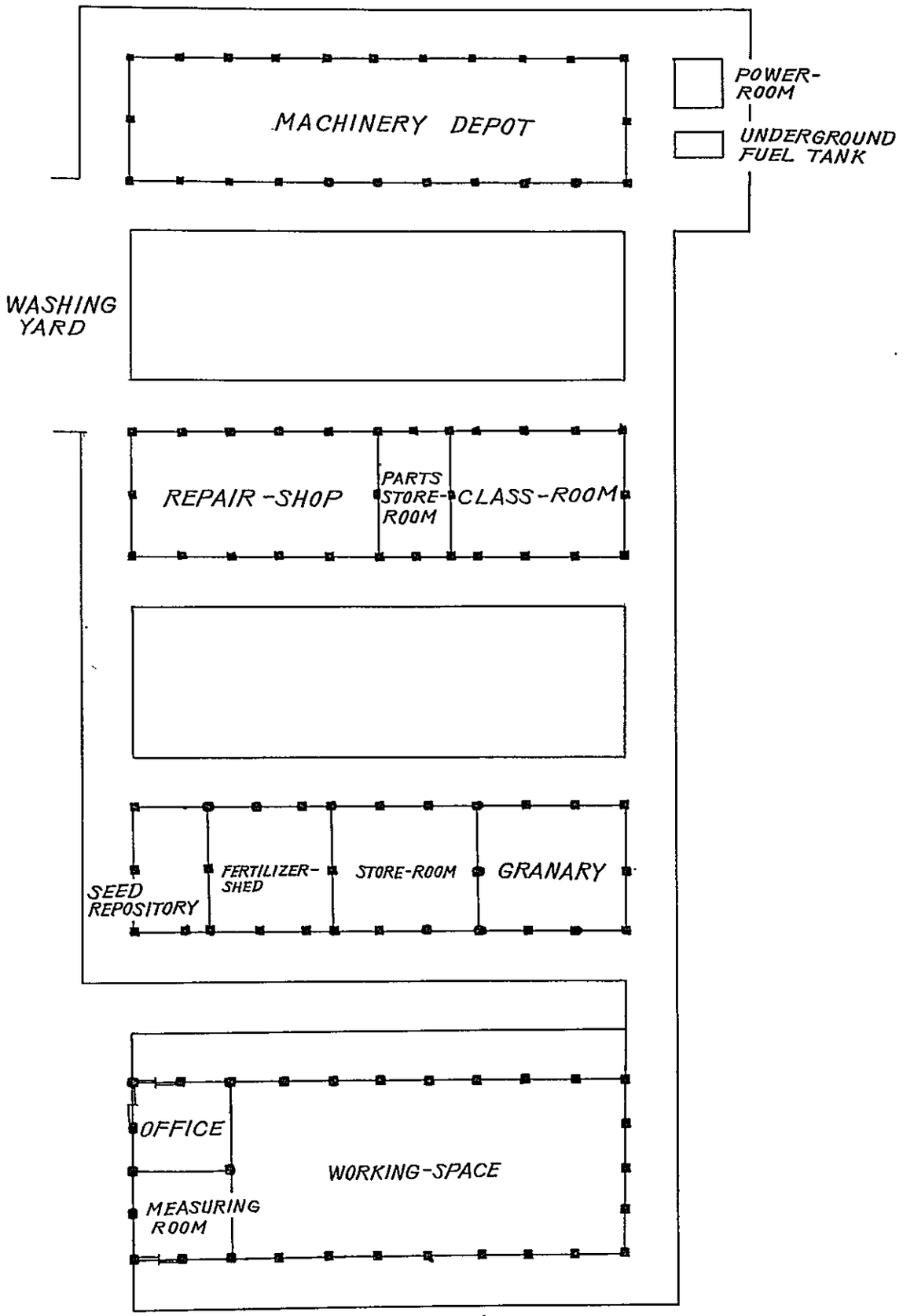
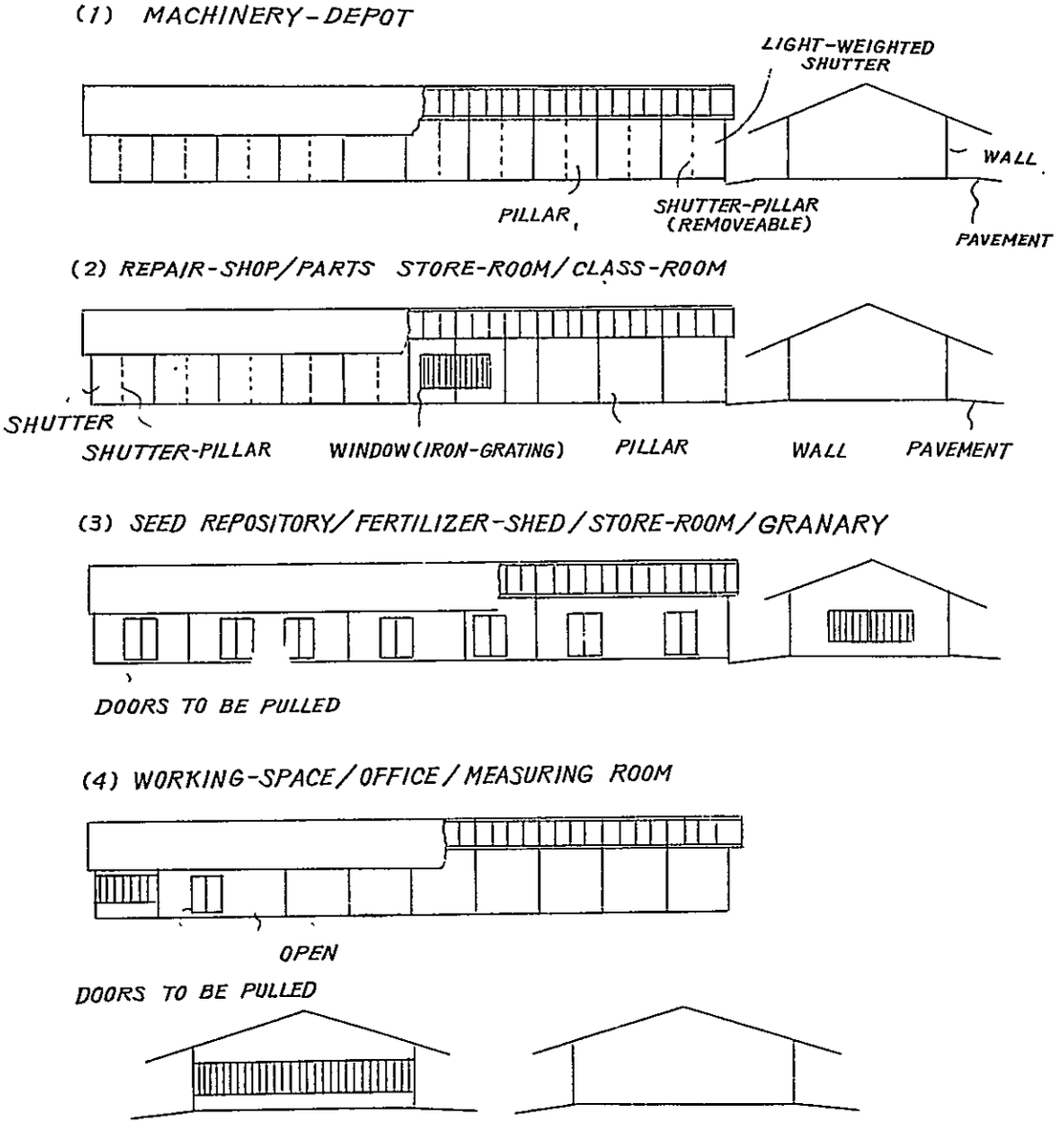


FIG. 5-2: UPLAND PILOT FARM BUILDING-CUM-AGRICULTURAL MECHANIZATION CENTRE (SIDE-VIEW)



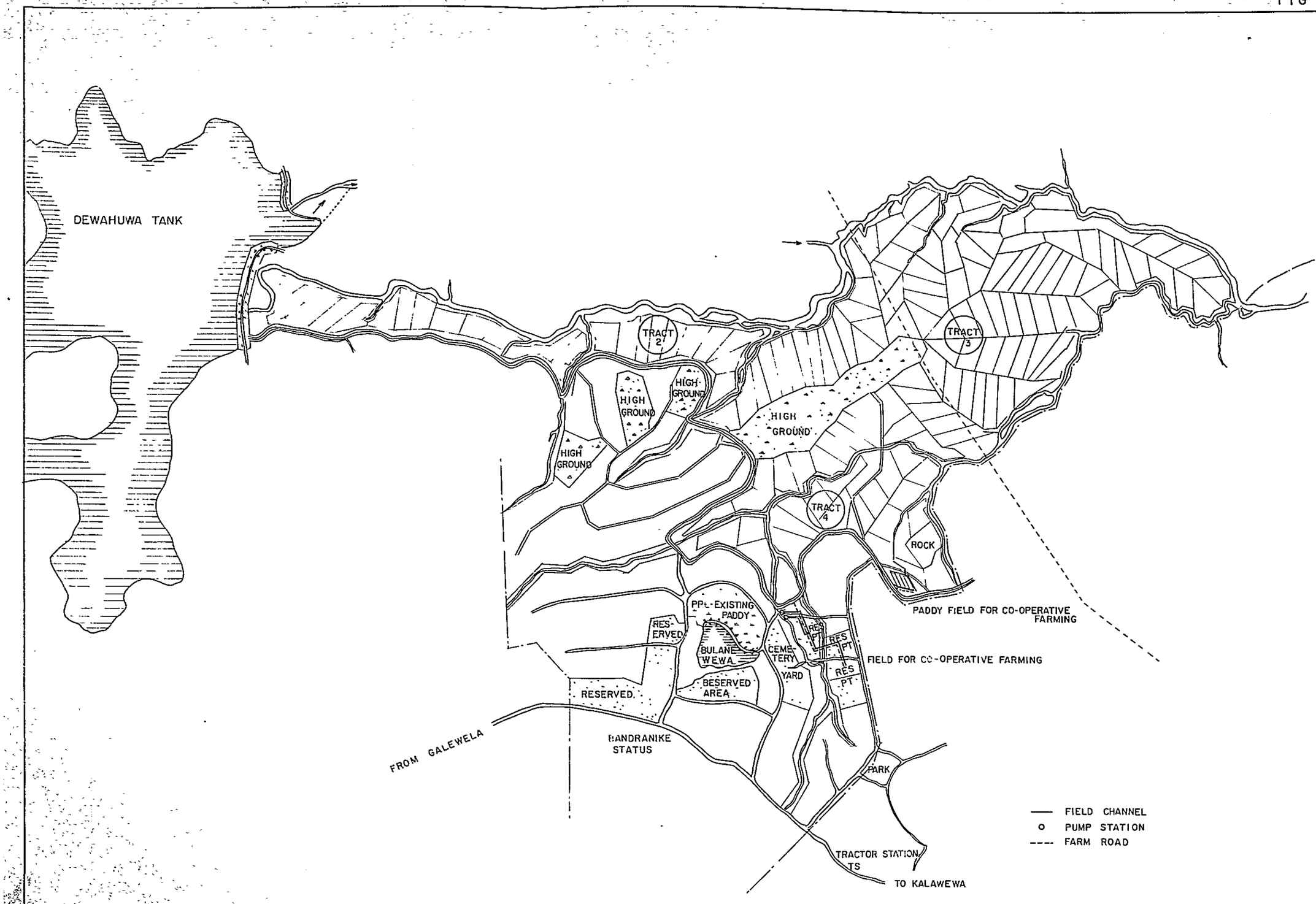
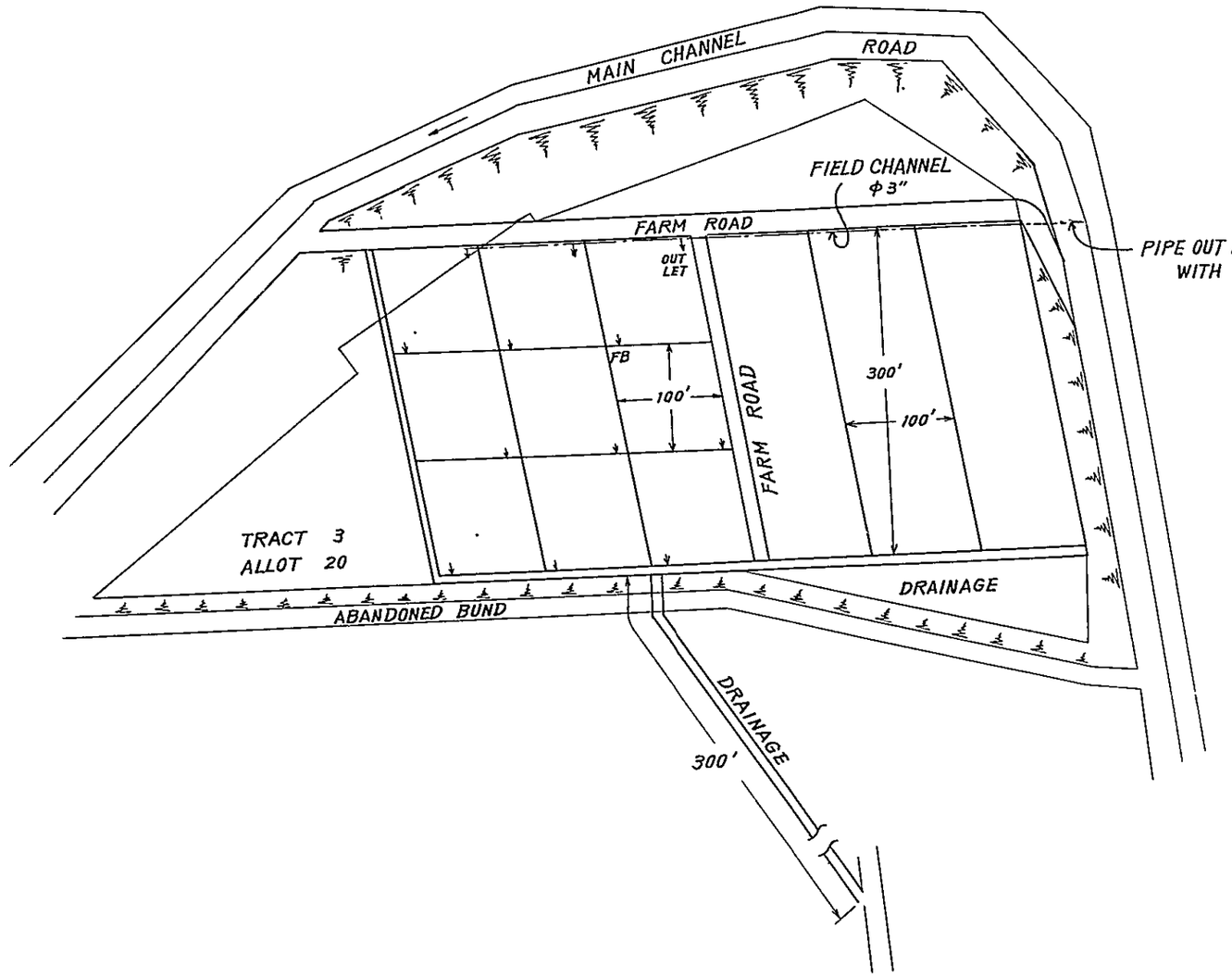


FIG 5-3 PILOT FARM LOCATION

SCAL: 12 CHAINS TO AN INCH

FIG. 5-4 PADDY FIELDS FOR PILOT FARMING



Chapter VI : Agro-Industry Development Plan

6-1: Guiding Principles

6-1-1: The following considerations are deemed necessary in developing Agro-Industries:

a.- Deliberate studies for the optimal combination of four essential factors of production, viz: (i) raw material, (ii) labour (not only quantitatively but qualitatively also as for its technical levels), (iii) market, and (iv) capital (in case foreign machinery and facilities are involved, possibility of obtaining their import-licenses needs to be ascertained), to be followed by:

b.- Selection of such enterprise or enterprises which give, due to wise factor-combination, reasonable expectations for more gains than those ordinarily obtainable from the current mode of factor-combination in the area, provided that:

c.- Establishment of such enterprise or enterprises will initiate chain-reactions of re-organization and re-combination of under-utilized factors of production there, so that 'virtuous cycle', in term of accelerated capital-accumulation encouraging bolder ploughing-back which again substantially contribute for further capital-accumulation, will start func tioning.

6-1-2: Agro-industrial ventures in the project-area do not need to be developed solely in view of getting more cash-income from outside market; they may as well be encouraged to satisfy the self-generating demands in the locality for its general productivity-increase (production of more units of goods and services in better quality at the same cost, or bringing down of the cost-of-production of the goods and services in the same quantity and quality, or combination of these two) and the 'higher living-stnadard' of the residents (absolute betterment of their food-intake, clothings and housing and also, relative improvement in the conveniences and comforts of the people's life).

6-1-3: Agro-industries meeting the above aims and purposes and falling within the above criteria shall be developed in a way complementary to the success of the Community Development Project which is closely bound to agricultural economy of the project-area; they shall be operated through all-out participation of the people of the area on the principle of equitable distribution of their fruits among the people according to their contributions; development of agro-industries, therefore, will be entrusted with DBMPCS (its Agro-Industries & Utilities Dept) which is the principal planning and executive machinery of the Community Development Project there.

6-2: Implementation Scheme

6-2-1: Agro-industries to be developed in the project-area will be conveniently grouped into the following four categories:

(a) those which can be operated all through the year - requiring no particular factories nor machinery, excepting family-labour;

(b) those primarily concerned with processing of locally available agricultural products from season to season - simple plant and equipment of the cottage-industry-type and labour organized to a certain degree will be required for their operation;

(c) those ultimately aimed at accelerating the productive 'division-of-labour' among the people and creation of full-time industrial workers out of half-employed artisans, by introducing among the latter the improved means of production and an advanced technique so as to intensify their technical system and, simultaneously, bring up their productivity to such an extent that they will abandon, for their own advantages, half-farming way of life to become full-fledged industrial workers, and

(d) Non-agricultural industries meant for absorption of a considerable amount of surplus-labour, particularly during Yala season, in return to wage equivalent to full-time pay. They shall be developed either in the neighbourhood of the railway-station or along the trunk-road. Maha-season shortage of labour-force for their full-year operation will have to be replenished by labour-force available outside of the project-area.

6-2-2: Agro-industries which may be developed almost immediately along the above specified terms and conditions will be:

Under Category (a):

Supplementary-employment-type job of Duck-reering along the lengthy channels in the project-area. Ducklings will be procured by DBMPCS for distribution among the farmhouseholds; feedstuff will be domestically supplied and their eggs and meat will be consumed primarily by the residents as supplementary nutritional values and their surplus to be marketed co-operatively through DBMPCS (Marketing & Supplies Dept). After good experiences obtainable in this type of fowl-keeping, poultry will be introduced, through the similar method as with ducks. Fish-culture in Dewahuwa Tank along the same direction will prove worthwhile. Procurement of chicks, eggs and fry will be jointly done through DBMPCS and the cost involved will be recovered from the proceeds of co-operative sales of marketable surpluses of eggs, meat and fish.

Chapter VII: "Better-Living" Programme

7-1: Guiding Principles

7-1-1: The aim and purpose of this Programme lie in maintenance and upliftment of health-conditions and sanitary environments of the people in the project-area and general improvement of their living standard through enlightenment and advancement of their knowledge as well as modes of living.

7-1-2: The actual workers who translate this Programme into action consist of the volunteers coming from Mahila Samitiya/(*1) and Gram Samwardena Samitiya(*2) which need fresh impetus and new visions for their own re-organization and re-vitalization.

7-1-3: DBMPCS (its Welfare Dept) will render full support to their practical workers in planning, financing and implementing this "Better-Living" campaign among the people of the project-area.

Note: (*1) and (*2) = See Other Organizations 2-4-4 of this Report.

7-2: Implementation Scheme

7-2-1: DBMPCS (its Welfare Dept) will help re-organizing Mahila Samitiya and Gram Samwardena Samitiya in the project-area and assist in recovery of and/or increase in the Government subsidies towards these two local organizations.

7-2-2: Qualified volunteers from amongst the members of the re-organized Mahila Samitiya will be facilitated to attend various training courses held by Lanka Mahila Samitiya on such as Better-Cooking, Better-House-Keeping, Better Child-Care, Better Housing (particularly, improvement of Kitchen and Latrine) and Family-Planning; upon their return, they will be supplied with necessary teaching material and demonstration-stuff as well as small pocket-money offerable by DBMPCS (out of the commissions due to Marketing & Supplies Dept. of DBMPCS).

7-2-3: Able volunteers from amongst the members of Gram Samwardena Samitiya will be encouraged to complete a Health-Ledger of the residents of the project-area with the guidance and help of the Hospital, the Dispensary and the Health Inspector in the area.

7-2-4: The residents of the project-area have been observed to be less keen in improving their own ways of life, more or less akin to other people living in the Dry-Zone. Any

increase of their productivity and income-augmentation may wisely be channelled into two main directions of: (i) re-investment for enlarged re-production, and (ii) levelling up of their own living stadard.

Due to the limited length of survey this time, the second Mission could not ascertain their mental frustrations and the causes and reasons of the latter. Drinking and gambling practices which they seem to be increasingly addicted to shall be curved at any rate.

In the present Report, a tangible scheme to provide domestic-water to some 2,000 people of the area has been projected in view of fostering "Better-Living" Scheme visualized in this Chapter.

Under Category (b):

(i) - Polishing of rice meant for distribution on quota among the people of the project-area (Rice-Mills existing in the project-area may be brought under the management of DBMPCS for this purpose); (ii) Preparation of Starch from Manioc; (iii) Expelling of oil from rice-bran, and (iv) Expelling of oil from soya-bean. After successful ventures in these processing industries, (i) refining and processing of Kenaf into the substitutes of Jute and Jute-bags etc, and (ii) Production of paper and paper-board and their processing into various paper-articles by using paddy-straw etc as raw-materials, may be started. These industries will be developed, operated and managed by DBMPCS (Agro-Industries & Utilities Dept) and the fund for procurement of machinery and facilities required for the purpose will be borrowed from the People's Bank, together with their working capital.

Under Category (c):

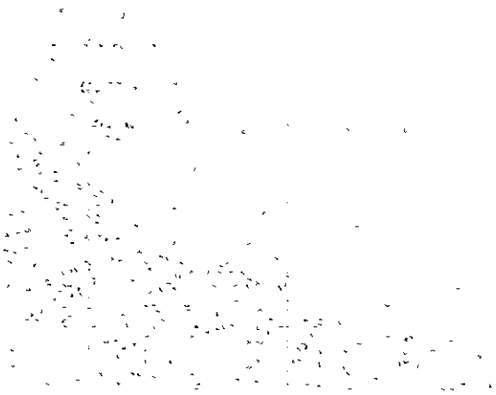
Wood-working industry, production of bullock-cart being the main undertaking in view of strengthening local transport-power and later cartering for the outside demands with competitive price due to mechanization of its production. Residents who are skilled in carpentry will be organized into a small team with which a set of electric wood-working machinery will be provided for experimental work. Upon success, DBMPCS (Agro-Industries & Utilities Dept) will set it up on business-basis with the experienced carpenters as full-time workers. Initial set of wood-working machinery for the experimental purposes may be provided from Japan but additional machinery and establishment and working capital for turning this experiment into a business-deal will have to be looked after by the People's Bank.

Under Category (d):

Production of concrete products such as blocks, slabs, sheets and humepipes widely used for irrigation-drainage works and construction of roads and buildings will be undertaken. Initially, people in the project-area who have some experience in masonry will be organized as the skeleton-workers with whom Japanese machinery will be provided. Upon successful experiment, a new plant will be built either in the neighbourhood of Negama Railway-Station or along the Trunk motor-road nearby the project-area, and the industrial venture goes as a joint-enterprise of the District-wide co-operatives. Machinery and equipment for its experiment will be supplied from Japan and those required for enterprise will have to be looked after by Agricultural & Industrial Credit Corporation or Development Finance Corporation of Ceylon, and its working capital may be forthcoming from the People's Bank.

6-2-3: The Government of Ceylon are seriously concerned with development of Agro-Industries in the country and their expectations for Japanese co-operation in this field are correspondingly high. The first Mission taken lead of by Dr. Shiroshi Nasu is likewise aware of the importance of their development and recommending introduction of adequate kinds in the rural area of

Ceylon. Development feasibility of agro-industries has been taken up by the second Mission among its main studies but no hasty recommendations have been made as for any specific kinds to be immediately taken up there because the Mission is under the impression that more lengthy analysis of the situations is imperative for pinning down items of industries to be initiated. Poultry facilities, wood-working machinery and a set of machinery and equipment for production of secondary concrete products purely for experimental purposes have so far been included in our cost-estimation for implementation of our Project.



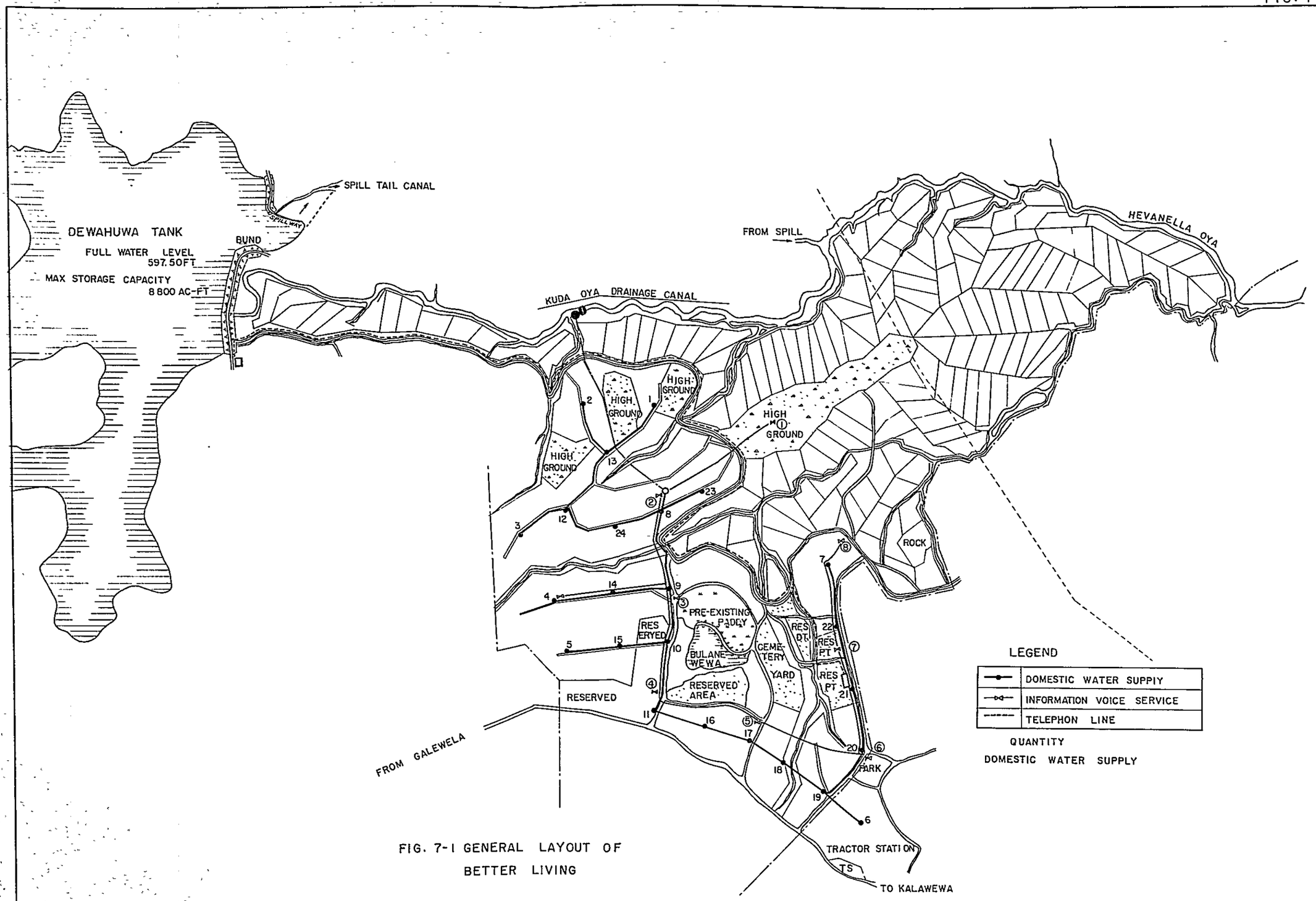


FIG. 7-1 GENERAL LAYOUT OF BETTER LIVING

SCALE: 12 CHAINS TO AN INCH

Chapter VIII: Maintenance & Operation Programme

8-1: Management & Control of Irrigation Facilities

Maintenance and control of the irrigation facilities will be taken responsibilities of by the official of the Department of Irrigation stationed in the area as well as by the system made up of the beneficiary cultivators (in the name of Cultivation Committee). The official of the Department of Irrigation will look after the main irrigation facilities and, also, discharge of water from the dam, main channel and important branch-channels and their outlets. The beneficiary cultivators and their water-control body will take over responsibility of maintaining the marginal or peripheral irrigation facilities and, also, co-operate the official of the Department of Irrigation in matters concerning water-control in general.

To assure well co-ordinated work between them, co-ordination system comprising of the representatives of the both parties shall be established.

8-2: Management & Control of Other Facilities

Facilities established under this project, such as Agricultural Mechanization Centre, the simplified domestic-water distribution system, wired broadcasting apparatus etc. will be managed and controlled by DBMPCS.

Chapter IX: Agricultural Co-operative Development Plan

9-1: Basic Policies

9-1-1: Agricultural Development Scheme which we are intending to operate in the project-area is a comprehensive Community Development Project in which are integrated two kinds of developmental factors: one being 'exogenous' and the other, 'endogenous'.

Exogenous developmental factors consist of:

a.- Renovation of physical infra-structure primarily through improvement of irrigation-drainage facilities, and

b.- Improvement of farm-management system through concentrated input of power-driven farm-machinery, fertilizers and farm-chemicals, coupled by introduction of scientific methods of cultivation.

On the other hand, endogenous developmental factors will be:

a.- Re-organization and strengthening of farmers' organizations, their agricultural co-operatives, in particular, and

b.- Livelihood improvement campaign, side by side with general education drive among the residents.

Experiences obtained in many parts of the world with the similar kinds of rural development projects do not seem to justify the idea that their success counts on the size of mathematical sum-total of the endogenous factors on one hand and the exogenous factors, on the other. It is rather the 'endogenous' factors which count much weightier than the exogenous in most of the cases, and unless the former are well repleted, compact and responsive, the latter cannot make the best of the opportunities given and the situations prepared.

On the contrary, when and where the endogenous factors were fit, the exogenous factors could achieve enormously well and attain commendable results, almost unjustifying to their quantity and quality, because they could depend upon so-called 'multiplying-effects' on and among the endogenous factors. Otherwise, input of exogenous factors often proved to be far from commensurating.

The most desirable pattern of development, then, should be the one where the exogenous factors would be put in, so to speak, through the endogenous factors; we may

conclude that introduction of the exogenous factors is limited to the receptiveness and gauge, or conditional to replenishment and strengthening, of the endogenous factors.

9-1-2: The important-most endogenous factor in our case is Agricultural Co-operatives in the project-area and for implementation of our Community Development Project, organizational and managerial re-vitalization and re-orientation of the Co-operatives is almost imperative. And Agricultural Co-operatives pivotal for successful implementation of the Community Development Project shall not only be "multi-" purposed but "multiplying" also. The kinds of services it means to offer, of course, need to be "multiple" but they invariably fail to generate "multiplying-effects" unless they are well-knit and dove-tailed among each other. It shall also be "purposed" for social as well as cultural benefits of the area wherein it functions, on and above that for economic betterment of its members. In many developing countries, Co-operatives are functioning as so many "Schools" where people learn the doctrine of, and behaviour based upon, "Democracy".

9-1-3: Our efforts in bringing up agricultural co-operatives shall be focused, for the time being, at Dewahuwa-Bulanawewa Multi-Purpose Co-operative Society (abbreviated as DBMPCS), which covers our project-area as its service-zone. Co-operative movement is bound to expand both horizontally and vertically, from the sheer reason of consolidating its own operational position and improving its proper services: efficiency of co-op. work as measured by the quantity and quality of its services will increase proportionately to the intensity of its functional tie-up with other primary organizations as much as with its higher organizations at District- or Provincial- levels, and further upwards with those on the National level. It is taken as granted, therefore, that the full-fledged co-operative activities starting at DBMPCS would find, sooner than later, that its optimal scale of operation should be expanded at least within the whole Dewahuwa Scheme area. Its vertical relations with co-operative organizations in higher echelons will naturally grow in term of business-transactions as well as exchange of information.

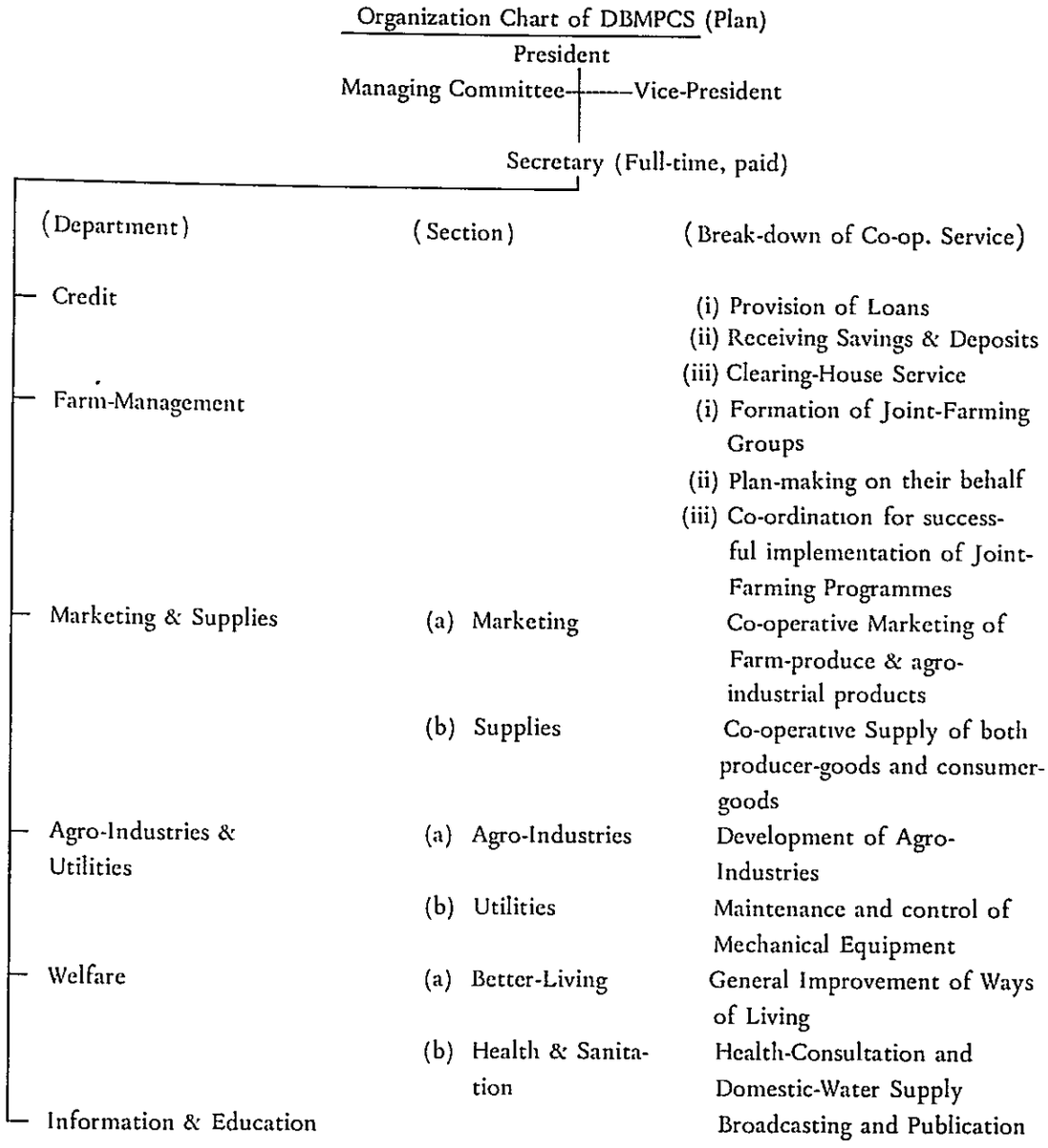
9-2: Implementation Scheme

9-2-1: Functional Aspect of DBMPCS

Necessary steps will have to be taken, in consultation with the Government of Ceylon and its National Co-operative Movement, to bringing up DBMPCS strong enough to bear the responsibilities of both strategical headquarters and tactical vanguard for productivity-increase and livelihood-improvement in the project-area.

9-2-2: Departmental Co-op. Service

DBMPCS will have six Departments under its Managing Committee. Its Organization-Chart will show as follows:



(Department)	(Section)	(Break-down of Co-op. Service)
Credit		(i) Provision of Loans (ii) Receiving Savings & Deposits (iii) Clearing-House Service
Farm-Management		(i) Formation of Joint-Farming Groups (ii) Plan-making on their behalf (iii) Co-ordination for successful implementation of Joint-Farming Programmes
Marketing & Supplies	(a) Marketing	Co-operative Marketing of Farm-produce & agro-industrial products
	(b) Supplies	Co-operative Supply of both producer-goods and consumer-goods
Agro-Industries & Utilities	(a) Agro-Industries	Development of Agro-Industries
	(b) Utilities	Maintenance and control of Mechanical Equipment
Welfare	(a) Better-Living	General Improvement of Ways of Living
	(b) Health & Sanitation	Health-Consultation and Domestic-Water Supply
Information & Education		Broadcasting and Publication

9-3: Departmental Organization and Management

9-3-1: Office-Bearers and Employees

Managing Committee of DBMPCS will need to be re-elected in the coming General Meeting and it is hoped that newly elected members of the Managing Committee will consist of those farmers who, while appreciating the aims and purposes assigned to the re-organized DBMPCS, are prepared to take over personal responsibilities in co-operative efforts directed for attainment of these aims and purposes, and determined to work as driving-forces of the Community Development Project. In fact, Co-operative will offer good opportunities for the people to find out such type of persons and for such type of persons to take up challenge of socio-economic targets and make themselves democratic leaders of the Movement.

While Managing Committee will chalk out the guiding principles and definite policies of day-to-day functioning of DBMPCS, its employees must be made up of those who are honest, hard-working and clean. Employees selected on their qualifications and abilities will be paid adequately and awarded with special bonus or promotion when their work will be exemplary before their co-workers.

9-3-2: Departmental Function

(1) Credit Department:

This Department will offer three important banking services as follows:

(i) Provision of Loans: The total amount of Paddy Cultivation Loan which goes through DBMPCS to the cultivators will have to be increased. More number of cultivators eligible for such Loan needs to be brought under Co-op. umbrella. Medium-term loans and long-term loans are to be made available from the People's Bank on the security of the fixed savings and deposits made in the name of the Joint-Farming Groups.

(ii) Receiving of Savings & Deposits: Credit Department of DBMPCS will receive the proceeds of co-operatively marketed farm-produce as the savings and deposits in the name of each Joint-Farming Group (half of the amount will be made a joint-deposit in the name of Joint-Farming Group and the remaining half, the current-deposits or savings in the name of individual cultivators belonging to the same Joint-Farming Group) and arrangement shall be done to get medium-term loan from the People's Bank on the security of these deposits and savings.

(iii) Clearing-House Services: All the producer-goods supplied to Joint-Farming Groups and the consumer-goods supplied to the members of the Groups by DBMPCS (through its Supplies Section) will be debited to respective deposit-and savings-accounts mentioned in the above. Cultivators' indebtedness to money-lenders and merchants, if any, will be liquidated by this Department in such a way that the cultivators' debts to third persons

will be transfered as the debts of DBMPCS on the condition that the original debtors will pay back their dues to DBMPCS through an easy-payment system (after each harvest for several seasons to come).

Credit Department will have to develop a reliable account system and effective book-keeping and voucher-system to cope with the above function.

(2) Farm-Management Department:

(i) Formation of Joint-Farming Group on each 25 acres of Paddyfield: In pursuance of the idea explained in 3-5: Pattern of Farm Management under Chapter III of this Report, actual tillers (irrespective of their present status of whether permit-holders, tenants or agricultural labourers) of the paddyfields amalgamated and concentrated into 25-acre block will be organized into each one Joint-Farming Group. Every Joint-Farming Group will have one elected co-ordinator. Joint-Farming Groups will be organized on 15% of the paddy-field in the initial year (1969-70), on additional 35% in the second year (1970-71), and on the remaining 50% in the third year (1971-72). Formation of Upland Joint-Farming Groups (along the same direction as with Paddyfield Joint-Farming Groups) will be started from the second year (1970-71) of the project.

(ii) Plan-Making on behalf of Joint-Farming Groups: Joint-Farming Programme for each Group will be prepared for both Maha and Yala seasons after careful studies among its Co-ordinator, all the Department-Heads of DBMPCS (Credit, Farm-Management, Marketing & Supplies, Agro-Industries and Utilities, Welfare, and Information & Education), representatives of Cultivation Committees Nos. 1 & 2, Colonization Officer, DRO's of Anuradhapura and Matale, Technical Assistant of the Department of Irrigation, Co-operative Supervisor, Agricultural Instructor and other officials from the relevant Departments and Ministries. Demands, views and opinions of each Joint-Farming Group submitted through its Co-ordinator will be the main-theme of the conference and other participants will make adequate contributions for realization of the actual cultivators' wishes: for instance, Paddy Cultivation Loan application must be filed to the authorities by the Credit Dept; arrangement for securing input-requirements such as seeds, fertilizers, farm-chemicals etc. shall be met by the Supplies Section: proper maintenance of farm-machinery depends on efficient work of the Utilities Section; water-arrangement will require co-operation from Technical Assistant of the Department of Irrigation and Cultivation Comts. No. 1 & 2: transport of producer-goods and consumer-goods as well as harvested farm-produce will depend on transport services provided by the Utilities Section; marketing of the agricultural products of the Joint-Farming Groups by the Marketing Section; transfer of their sales-proceeds into Co-op. savings after deducting costs and expenditures, to the Credit Dept., etc etc.

Joint-Farming Programme for Maha season will be prepared by September and that for Yala, by March. Maha programme may be amended at mid-October and Yala programme at mid-April, depending on rainfall in the former case and availability of water in the Tank, in the latter case. Both Programmes will be approved in DBMPCS's General Meetings in end-September/early October and end-March/early April. In DBMPCS's Autumn-Meeting, report on the last Yala results will proceed the reading of coming Maha Programme as in its Spring-Meeting, reporting on the last Maha results will proceed reading of coming Yala programme.

(iii) Co-ordination for successful implementation of Joint-Farming Programmes

All the necessary co-ordination works for successful implementation of Joint-Farming Programmes fall on this Department. Farm-Management Department of DBMPCS will look after not only material progress in term of more yield in better quality but also commercial aspects such as planned or phased planting of cash-crops, standardization of produce, grading, packing and transport etc to enhance sales-value of the products.

Counterpart-officials of the Government of Ceylon will maintain close contacts with this Department, assisting it in every aspect of its work. Their particular co-operation is sought in close observation of the function of the Joint-Farming Groups and, through constructive criticism of such, to make adequate advices and recommendations for betterment of Joint-Farming practices and also for enlarged re-production of better Joint-Farming Groups. Utmost use of the Pilot-Farms is desirable in this connection.

(3) Marketing & Supplies Department:

(i) Marketing Section: Paddy produced by each Joint-Farming Group will be 100% sold under GPS. Other farm-products such as onions will be similarly sold under GPS, as far as possible. Farm-produce other than GPS items shall be shipped out, after careful grading and packing, to the weekly fairs established in eight neighbouring cities and towns, jointly and directly, by use of motor-trucks issued from the Utilities Section. Proceeds of this kind of co-operative sales will be deposited with the Credit Department which will enter the entire amount into the deposits and savings accounts in the name of either Joint-Farming Group or individual cultivators, to be drawn as required in later date.

(ii) Supplies Section: Supplies will be conveniently sub-divided into (a) producer-goods, and (b) consumer-goods.

(Producer-Goods)

Fertilizers and farm-chemicals (weedicide, in particular) provided in kinds under Paddy Cultivation Loan will not be separately handled from those supplied from Japan under the

project. Both will be supplied, together with those procurable through Fertilizer Corporation and CWE (Co-operative Wholesale Exchange), to fulfill the input-requirement as specified by the Joint-Farming Groups through the Farm-Management Dept.of DEBMPCS. No individual producer-goods supply will be made. Their supplies will be made on credit, or their net cost and expenditure incurred for their supply will be debited to the ‹deposit-account held in the Credit Department of DBMPCS in the name of each Joint-Farming Group. Therefore, no cash transaction will intervene. Collective indents for producer-goods will be made to the Supplies Section after Joint-Farming Programmes will be chalked out in September, for Maha, and in March, for Yala.

(Consumer-Goods)
Supplies Section of DBMPCS will continue on distributing the Government rations to the residents of the project-area with best efficiency and highest honesty. As for other consumer-goods required by the cultivators belonging to each Joint-Farming Group and their family-members, Collective Advance Order, preferably twice a year, half-year order in September (Maha season consumer demands) and another half-a-year order in March (Yala season consumer demands) will be placed with the Supplies Section of DBMPCS. They shall be supplied in good quality at cheaper price and in good time. Costs and expenditures incurrable for such supply-services will be debited to the savings-account held in the name of each individual cultivator: therefore, no cash transactions will intervene.

Attractive Co-operative Store will be set up where casual daily necessities not indentable in good advance will be displayed at the bottom price. Customers may pay for them in cash or on credit (debitable to the customers' savings a/c with DBMPCS).

(4) Agro-Industries & Utilities Department:
(i) Agro-Industries Section: See Chapter VI· Agro-Industry Development Plan, of this Report.

(ii) Utilities Section: This Section will be held responsible for efficient maintenance and control of power-driven farm-machinery and motor-trucks supplied by the Japanese Government under the project. These mechanical equipment will need to be maintained in conditions ever ready for operation by the facilities available at the Agricultural Mechanization Centre to be established within the project-area.

(5) Welfare Department:
This Department will take upon itself the task of advancing general welfare of the residents of the project-area in full co-operation with reorganized Mahila Samitiya and Gram Samwardena Samitiya in promotion of "Better-Living" programme dealt in Chapter VII of this Report.

(6) Information & Education Department:

This Department will take up propaganda, information and education services. As its mouth-piece, the wire-broadcasting apparatus (10 speakers set at convenient places in the project-area will be centrally controlled from a midget broadcasting station in DBMPCS headquarters) will be supplied from Japan. Co-op. publication is another function of this Department.

Chapter X: Cost of the Project

10-1: Investment Criteria

This project, being a type of Community Development Project, has many-phased works as its components. Estimation of its cost has been done in each category of investment as follows:

Total Investment (6,200) Unit= ,000 Rs.	(Direct-Investment (2,840)	(Infra-Structural Renovation (1,665)	(1. Paddyfield irrigation facilities
			(2. Upland-field irrigation facilities
			(3. Improvement of Drainage
			(4. Repair & Construction of Roads
			(5. Consolidation of Paddyfield
			(6. Introduction of Earth-moving & Construction-Machinery
		(Initial Input for Better Farm-Management (1,175)	(7. Farm-machinery
			(8. Fertilizers
			(9. Farm-chemicals
		(Pilot-Farms (584)	(10. Paddyfield Pilot-Farm
			(11. Upland Pilot-Farm
			(12. Agricultural Mechanization Centre
			(13. Farm-machinery, fertilizers & farm-chemicals for the use of Paddyfield/ Upland Pilot-Farms
	(Indirect-Investment (2,460)	(Operation & Maintenance (1,136)	(14. Operational Facilities and their Maintenance
			(15. General Supervision & Control
		(Office-space & Experts' Accommodations (740)	(16. Office-space & Experts' Accommodation facilities
	(Public Investment (679)	(Better-Living (215)	(17. Conventional Domestic Water
		(Agricultural Co-operatives (355)	(18. Agric. Co-op. HQ & its facilities
			(19. Transport Facilities
			(20. Wired-Broadcasting Apparatus
		(Agro-Industry (109)	(21. Concrete Products Machinery
			(22. Wood-working Machinery
			(23. Poultry Facilities
	(Others (221)		

10-2: Manners of Investment

Direct-Investment is meant only for our immediate project-area (770 acres of paddyfield, plus 100 acres of upland-field).

Indirect-Investment covers the total Dewahuwa Scheme area (2,330 acres of paddy-field and its adjacent highland).

Public-Investment is directed to our immediate project-area as far as 'Better-Living' and Agricultural Coops. are concerned, but Agro-Industry portion of it is not confined to our immediate project-area nor Dewahuwa Scheme area.

Estimation of cost is based on the following terms and conditions:
(1) This project will run for full five years, starting from October 1969 and ending in September 1974;

(2) Principal machinery, equipment and material such as construction machinery, pumps, steel materials, major structures, cement, wires etc. will be supplied from Japan (foreign exchange component) and local labour, fuel, wooden materials, bricks etc. will be supplied by the Government of Ceylon (local currency component);

(3) Works meant for improvement of irrigation-drainage facilities will be completed within the first three years, and

(4) For smooth operation of the project, farm-management input such as farm-machinery, fertilizers and farm-chemicals are estimated as the initial investment items.

10-3: Total Investment (Unit= ,000 Rs)

Kind of Investment	Local-currency Component	Foreign-exchange Component	Total Amount
Direct Investment	741	2,099	2,840
Indirect Investment	1,369	1,091	2,460
Public Investment	219	460	679
Other Investment	221	-	221
Total Investment	2,550	3,650	6,200

Table 10-1: Cost Estimation (Unit= ,000 Rs)

Item	Description of Items:	Total Cost	Currency Component	
			Foreign	Domestic
Infra-Structual Renovation	1. Paddyfield Irrigation	273	69	204
	2. Upland Irrigation	444	265	179
	3. Drainage Improvement	22	-	22
	4. Road Repair & Construction	151	14	137
	5. Paddyfield Consolitation	441	242	199
	6. Construction Equipment	334	334	-
	Sub-Total:	1,665	924	741
Initial Input for Better Farm-Management	7. Farm-Machinery	850	850	-
	8. Fertilizers	207	207	-
	9. Farm-Chemicals	118	118	-
	Sub-Total:	1,175	1,175	-
Pilot-Farms	10. Paddyfield Pilot-Farm	29	1	28
	11. Upland Pilot-Farm	94	61	33
	12. Pilot-Farm-cum-Agricultural Mechanization Centre Bldg.	161	78	83
	13. Farm-machinery, Fertilizers, & Farm-chemicals for Pilot-Farm:			
	Farm-Machinery	258	256	2
	Fertilizers	22	22	-
	Farm-Chemicals	20	20	-
	Sub-Total:	584	438	146
Operation and Maintenance	14. Operational Facilities and their Maintenance	824	377	447
	15. Supervision & Control	105	45	60
	Transportations & Vehicles	207	57	150
	Sub-Total:	1,136	479	657
	C/F:	(4.560)	(3,016)	(1,544)

Item	Description of Items	Total Cost	Currency Component	
			Foreign	Domestic
	B/F:	(4,560)	(3,016)	(1,544)
Office-Space and Experts' Accommodations	16. Office-Space and Experts' Accommodations	740	174	566
Better-Living Programme	17. Conventional Domestic-Water	215	183	32
Agricultural Co-operative Development	18. Co-op. HQ. Building & Facilities	123	13	110
	19. Transport Facilities	186	140	46
	20. Wire-Broadcasting Apparatus	46	39	7
	Sub-Total:	355	192	163
Agro-Industry Development	21. Concrete Product Machinery	62	57	5
	22. Wood-working Machinery	41	23	18
	23. Poultry Facilities	6	5	1
	Sub-Total:	109	85	24
Others	Landing & Inland Transportation Cost	221	-	221
	Grand Total:	6,200	3,650	2,550

Table 10-2 : Detailed Break-Down of Estimated Cost

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remarks
						Foreign	Domestic	
INFRA-STRUCTURAL RENOVATION								
1. Paddyfield Irrigation	Main Channel Regulator	10	No.	8	80	40	40	New installation along the Main-channel from Tract 1 to Tract 9
	Turnout works							
	Turnout to distributary through pipe-out	50	"	Rs 1,100	55	8	47	
	Turnout to Field-channel	25	"	Rs 300	8	3	5	Tract No. 3
	Turnout improvement on distributaries	4	"	Rs 300	1	0	1	
	Turnout to 25 acre allotments	130	"	Rs 60	8	6	2	
	Measuring Weir							
	54 cusec	2	"	Rs 1,300	3	-	3	
	18 cusec	3	"	Rs 700	2	-	2	
	1 cusec	50	"	Rs 200	10	-	10	
	Tract No. 3 Proposed Branch-channel							
	Turnout to branch	1	"	4	4	3	1	
	Excavation	3,600	Ft	Re 1	4	-	4	
	Bed & Slope Protection of Main-channel	5,000	"	Rs 5	25	-	25	
	Bridges over Main-channel	5	No.	5	25	-	25	
	Desilting							
	Main-channel	10	Ml.	1	10	-	10	
	Distributary	4	"	Rs 500	2	-	2	
	Contingencies	Item	%	15	36	9	27	
	Sub-Total =				273	69	204	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remark
						Foreign	Domestic	
2. Upland Irrigation	Check-Gate & Low Dam							
	Sluice-gate 5 x7' x 2 Nos.	1	No.		17	15	2	
	Structure	1	"		40	-	40	Concrete
	Pump Facilities 1,500 A.Gal/min.	1	Set		40	15	25	Head: 120 feet
	Main Pipe 12" diametre	4,500	Ft.	Rs 20	90	70	20	Steel
	Distributing Pipe	Items			160	130	30	Dia=12":9,000 ft)Plastic
	Delivery Tank	1	No.	10	10	-	10	Dia=6":5,000 ft
	Delivery Outlet	24	"	Rs 1,200	29	-	29	
	Contingencies	Item	%	15	58	35	23	
	Sub-Total=				444	265	179	
3. Drainage-Improvement	Improvement of Existing Drainage	6,600	Ft.	Rs 2	13	-	13	
	Drainage Outlet	6	No.	1	6	-	6	
	Contingencies	Item	%	15	3	-	3	
	Sub-Total=				22	-	22	
4. Road Repair & Construction Equipment	Improvement of Feeder-road	8	Ml.	11	88	-	88	Excluding depreciation-cost of Construction machinery
	11-ton Bulldozer/Wide truck Shoes Type	2	No.	90	180	180	-	
	2-ton Dump-truck	2	"	18	36	36	-	
	2-ton Light-van Truck	1	"	13	13	13	-	
	Multipurpose Excavator - tire	1	"	90	90	90	-	
	Farm-Path Construction	8	Ml.	5	40	-	40	
	Farm Bridge	60	No.	Rs 250	15	13	2	
	Contingencies	Item	%	5	23	16	7	
	Sub-Total=				485	348	137	
5. Paddyfield Consolidation	Earth-works	770	Ac.	Rs 200	154	-	154	By Bulldozer
	Seepage-Proof Sheet Height: 1 ft	146	Ml.	1.2	176	176	-	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remark
						Foreign	Domestic	
	Field Outlet Block Works							
	Labour	7,000	Pcs.	Re 1	7	-	7	
	Material (Cement)	7,000	"		12	12	-	Agro-Industrial Products
	Feed Furrow							
	Labour	4	Mil.	3	12	-	12	
	Material (Cement & Reinforced Net)	4	"		22	22	-	
	Contingencies			15	58	32	26	
	Sub-Total=				441	242	199	
	Total=				1,665	924	741	
INITIAL IN-PUT FOR BETTER FARM-MANAGEMENT								
7. Farm-Machinery	Two-Wheel Tractor 13-14HP	40	No.	6	240	240	-	
	Thresher 500m/m	40	No.	1.4	56	56	-	
	Trailor 1 Ton	40	No.	0.6	24	24	-	
	Sprayer (Knap-sack type)	40	No.	0.5	20	20	-	
	Automatic Transplanting Machine	40	No.	2.5	100	100	-	
	Binder (Harvestor)	40	No.	6.7	268	268	-	
	Parts for the above machinery	Item	%	20	142	142	-	
	Sub-Total:				850	850		
8. Fertilizers	Ammonium Sulphate	257	Ton	Rs 320	82	82	-	
	Concentrated Superphosphate	132	"	460	61	61	-	
	Muriate of Potash	74	"	500	37	37	-	
	Contingencies		%	15	27	27	-	
	Sub-Total:				207	207	-	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remark
						Foreign	Domestic	
9. Farm-Chemicals	Pesticides (Usprun, Asogin, Kitagin, Dithen & Others)	Item	Allow	-	34	34	-	
	Insecticides (BHC, Smithion, EPN, Endrin & Others)	Item	Allow	-	46	46	-	
	Weedicides (PCP, PAM, CAT & Others)	Item	Allow	-	23	23	-	
	Contingencies		%	15	15	15	-	
	Sub-Total:				118	118	-	
Total=					1,175	1,175		
	Pump (engine-mounted)	1	No.	Rs 1,700	3.4	3.4	-	
	Winnower	2	No.	Rs 900	1.8	1.8	-	
	Parts for the above machinery	Item	%		21	21	-	
	Cultivating Tools	Item	Allow	-	6	4	2	
	Mammoty (30), Pickel (5), Hoe (10), Rake (10), Knife-toothes Scythe (30), Sickle (150), Rotary Weeder (10), Shovel (30)							
	Repair Tools	1	Set	-	20	20	-	
	Sub-Total:				258	256	2	
	Fertilizers							
	Ammonium sulphate	23	Ton	Rs 320	7.4	7.4	-	
	Concentrated Superphosphate	11	Ton	Rs 460	5.1	5.1	-	
	Muriate of Potash	7	Ton	Rs 500	3.5	3.5	-	
	Concentrated synthetic fertilizer	36	Ton	Rs 570	2.1	2.1	-	
	Lime, Silicate & Magnesia	38	Ton	Rs 100	3.8	3.8	-	Mixed manure
	Sub-Total:				22	22	-	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remark
						Foreign	Domestic	
	Farm-chemicals							
	Pesticide (Usplulum, Asozin, Kitazin, Dithame etc)	Item	Allow	-	6.7	6.7	-	
	Insecticide(BHC, Smithion, EPN, Endrin etc)	Item	Allow	-	7.6	7.6	-	
	Weedicide (PCP, PAM, 24-D, DCPA, Gezamil, CAT etc)	Item	Allow	-	5.3	5.3	-	
	Sub-Total:				20	20		
	Total:				584	438	146	
PILOT-FARM								
10. Paddyfield Pilot-Farm	Construction of Paddyfield (Earth-work)	4.2	Ac	3	13	-	13	by use of Bulldozer
	Drainage-works	1,300	Ft.	Rs 8	10	-	10	
	Intake & Field-irrigation facilities	1	No.	2	2	1	1	
	Contingencies	Item	%	15	4	-	4	
	Sub-Total:				29	1	28	
11. Upland Pilot-Farm	Clearing	10	Ac.	Rs 100	1	-	1	
	Farm Arrangement	10	Ac.	Rs 700	7	-	7	
	Farm-Pond Construction	1	No.		30	17	13	
	Irrigation facilities							
	Pump H=30' Q=12.6cuft/min.	1	No.	3	3	2	1	Gravity
	Pump H=150' Q=3.2cuft/min.	1	No.	4	4	3	1	Sprinkler
	Field-channel	1,900	Ft.	Rs 10	19	14	5	Pipe & Earth-channel
	Sprinkler Pipe	650	Ft.	20	13	13	-	
	Semi-permanent Sprinkler system	2	Ac.	3	6	6	-	
	Farm Road	1,600	Ft.	1	2	-	2	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remark
						Foreign	Domestic	
	Contingencies	Item	%	10	9	5	3	
	Sub-Total:				94	61	33	
12. Pilot-Farm-cum-Agricultural Mechanization Centre Building	Machinery-Depot	350	Sq.Yd.	Rs 80	28	-	28	
	Fertilizer-Shed	350	Sq.Yd.	Rs 80	28	-	28	
	Operation-Office	120	Sq.Yd.	Rs 100	12	-	12	
	Shutter (light-weighted)	300	Sq.Yd.	Rs 80	24	24	-	
	Washing Yard facilities	1	Set	3	3	1	2	
	Office equipment & accessories	1	Allow	15	15	13	2	Fans, Desks & Cabinets
	Measuring Apparatus	1	Set	30	30	30	-	
	Contingencies	Item	%	15	21	10	11	
	Sub-Total:				161	78	83	
13. Farm-machinery, fertilizers & farm-chemicals for Pilot-Farms	Farm-Machinery							
	Two-Wheel Tractor 6 PS	2	No.	Rs 2,500	5	5	-	
	– do – 9 PS	1	No.	Rs 4,200	4.2	4.2	-	
	– do – 14 PS	1	No.	Rs 6,000	6	6	-	
	Thresher 500 m/m	1	No.	Rs 1,400	1.4	1.4	-	
	Sprayer (Knap-sack type)	3	No.	Rs 500	1.5	1.5	-	
	(Trailed)	1	No.	Rs 10,000	10	10	-	
	Trailer 1 Ton	2	No.	Rs 600	1.2	1.2	-	
	Four-Wheeled Tractor	2	No.	Rs 14,000	24	24	-	
	Four-Wheeled Tractor Accessories:							
	Dump-trailer 2 tons	1	No.	Rs 6,000	6	6	-	
	Rotary-tiller	1	No.	Rs 3,400	3.4	3.4	-	
	Plough	1	No.	Rs1,700	1.7	1.7	-	
	Disc-plough	1	No.	Rs 3,400	3.4	3.4	-	
	Disc-harrow	1	No.	Rs 3,400	3.4	3.4	-	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remark
						Foreign	Domestic	
	Tooth-harrow	1	No.	Rs 1,700	1.7	1.7	-	
	Cultipacker	1	No.	Rs 1,700	1.7	1.7	-	
	Leveller (paddy)	1	No.	Rs 500	0.5	0.5	-	
	– do – (upland)	1	No.	Rs 900	0.9	0.9	-	
	Drill	1	No.	Rs 7,000	7	7	-	Seeds & manure
	Cultivator	1	No.	Rs 3,400	3.4	3.4	-	
	Ridger	1	No.	Rs 3,400	3.4	3.4	-	
	Duster	1	No.	Rs 3,400	3.4	3.4	-	
	Transplanter (paddy)	2	No.	Rs 2,500	5	5	-	
	Power Scythe	5	No.	Rs 900	4.5	4.5	-	
	Binder	1	No.	Rs 7,000	7	7	-	
	Combine-Harvester	1	No.	Rs 80,000	80	80	-	
	Drier 15 sq.yd plate-type	1	No.	Rs 3,500	3.5	3.5	-	For chilli cultivation
	Husker	1	No.	Rs 1,700	1.7	1.7	-	
	Rice-Polisher	1	No.	Rs 1,700	1.7	1.7	-	
	Chain-saw	2	No.	Rs 1,700	3.4	3.4	-	
	Cutter (straw)	1	No.	Rs 900	6.9	0.9	-	For making organic manure
	Engine 10 PS	2	No.	Rs 2,500	5	5	-	
	Pump Engine mounted	1	No.	1,700	3.4	3.4	-	
	Winnower	2	No.	900	1.8	1.8	-	
	Parts for the above machines	Item	%	10	21	21		
	Farmers' tools	Item	Allow	-	6	4	2	
	MAMMOTY (30), pickel (5), Hoe (10), Pake (10), Knife tooth scythe (30), Sickle (150), Rotary weater (10), Shovel (30)							
	Repair tools	1	set		20	20	-	
	Sub-Total				258	256	2	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remark
						Foreign	Domestic	
	Ammonium Sulfate	23	t	Rs 320	7.4	7.4	-	
	Concentrated Superphosphate	11	t	Rs 460	5.1	5.1	-	
	Muriate of Potash	7	t	Rs 500	3.5	3.5	-	
	Concentrated Syncthetic Fertilizer	36	t	Rs 570	2.1	2.1	-	
	Lime, Silicate and Magnesia	38	t	Rs 100	3.8	3.8	-	Mixed manure
	Sub-Total				22	22	-	
	Pesticide (Uspulum, Asozin, Kitagin, Dithane, Others)	Item	Allow		6.7	6.7	-	
	Insecticide (BHC, Smithion, EPN, Endrin, Others)							
	Weedcide (PCP, PAM, 24-D, DCPA Gezamil, CAT, Others)							
	Sub-Total				20	20		
	Total				584	438	146	
OPERATION & MAINTENANCE								
14. Operational Facilities & Their Maintenance	Measuring Gauge							
	Automatic Water Gauge for Dam	1	No.	26	30	23	7	30 feet
	– do –	1	No.	48	48	40	8	7 feet
	Automatic Gauge for Channel	2	No.	26	52	42	10	4 feet
	Meteorological Observation Facilities	1	Set	17	17	17	-	
	Telephone Facilities - Operational Service	1	Set	44	44	22	22	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remark
						Foreign	Domestic	
	Electric Facilities							
	Diesel Generator 40 KVA	2	No.	37	74	74	-	100V
	Diesel Generator House	2	No.	6	12	-	12	
	Poles & Accessories	2	Set	3	6	6	-	
	Wire & Switches	2	Set	4	8	8	-	
	Lamp & Accessories	2	Set	30	60	60	-	
	Installation	2	Set	8	16	-	16	
	Fuek Tank	2	Set	20.	40	36	4	
	Operation							Curreny system (Dept. of Irrigation) + 10 heads Fuel for Electric Facilities; Pumps & Pilot-Farm
	Labour	5	Years	30	150	-	150	
	Material	5	Years	32	160	-	160	
	Contingencies	-	%	15	107	49	58	
	Sub-Total:				824	377	447	
15. General Supervision & Control								
	Repairing of facilities	5	Year	10	50	25	25	
	Material for Office-use	5	Year	5	25	20	5	
	Labour	5	Year	6	30	-	30	
	Sub-Total:				105	45	60	
Others	Transportation charges & Vehicles							
	Fuel etc.	5	Year	10	50	-	50	
	Transport Allowance	5	Year	10	50	-	50	
	Vehicle maintenance	5	Year	15	75	25*	50	*Parts only
	Jeep	2	No.	16	32	32	-	
	Sub-Total:				207	57	150	
	Total:				1,136	479	657	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remark
						Forein	Domestic	
OFFICE-SPACE & EXPERTS' ACCOMMODATIONS								
16. Office-Space & Experts' Accommodations	Head Office	1	No.					
	Construction (Office)	500	Sq.Yd	Rs 110	55	-	55	
	– " – (Storage)	100	Sq.Yd	Rs 80	8	-	8	
	Medical facilities	1	Allow	20	20	20		Desks, Cabinets, Recopying machine, Calculator
	Office facilities							
	Experts' Living Quarters	15	No.					
	Construction	@150-250	Sq.Yd	Rs 120	360		360	Experts 10; Counterpart officers 5
	Domestic facilities	15	Set	6	60	60	-	Refrigerator, Air-condit
	Domestic Water Supply	1	Set	50	10	40	40	Kitchenets for Office & Living Quaters
	Class-room facilities	1	Allow	50	50	26	24	
	Contingencies	Item	%	15	97	23	74	
	Total				740	174	566	
BETTER-LIVING PROGRAMME								
17. *Conventional* Domestic Water Supply	Intake facilities							
	Well excavation	1	No.	10	10	-	10	
	Pump 10 HP	2	No.	12	24	24	-	1 spare pump
	Pump-House	1	No.	2	2	-	2	
	Delivery facilities							
	Delivery pipe dia.3"	4.5	1,000ft	4	18	18	-	
	Delivert Tank 40 c.yd	1	Set	16	16	8	8	
	Supply facilities							
	Main pipe dia. 4"	9	1,000ft.	5	45	45	-	
	Distribution pipe dia. 1½"	20	1,000ft.	3	60	60	-	
	Outlet & Water-tap	24	Set	0.5	12	4	8	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency Component		Remark
						Forein	Domestic	
	Installation							
	Contingencies	Item	%	15	28	24	4	
	Total:				215	183	32	
AGRICULTURAL CO-OPERATIVE DECELOP-MENT								
18. Co-operative Head-quarters Building & Facilities	Co-op. Headquarters Building							
	Construction	400	Sq.Yd.	Rs 100	40	-	40	
	Godown Construction	700	Sq.Yd.	80	56	-	56	
	Office Facilities	Item	Allow	sum	15	10	5	Desks, cabinets, etc.
	Material for Information & Education				2	1	1	Slide-projector, Movie
	Miscellaneous items & Maintenance	Item	Allow	sum	10	2	8	& films, books etc.
	Sub-Total:				123	13	110	
19. Transport facilities	Garage	300	Sq.Yd.	Rs 80	24	-	24	
	Motor-vehicles							
	1 Ton truck	5	No.	8	40	40	-	
	6 Ton truck	1	No.	30	30	30	-	
	Micro-Bus	1	No.	25	25	25	-	Accommodating 25 perso
	Light-Van	2	No.	7	14	14	-	
	Gasoline-stand	1	Set	25	25	25	-	
	Spare-parts & accessories	Items	%	10	6	6	-	
	Maintenance	Items	Allow	sum	5	-	5	
	Contingencies	Item	%	10	17	-	17	
	Sub-Total:				186	140	46	
20. Wire-Broadcasting Apparat us	Amplifer set	1	No.	8	8	8	-	

Item	Description of Items	Q'ty	Unit	Rate	Total Cost	Currency. Component		Remarks
						Foreign	Domestic	
	Poles & wires	Itemq	Allow	sum	13	13	-	
	Speakers	10	No.	1	10	10	-	
	Radio set & antenna	1	No.	1	1	1	-	
	Record set & records	Item	Allow	1	1	1	-	
	Miscellaneous items	Item	Allow	sum	2	2	-	
	Contingencies	Item	%	30	11	4	7	Installation works
	Sub-Total:				46	39	7	
	Total:				355	192	163	
AGRO-INDUSTRY DEVELOPMENT								
21. Concrete Product Machinery								
	Concrete Mixer 8 cubft capacity	1	No.	2	2	2	-	
	Belt conveyer	1	No.	1.5	2	2	-	
	Table Vibrator 3' x 3'1	2	No.	4	8	8	-	
	Steel Panel Form							
	Feed-channel plate	300	Pcs.	Rs 33	10	10	-	
	Field-block	150	"	" 83	13	13	-	
	Tools	2	Se	1	2	2	-	
	Forming oil	3	200	0.3	1	1	-	
	Fork-lift (four-wheeled)	1	No.	13 13	13	13	-	
	Contingencies	Item	%	20 20	11	6	5	
	Sub-Total:				62	57	5	
22. Wood-Working Machinery	Wood-working machinery	Item	Allow		41	23	18	
23. Poultry facilities	Poultry facilities	Item	Allow	sum	6	5	1	
	Total:				109	85	24	

Chapter XI: Economic Justification of the Project

11-1: Investment Criteria

Investment under the following six headings is being visualized for implementation of this project:

No.	Schemes:	Contents:
1	Infra-Structural Renovation	Improvement of irrigation-drainage facilities, roads and paddyfields
2	Betterment of Farm-Management	Initial input in term of farm-machinery, fertilizers and farm-chemicals
3	Pilot-Farms & Agricultural Mechanization Centre	Construction of buildings and farms as well as equipment of facilities
4	Agricultural Co-op Development	Construction, building and equipment
5	Agro-Industry Development	Machinery for experimental operation
6	Better-Living Programme	Conventional domestic water-supply

Investments which will be made for Schemes No. 1 and No. 2 are expected to bring about direct benefits in term of increased agricultural production in the project-area. That for Schemes No. 3, No. 4 and No. 5 will generate more or less 'added-value' through their operation on self-paying basis but estimation of their benefits is rather difficult at pre-investment stage. Investment for Scheme No. 6 is primarily for betterment of living conditions of the residents and, therefore, is not meant for creation of any direct economic benefits.

Cost-benefit trial balance sheet called for economic justification of the project will possibly be prepared as for Schemes No. 1 and No. 2, through tentative comparison between the total inputs (capital, interest and maintenance-cost) and their total outputs (estimated value of incremental agricultural production), but not for other Schemes. Recapitulation of main features of their intended benefits will suffice for other investment items.

11-2-1: Benefits from Direct Investment

(Benefits accruing to the immediate project-area)

The balance between the net-profit being raised from agricultural production on 770 acres of paddyfield and 100 acres of upland-field and the net-profit available therefrom upon completion of the project will stand as benefit attributable to the Direct Investments under Schemes No. 1 and No. 2.

Current net-profit (gross-profit minus production-cost) from agricultural operation in the project-area (see 2-5: Actual State of Farmers, under Chapter II: Current Situations in Dewahuwa of this Report) is estimated at Rs 114,600, as follows:

	Gross profit per ac	Production cost per acre	Net profit per ac	Acreage under Operation	Total net-profit
Paddy (Maha season)	Rs 540	Rs 400	Rs 140	770 ac	Rs 107,800
Upland-crops (represented by upland paddy)	Rs 300	Rs 260	Rs 40	170 ac	Rs 6,800
	TOTAL:			940 ac	Rs 114,600

Through implementation of the project, the current pattern of agricultural operation will be replaced by more advanced one as summarized in the below:

(1) Yield of paddy will be raised from 45 bushels to 90 bushels per acre during Maha season;
(2) Paddyfield will be utilized for cultivation of paddy on 1/3 of its acreage and for production of chilli on another 1/3, during Yala season, and
(3) Acreage of upland-field under operation will be enlarged from the current 170% to 200%.

Consequently:

	Gross profit per ac	Production cost per acre	Net-profit per ac	Acreage under Operation	Total Net-Profit
Paddy (Maha season)	Rs 1,080	Rs 640	Rs 440	770 ac	Rs338,800
" (Yala season)	720	520*1	200	250 "	50,000*2
Chilli (Yala season)	1,320	1,140	180	250 "	45,000
Upland-crops (represented by upland-paddy)	600	510	90	200 "	18,000
	TOTAL:			1,470 ac	Rs451,800

Note: *1 & *2 = Yield of paddy per acre and its production cost during Yala season are estimated at 2/3 and 4/5, respectively, of those during Maha season.

Net-profit upon completion of the projec. (Rs 451,800) -
Current net-profit (Rs 114,600) = Benefit (Rs 337,200)

(Benefits spilling over to non-project area)

Benefits attributable to more rational utilization of Dewahuwa Tank-water due to the project are not confined within the project-area alone but extend to the whole Dewahuwa Scheme area. Upon completion of the project, the whole area of Dewahuwa Scheme will be assured with full supply of water during Maha season and, even during Yala season, paddy-cultivation on approximately 1/3 of its paddyland will become feasible. Second cropping of paddy during Yala on 1/3 of the paddyland alone will bring Rs 20,800-worth additional net-profit to the farmers in middle-and lower-stream areas of Dewahuwa (yield of paddy per acre and its production-cost during Yala season have been estimated at 2/3 (30 bushels) and 4/5 (Rs 320), respectively, of those during Maha season):

	Gross-income per acre	Production-cost per ac	Net-profit per acre	Acreage sown	Total Net-profit
Paddy (Yala)	Rs 360	Rs 320	Rs 40	420 acres	Rs 20,800

Project-area (Rs 337,200) + Other Dewahuwa area (Rs 20,800) = Rs 358,000

11-2-2: Benefits from Indirect & Public Investments

(1) Better-Living Programme:

Availability of water on the highland of the project-area will be very much facilitated by installation of conventional domestic water-supply equipment. 11 public wells and the privately-dug wells, one for each two families there, do not satisfy their need during Yala season.

(2) Pilot-Farms & Agricultural Mechanization Centre:

These facilities will help establishing definite patterns of farming in the project-area and Dewahuwa Scheme region. Hand in hand with the Government's Mahailluppalama station, our Pilot-Farms and their demonstration-fields will contribute for development of agriculture in the Dry-Zone of Ceylon.

(3) Development of Agricultural Co-operatives:

This project puts the maximum emphasis on development of the Agricultural Co-operation which is expected to play a leading role in production-increase and livelihood-improvement in the project-area. Co-op services in credit, marketing & supply, farm-management guidance,

agroindustry & utilities, welfare, information and education will be offered to its people in the best integration so that their multiplying-effects will accelerate the tempo of overall developmental processes. Agricultural Co-operatives to be developed in the project-area will be managed on self-paying basis and the facilities whose maintenance and control is entrusted with it will be put into use for general convenience of the people of the area at the minimum cost of the beneficiaries.

(4) Agro-Industries:

Industrial undertakings meant for mobilization of more material and labour left under-utilized in the rural area with less capital-input comparative to the size of employment and income therefrom are of great economic importance in the Dry-Zone, particularly during Yala season. A number of tentative programmes, some with a modest initial investment in term of machinery for experimental purposes, are under consideration. Re-organized DBMPCS will be offered with continuing assistance in developing appropriate industrial ventures under this project.

11-3: Economicality of the Project

Economicality of the direct-investment part of the project will be examined here on the basis of socio-economic survey conducted in the year preceding to commencement of the project (that is 1969).

11-3-1: Annual Incremental Net Benefit

Improvement-effects of the project on the productivity-increase are supposed to work through annual incremental process until it reaches at a specific turn-over at the end of the fifth year. Assuming the economic useful life as 30 years and the annual interest-rate at 6%, an annual incremental net benefit will be calculated at Rs 300,000.

Year	Net Incremental Profit		Its present worth	
1	Rupee	0	Rupee	0
2	Rupees	89,500	Rupees	79,000
3	"	179,000	"	150,300
4	"	268,500	"	212,700
5	"	358,000)	"	
⋮		⋮)		
		)		
		)		
		)	Rupees	3,687,400
		)		
		)		
30	Rupees	358,000)		
	TOTAL:		Rs	4,130,100

Annual incremental net profit =

Rs 4,130,100 x 0.07265 = Rs 300,100

(0.07265 = Capital - recovery factor)

11-3-2: Annual Cost & Expenditure

The above-calculated profit is due to direct-investments meant for infra-structural renovation and initial input for betterment of farm-management in the project-area. The investment for betterment of farm-management, in fact, assumes the form of the annual production-cost meant for incremental net-profit year after year, hence infra-structural renovation investment alone stands as annual cost involved in our estimation.

At the assumed annual interest-rate of 6%, the total of the annual costs for infra-structural renovation will come to Rs 103,000:

Year	Infra-Structural Renovation Cost	Its present worth
1	Rs 80,000	Rs 75,500
2	Rs 600,000	Rs 534,000
3	Rs 600,000	Rs 503,800
4	Rs 385,000	Rs 305,000
Total	Rs 1,665,000	Rs 1,418,300

Annual Cost: Rs 1,418,300 x 0,07265 = Rs 103,000

(0,07265 = Capital - recovery factor)

11-3-3: Annual Operation Cost

For maintenance and operation of the structures newly built under the project, an incremental annual cost of Rs 19,000 will be reqired, in addition to Rs 400 as for depreciation or replacement-cost of the pumps (supposing their economic useful life lasts for 15 years).

Replacement-cost of Pumps = Rs 15,000
Present-worth of Pumps = Rs 5,900 (Rs 15,000 x 0.3936)
Annual-cost of Pumps = Rs 400 (Rs 5,900 x 0.07265)

11-3-4: Benefit-Cost Ratio

(i) Annual Incremental Benfit	Incremental net-profit:	Rs 300,100
	Incremental maintenance & operation-cost (−)	Rs 19,400
	Total:	Rs 280,700
(ii) Annual Cost		Rs 103,000
(iii) Benefit-Cost Ratio		$\frac{\text{Rs } 280{,}700}{\text{Rs } 103{,}000} = 2.7$

11-4: Evaluation of Economicalities on the Part of the Farmers.

Although the entire cost incurrable for implementation of the project will be borne by two Governments of Japan and Ceylon, evaluation of the economicalities of the project on the part of the farmers will need to treat such cost as if it were due to a long-term loan advanced on behalf of the beneficiary farmers. On this assumption, the cost to be taken into account will be confined to such investments which are meant for direct production-increase:

Infra-structural renovation works	:	Rs 1,482,000
Initial Input for Better Farm-Management:		Rs 1,175,000
Farm-machinery:	Rs 850,000	
Fertilizers :	Rs 207,000	
Farm-chemicals:	Rs 118,000	
	Total:	Rs 2,840,000

It is to be noted, however, that irrigation part of the above infra-structural renovation works amounting to Rs 273,000 covers the whole Dewahuwa Colonization Scheme area (2,330 acres) and, therefore, the equivalent cost for our immediate project-area (770 acres) is Rs 90,000 only. Among the initial input for better farm-management, fertilizer and farm-chemical are to be paid for year after year as production-cost and, accordingly, do not necessarily require long-term loan for their annual application. Under the financing system established in Ceylon to facilitate for paddy-cultivation, fertilizers and farm-chemicals are provided in kind as a part and parcel of the Paddy Cultivation Loan: in our estimation of paddy production cost (2-5-5: Farm Economy, under Chapter II of this Report), 10% of their cost has been appropriated for as interest-payable. Thus, farm-machinery alone will remain as the item dependable on long-term borrowings. Consequently, the works supposed to be undertaken by long-term borrowings on the part of the farmers would be:

Infra-structural renovation work:	Rs 1,482,000
Initial input for better farming:	Rs 850,000
Total:	Rs 2,332,000

In securing the above amount of money required for execution of this kind of developmental work, the following loan facilitation will be possibly arranged for:

Case No.	Terms of Borrowing	Interest-rate	Period for Amortization
1	Unredeemable for the first 5 years (only interest is to be paid)	6%	10 years
2	– do –	"	20 "
3	– do –	"	25 "
4	– do –	3.5%	10 "
5	– do –	"	20 "
6	– do –	"	25 "
7	– do –	"	30 "

Under the above terms and conditions, the amount loanees will have to pay per acre per year will be between Rs 364 and Rs 146, as follows:

Case No.	Borrowings	Annual Amortization	Annual Amortization per acre
1	Rs 2,332,000	Rs 316,800	Rs 364
2	– " –	" 203,300	" 234
3	– " –	" 182,400	" 210
4	– " –	" 280,400	" 322
5	– " –	" 164,100	" 189
6	– " –	" 141,500	" 163
7	– " –	" 126,800	" 146

(Note: In the above calculation, the total holdings of the beneficiary farmers are supposed to be 870 acres.)

Taking the Colonist in the project-area, as an example, who can hope for additional income of Rs 2,230 from the improvements due to 4.5 acres out of his total holdings of 4.6 acres, redemption of such long-term loan is possible out of his additional income at the following ratio:

Case No.	Annual Amortization per ac	(A) Annual Redemtion by Colonist	(B) Additional Income to the Colonist	$A/_B$
1	Rs 364	Rs 1,638	Rs 2,230	73%
2	" 234	" 1,053	– " –	47%
3	" 210	" 945	– " –	42%
4	" 322	" 1,449	– " –	65%
5	" 189	" 851	– " –	38%
6	" 163	" 734	– " –	33%
7	" 146	" 657	– " –	29%

The terms and conditions on which long-term loans might be available for infra-structural renovation and better farming thereupon would have considerable influences on the farmers' financial position. Marginal propensity to save among the Ceylonese farmers would account for another important factor in this connection. In case, for instance, the ratio of amortization out of incremental income should be less than their marginal propensity to save, this type of agricultural development scheme would become less burdenous on the part of the individual farmers and, accordingly, more acceptable. Grants-in-aid or subsidies offerable by the Government on behalf of the farmers willing to undertake this type of developmental work will proportionately bring down the ratio of amortization out of the additional income accruing from the development venture and help 'spilling-over' of our experiment in the project-area to other regions.

Long-term financial accommodation now possible for this type of venture within the framework of domestic banking might not allow application of more favourable terms than those for Cases No. 2 and No. 3 in the above. International Banks, such as the IBDR and the Asian Development Bank, for instance, or the developed aid-giving nations might as well be approached for provision of liberal termed credits which should make Cases Nos. 5 to 7 possible for the benefits of the Ceylonese farmers.

Chapter XII: Annual Schedules for Implementation of the Project

12-1: Implementation Programme (1969-1974)

Tentative schedule for implementation of the project extending for full five years from the budgetary point-of-view is given on Table 12-1 (Budgetary Operation Schedule) and Table 12-1 (Time Schedule).

12-2: Timing of Deputation of Experts & Specialists from Japan

As shown on Table 12-3. Local co-ordination team which is expected to be provided by the Government of Ceylon is given on Table 12-4.

Table 12-1: Budgetary Operation Schedule
(Unit = 1,000 Rupees)

Item	Total	PERIOD					
		1969	1970	1971	1972	1973	1974
Infra-Structural Renovation	1,665	80	600	600	385	0	0
Initial Input for Better Farm-Management	1,175	110	320	310	260	175	0
Pilot-Farms	584	60	290	170	24	22	18
Agricultural Co-operative Development	355	0	100	150	55	50	0
Agro-Industry Development	109	0	80	10	10	9	0
Better-Living Programme	215	0	0	10	130	75	0
Operation and Maintenance	1,136	90	410	250	148	126	112
Office-space & Accommodations	740	90	400	140	60	30	20
Landing & Inland Transportation	221	20	100	60	28	13	0
TOTAL	6,200	450	2,300	1,700	1,100	500	150

Table 12-2: Time Schedule

		69 Oct	70 Apr	70 Oct	71 Apr	71 Oct	72 Apr	72 Oct	73 Apr	73 Oct	74 Apr	74 Oct
		Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala	
Infra-Structural Renovation:												
Paddyfield irrigation	273											
Uplandfield irrigation	444											
Drainage	22											
Road	151											
Field consolidation	441											
Construction-equipment	334											
	1,665											
Initial Input for Better Farm-Management:												
Farm-machinery	850											
Fertilizer	207											
Farm-chemical	118											
	1,175											
Pilot-Farms:												
Paddy Farm	29											
Upland Farm	94											
Farm Buildings	161											
Farm-machinery	258											
Fertilizer	22											
Farm-chemical	20											
	584											
Better-Living:												
Domestic Water-supply	215											
Agric. Co-op:												
Wired-Broad-casting	355											

Table 12-2: Time Schedule –(2)–

Item	Cost	69 Oct	70 Apr	70 Oct	71 Apr	71 Oct	72 Apr	72 Oct	73 Apr	73 Oct	74 Apr	74 Oct
		Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala	
Agro-Industry Development:												
Concrete Products Machinery	109											
Operation & Maintenance:												
Operation Facilities & Operation	824											
Maintenance	105											
Transportation Charge	207											
Office-space & Accommodations:	740											
Landing & Inland Transportations:	221											
TOTAL:	6,200											

Table 12-3: Deputation of Experts & Specialists from Japan

Length of Deputation & Category	Assignment of Duty	Number	Duration of Service
Long-Term	Project-Manager	1*	For full 5 years
	Paddy-cultivation	1*	– do –
	Upland-crops & vegetables	1	– do –
	Irrigation-Drainage	1*	– do –
	Farm-machinery	1	– do –
	Agricultural Co-operation	1*	– do –
	Paddyfield consolidation	1	For the first 2 years only
	Agricultural-extension	1	Since the 3rd year
	Liaison	1	For the 1st one year only
		9	
Short-Term	Experts, specialists and Engineers on such as Construction (Buildings, electrical works, water-supply works etc), Better-Living, Agro-Industry and Sociologist will be deputed on short-term basis.		
Japan Overseas Co-operation Volunteers	Agricultural Engineering	2	One for the first 2 years and the other for full 5 yrs.
	Construction-machinery	1	For the first 2 years
	Farm-machinery	1	For full 5 years
	Agricultural Co-operation	1	– do –
	Upland-crops & vegetables	2	One for the first 2 years and the other for full 5 years.
	Paddy-cultivation	2	Since the 3rd year.
		9	
Colombo-Plan Experts	Medical personnel Teaching staff	Necessary number of personnel may be deputed as required in the course of project-implementation.	
Note = (*) marked 4 people among the long-term experts and specialists will be assigned on duty from October 1969 as Colombo Plan Experts, even when the Agreement may not be signed beforehand.			

Table 12-4: Local Co-ordination Team to be provided by the Government of Ceylon

Category	Assignment of Duty	No.	Remarks
Project-Members	Director	1	Non-resident
	Counterpart-officials:		
	Paddy-cultivation	1	Resident-officer
	Upland-crops & vegetables	1	– do –
	Farm-machinery	1	– do –
	Irrigation	1	– do –
	Agricultural Co-operation	1	– do –
	Agricultural Extension	1	– do – (from the 3rd yr.)
	One of the counterpart-officials will be nominated Co-Project-Manager.		
Administration & Maintenance staff	Clerks	2	
	Typist	1	
	Construction-machinery Operator	2	
	Driver	2	
	Pilot-Farm labourer	4 – 6	
	Helper	2	
	Watchman	1	

APPENDICES

(i) Analysing Tables & Appraisal Table for Selection of Project-area out of 8 Candidate-Sites:

(ii) Map Showing the Location of 8 Candidate-Sites:

(iii) Mr. Mahadeva's Letter addressed to Dr. Fukuda in Finalization of the Project-area:

(iv) Memorandum submitted by the Team to Mr. Banda upon Completion of its Mission:

(v) Record of Discussion between the Mission and the Government of Ceylon:

(vi) Mr. Mahadeva's Letter addressed to Mr. Ohto re. "Record of Discussion".

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Appendix: (i)

ANALYSING TABLES AS TO THE EIGHT CANDIDATE-SITES FOR CEYLON - JAPAN JOINT AGRICULTURAL DEVELOPMENT SCHEME

Table 1: Basic Information
Table 2: Socio-Economic Conditions
Table 3: Agricultural Operation
Table 4: Physical . Infra-structure

Survey Date: 20.2.69 to 24.2.69

Members of Survey Team:

(Japanese)	(Ceylonese)
Dr. H. Fukuda	Mr. D. Wijesinghe, My/A & F.
Mr. T. Kimura	Mr. J. A. Lewis, Dept. of Agriculture
Mr. T. Sasaki	Mr. N. D. Karunaratne, I. D. B.
Mr. K. Ohashi	Mr. P. L. N. De Silva, Dept. of Agr. Services
Mr. T. Handa	Mr. S. V. A. Buddhadasa, Irrigation Dept.
Mr. T. Kusano	Mr. T. B. Subasinghe, My/A & F.
	Mr. S. Natesan Dept. of Agriculture

Colombo.
25.2.69

TABLE - (1)

BASIC INFORMATION

	(1) Kela-Halmillawa	(2) Ranawa	(3) Dewahuwa	(4) Mahagal-kadawela	(5) Uriyawewa	(6) Bandara-Koswatte	(7) Meddekettiya	(8) Kirindigalla
Location (Topo Sht. #)	F/25 Dambulla N-W. 12ML	F/25 Dambulla N-W.10ML	I/5 Dambulla WEST 15ML	F/18 Anuradhapura South 26ML	F/22 Anamaduwa (Puttalam-Kurunegala North 6ML)	I/8 Kurunegala N-W. 20ML	I/9 Kurunegala N-E. 18ML	I/3 Kurunegala North 25ML.
Characteristics of Village	Traditional Village(Purana)	Traditional Village	Colonization Scheme	Traditional Village	V.E.Scheme	Traditional Village	Traditional Village representing those located	Traditional Village
Climatic Conditions	Dry Zone	Dry Zone	Dry Zone	Dry Zone	Dry Zone	Intermediate Zone (Having extensive Coconut Plantation as Hinterland)	Inter Zone	Intermediate
Land Utilization*								
MAHA (Lowland (Paddy)	150	300	2,300	160	300	200	178	135
(Upland (veg.)	50**	30*	1,500 (Plan)	60	(Unsatisfac-tory)	300 (chena)	50*	50*
YALA (Lowland (Paddy)	50	100 (Not dependable)	600	80	(Not depen-dable)	150	50	(Not depen-dable)
(Upland (veg.)	Nil	Nil	Almost nil	Almost nil	Nil	Almost nil	Almost nil	– " –
Population								
Total	430	505	4,500	650	300	1,150	800	515
Farmhousehold	88	83	590	140	50	220	200	103
Literacy (%)	40	40	60	60	50	60	85	60

** Excluding Chena Cultivation.

* To be checked with basic village statistics from Dept. of Census & Statistics.

TABLE - (2)

SOCIO-ECONOMIC CONDITIONS:

AGRICULTURAL CO-OPERATIVE	Kela-Halmillawa	Ranawa	Dewahuwa	Mahagal-Kadawela	Uriyawewa	Bandara-koswatta	Meddekettiya	Kirindigalla
Membership	Covered by Devahuwa	Covered by neighbouring Co-op.	Doing well	$150^{m}/135^{f}$			$10^{m}/33^{f}$	
Outstanding Loan				Rs 15168.25	Rs 250/acre	Rs 24,000	Rs 14,000	Not existing
Recovery rate	95%	95%	95%	5%	70%	67%	64%	
Consumer service	Yes	No.	Yes	Nil	Yes	Yes	Yes	
ITS RELATIONS WITH OTHER FARMERS' ORGANISATIONS	Fairly well	Rather dubious	Quite good	Good	Not very good	Not satisfactory	Good	Bad
AVERAGE INCOME PER HOUSE-HOLD (per annum)	Rs 1000	Rs 1280	Rs 3000	Rs 500	Rs 500	Rs 500	Rs 750	Rs 500
VILLAGER-COMPOSITION								
Singhalese	100% (more Kandyan)	100% (more Kandyan)	90% (half low country)	98%	Mostly Kandyan 99.5%	Kandyan 67%		Kandyan 100%
Tamil	–	–	–	0.5%	0.5%	–		–
Others	–	–	10% (Moors)	1.5%	–	33%		–
LAND-TENURE (Holding C%/ Household C%)	L F	L F	L F	L F	L F	L F	L F	L F
Land-owner	– –	– –	– –	– –	– –	60% 30%		50% 9%
Owner-farmer	100% 95%	100% 90%	100% 100%	100% 80%	100% 95%	40% 60%		50% 74%
Tenant	– –	– –	– –	– –	– –	– –	– –	– 17%
Agricultural labourer	5%	10%	– –	– 20%	– 5%	– 10%	– 30%	– –
VILLAGE-INDUSTRIES								
Current (Kinds)	Carpentry	Blacksmithy		Nil	Nil	Carpentry, Blacksmithy, Weaving, Bidi		

TABLE - (3)

AGRICULTURAL OPERATION	Halmil-Lawa	Ranawa	Devahuwa	Mahagal-Kadawela	Uriyawewa	Bandara-koswatta	Meddeketiya	Kirindigalla
A. PADDY	H4-80%	H4-60%	H4-80%	H4-60%	H4-80%	H4-80%	H4-75%	H4-30%
Variety (% sown)	H8-5 %		H8-20%	H8-10%		H8-20%	H8-15%	H8-25%
H-4, H-8	Others-15%	Others-40%		IR-8-2%	Others-20%		IR8-2%	Others-45%
IR-8, Others				Others-28%			Others-8%	
Yield per Acre (in bushels)	H4) H8) 50 Bus.	H4-50Bus.	H4) H8) 60 Bus.	H4) H8) 40Bus.	H4-40 Bus.	H4) H8) 40 Bus.	H4) H8) 40 Bus.	H4) H8) 40 Bus.
	Others 40Bus.	Others 35 or 40 Bus.		Others 30 Bus.	Others 30 Bus.		Others 35 or 35 Bus.	Others 25 Bus.
Application of Fertilizer (% of area)	5%	10%	45 or 50%	5%	40%	50%	10%	50%
Fertility of Soil (degree)	Fertile	Fertile	Fertile	Less Fertile	Less Fertile (Alkali soil)	Not Fertile (Sandy)	Less Fertile	Less Fertile (Alkali Soil)
Prevalence of Pests/Diseases (degree)	Little	Little	Little	Little	Little	Little	Little	Little
Mechanization (degree)	Very Little	Very Little	Better	Little	Little	Little	Little	Little
Availability of Mills (Number)	NIL	1	3	NIL	NIL	NIL	NIL	1
B. VEGETABLES	1.Pumpkin	1.Pumpkin	1.Pumpkin	1.Tomato	1.Pumpkin	1.Brinjal	1.Cucumber	1.Pumpkin
Varieties	2.Brinjal	2.Brinjal	2.Brinjal	2.Brinjal	2.Cucumber	2.Pumpkin	2.Pumpkin	2.Cucumber
	3.Chillies	3.Tomato	3.Chillies	3.Snakegourd	3.Brinjal	3.Cucumber	3.Tomato	3.Tomato
	4.Tomato	4.Chillies	4.Snakegourd	4.Pumpkin	4.Chillies	4.Chillies	4.Brinjal	4.Egg Plant
	5.Cucumber	Maize	Maize	5.Maize	5.Radish	5.Tomato	5.Chillies	5.Chillies
	Maize	Gingelly	Tobacco	6.Red Onions	Maize	Gingelly	6.Beans	6.Gingelly
	Gingelly	Millets	Gingelly	7.Chillies	Gingelly	Maize	Gingelly	Maize
	Millets		Mellets	Gingelly	Millets	Millets	Maize	Millets
				Millets			Millets	
Production (degree)								
Purpose of Production								
Own Consumption	80%	80%	50%	80%	70%	85%	100%	80%
Sales	70%	20%	50%	20%	30%	15%	–	20%

C. LIVESTOCK & POULTRY Kind & Number	Buffaloes Meat Cattle	– do –	– do – Poultry	– do –	– do –	– do –	– do –	– do –
Potentialities (Kinds)	Fruit Processing Vegetable " Milk " Meat " Basket Weaving	Fruit and Vegetable Processing Milk and Meat Processing Wood-Based Industries	i) Agricultural Waste Processing (1) Rice Bran (Provendep) (2) Paddy straw bags and mats (3) Tobacco products ii) Vegetable & Fruit Canning iii) Fish culture & Canning iv) Pottery, Basket & Handicrafts v) Hand-looms vi) Meat & Milk products	Gunny bags from locally available material/ tiles and bricks, Pottery, Fishing	Furniture & Cottage Industries		i) Coconut Based Industries: (Brooms, baskets cadjans etc.) ii) Vegetable & Fruit Canning iii) Fisheries	Improvement of the above.

TABLE - (4)

PHYSICAL INFRA-STRUCTURE	(1) Halmil-Lawa	(2) Ranawa	(3) Devahuwa	(4) Mahagal-Kadawela	(5) Uriyawewa	(6) Bandara-koswatta	(7) Meddeketiya	(8) Kirindigalla
IRRIGATION								
Irrigation Tank (Main) History	Ancient	Ancient	New Scheme Colonization	More than 100 years?	Augmentation	Ancient	Ancient/ Restor-ation	Ancient/ Restor-ation
Catchment-Area (sq.miles)	3.6	6.6	26.0	–	–	2.3	–	3.5
Capacity (acre-feet)	210	330	8800	–	900	300	–	550
Duration of H.W.L.								
Months	Dec or Jan	Nov. or Dec	Dec.	Nov. or Dec.	Oct. or Nov.	Dec. or Jan.	End of Dec.	Oct. or Dec.
Spill-Over (past 12 months)	NO	NO	NO (56,59,64,65,69)	Dec. 2 weeks (64,65,66-NO)	NO	over one month	YES	YES
Duration of L.W.L.								
Months	Aug.	Aug.	Aug.	Aug.	Aug.	Jul. or Aug.	Aug.	Jul. or Aug.
Completely dried (Yes/No)	YES	YES(1968)			YES	Only 1956	NO	NO
Necessity for Improvement	YES	YES	Not req.	YES	Very much	YES	YES	YES
Potentialities for increased capacity	YES (desilting benefitted from Mahaweli)	YES	NO	little (desilting)	little (desilting)	little (desilting)	little (desilting)	little (desilting)
Availability of Irrigation Facilities								
Main canal	Available	Available	good	Available	Available	Available	Available	Available
Branch "	poor	poor	Available	None	None	None	None	Poor
Field & control	None	None	Poor	None	None	None	None	None
DRAINAGE CONDITIONS	Poor	Poor	Natural Not so good	Poor	Fair	Fair	Poor	Poor
WATER-MANAGEMENT	C.C.	C.C.	C.C./I.D.	C.C.	C.C.	C.C.	C.C.	C.C./I.D.
WATER-MAINTENANCE	NIL	NIL	Poor	NIL	NIL	NIL	NIL	Poor
LAND CONSOLIDATION								
Field Allotment Size	0.2 AC more or less	0.2 AC	0.1 or 0.2 AC	0.1 AC	0.1 or 0.2 AC	0.1 or 0.2 AC	0.1 or 0.2 AC	
Fragmentation	Some	Some	NIL	Much	Some	Some	Much	Some

TABLE - (4) (Contd.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Levelling	Better	Better	Poor	Better	Poor	Poor	Better	
Farm-Road	NIL	NIL	Only trunk conditions bad	NIL	NIL	NIL	NIL	NIL
*TRANSPORT (Accessibility)	Poor	Poor	Good	Good	Poor	Good	Good	Fair

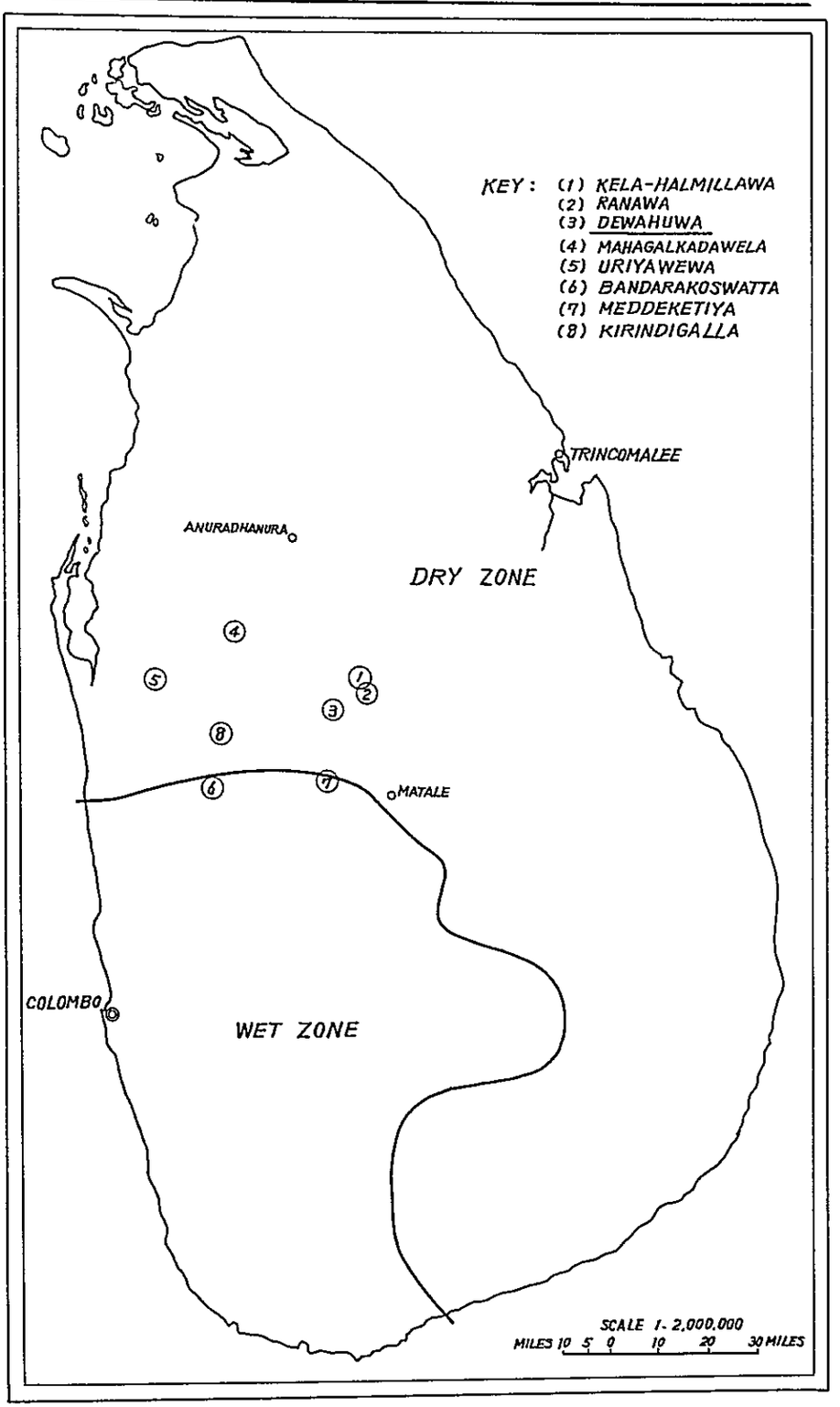
* Accessibility
** Nearness to grid

Key : C.C. - Cultivation Committee through Agrarian Services
I.D. - Irrigation Department

APPRAISAL TABLE

	Socio-Economic Conditions	Agricultural Operation	Physical Infra-structure	Comments
KELEHAMILLAWA	Cultivators are peacefully co-existent. Almost exclusively owner-farmers. Presumably too small sized as our project area.	Fertile soil bringing a considerably good yield inspite of less fertilizer input. Limited supply of water is impediment for development.	Poor reservoir capacity. Needs improvements on in-take and spillway. Connection with proposed Mahaweli Project will benefit this area	Though it is imperative to augment irrigation water, it is physically difficult until Mahaweli connection is possible. Accessibility is also very poor
RANAWA	Lacks co-operative organization.	The use of improved varieties of paddy and fertilizer is low More than 50% of the acreage of paddy land available is not cultivated even during the Maha season	Almost similar to above. Needs additional branch canals for irrigation purposes	Conspicuous improvement will result within a comparatively short period of time if existing cultivation committees will co-ordinate under wise guidance.
DEWAHUWA	Paddy field productivity is comparatively high. Cultivators' enthusiam for increased production is also high.	Paddy soil however has high permeability. There are good possibilities of lift irrigation of the highland	Improvements to water control as well as water management is required. Upland irrigation is feasible through pumping. Land consolidation will be required for a successful mechanization.	Out of the total 2,330 acres about 500 acres could be selected as the first stage of our development scheme, including both paddy and upland. Out of 5 Cultivation committee areas picked up one to start with. Exploitation of water issue for hydro power appears to be feasible for agro-industrial purposes.
MAHAGALKADEWELA	Co-operative Society is not functioning satisfactorily. Unity among villagers is not satisfatory	Agricultural productivity is low. 400 acres of land is available for new cultivation provided there is adequate water supply.	Improvements to the tank will not increase its capacity Irrigation system is not satisfactory. Levelling of paddy fields is poor.	A considerably long time approach will be required to bring about a social impact on development.
URIYAWEWA	In spite of high literary current livelihood is rather poor.	60 percent of the paddy tract is alkaline. Increased inputs of fertilizer may not bring about increases in productivity. Water shortage is very acute even at present.	Augmentation of tank capacity is almost impossible. Canals need lining	Potentialities for development are there if physical impacts will be given, including augmentation of reservoir water, but it is technically difficult at the moment.

MAP SHOWING THE LOCATION OF 8 CANDIDATE-SITES



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Appendix: (iii)

MINISTRY OF AGRICULTURE AND FOOD
No. 330, UNION : PLACE , P.O.BOX. 569
COLOMBO. 2

Dr. Hitoshi Fukuda,
Leader of the Feasibility
Survey Team for Agricultural
Development Projects in
Ceylon.

Dear Sir,

In the report of the Agricultural Survey Team lead by Dr. Shiroshi Nasu which visited Ceylon last year, one of the technical assistance projects suggested for agricultural development of Ceylon was the introduction of modern techniques, provision of the necessary infrastructure, improvement of irrigation systems and the establishment of agro-industries in a selected village area in Ceylon.

Eight alternative village areas were suggested to your team and after visiting these areas, your team recommended that an area of approximately 500 acres of paddy land and highland at Devahuwa should be taken up for development under this project. This recomendation was considered at a meeting presided over by the Hon. Minister of Agriculture & Food, which was held in this Ministry today. The Hon. Minister of Agriculture & Food accepted your recommendation for selecting the area in Devahuwa for development under this project.

The detailed proposals for the development of this project area are awaited by this Ministry.

Yours sincerely,

Signed

B. Mahadeva,
Permanent Secretary
Ministry of Agriculture & Food.

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Appendix: (iv)

MEMORANDUM

As the sequence of the Basic Survey Mission on Ceylonese Agriculture which visited this country last year, our Team consisting of the Leaders and Members as per attached list has stayed in Ceylon for nearly a month and half from 16 February 1969. The task assigned to us is comprised of: (1) selection, in consultation with the authorities concerned of the Government of Ceylon, of a Project area where intensive and integrated Programme aimed at over-all rural development will be implemented; (2) preparation of such Rural Development Plan based on feasibility surveys, and (3) recommendation as to the scope and form of technical co-operation to be provided for the Project.

Our survey activities having been concluded, the Team is now leaving for Japan to finalize its Report. In appreciation of the kindest co-operation and all-out assistance made available by the authorities concerned of the Government of Ceylon in execution of our assignment here during the last several weeks, we are happy to submit herewith a gist of our findings and prospectus for forthcoming Project which will take more tangible shape in our Report. This is just an interim-note meant for expediting necessary preparatory actions to be taken by both Governments for speedier implementation of the Project.

I: DETERMINATION OF PROJECT-AREA

1. The Team members and Ceylonese counterpart-officials jointly scrutinized eight candidate-sites which had been previously selected by the Government of Ceylon, from 20 - 24 February 1969 and, through appraisal conference held on 25 of the same month, DEWAHUWA was finally selected as the Project area, with the same decision being confirmed in the letter of Mr. Mahadeva, Permanent Secretary of Agriculture, addressed to Dr. H. Fukuda, the Team-Leader for the first part of its activities.

2. Ceylon-Japan joint feasibility survey undertaken in Dewahuwa Colony for demarcation of our immediate Project area was commenced on 4 March and, in our conference with the Government Agent of Anuradhapura on 7 March, an area covering about 700 acres of paddyfield with adjacent highland which corresponds to about one-third of Dewahuwa district (its upper-stream), was mutually agreed upon as such.

II: OUTCOMES OF FEASIBILITY SURVEY BY THE TEAM

1. Physical Infrastructure

Dewahuwa Dam which was completed by the Irrigation Department in 1951 is a splendid engineering achievement leaving little room for any claims whatsover from technical view-point; it is however regrettable that some betrayals were made to its anticipated reservoir-storage capacity, probably due to incomplete hydrological data available at the planning stage. Therefore, although a volume of water enough to irrigate the whole beneficiary area is normally available during Maha season, the drought-year fails to fill the tank with water upto its capacity of 8,800 ac-ft. at FSL 597.5. As at present, supply of water big enough to allow an extensive cultivation of paddy on all the paddyfield of 2,330 acres in Dewahuwa Colony is next to impossible during Yala, but possibility as for the storage of 5,000 ac-ft. water in the tank in the closing period of Maha season in normal years has been ascertained (the end of 1968-69 Maha recorded 577 ac.FSL - 700 ac-ft only), provided overall improvement of irrigation-system will be set on hand in such as prevention of leakage at so many outlets along the main channel, stoppage of leakage along the border of the fields, introduction of appropriate rotary irrigation methods, construction of check-gates, etc. Accordingly, in normal years, availability of water during Yala season may permit cultivation of some 250 acres of paddy and 450 acres of subsidiary food crops. The above observations are based on our analysis of hydrological data available for the last fifteen years.

Today, Dewahuwa cultivators are not without sad experiences that irrigation-water is hardly available when and where it is desperately needed even during Maha season, to say nothing of Yala season when farming is normally abandoned as a whole on the paddyfield. What are admittedly hoped for and need to be practically worked upon must be such as improvements of irrigation facilities coupled by better water-control/management and new ways of land-consolidation.

Each plot of paddyfield is excessively small-sized and it obviously needs to be rearranged as far as possible to facilitate for efficient use of farm-machinery. Minimization of wasted-water through better irrigation practices is like-wise found necessary; prevention of leakage along the border and systematic plot-to-plot irrigation is what is recommended for this purpose.

2. Agronomy

Productivity of paddy in our immediate Project-area was estimated through sample cutting survey and the circumstances under which paddy cultivation is commonly practiced by the farmers there have been analyzed. Consequently, it was found that although an average yield per acre is in the neighbourhood of 45 bushels, there is a considerable gap in between the minimum and the maximum yields even within the self-same district, apparently due to differences in the pattern of land-management and farm-operation. Low level of productivity in general and wide range of its fluctuations, in particular, has been observed as ultimately due, either independently or combinedly, to difficulties in concentrating desirable amount of labour during the planting season, ensuing elongation of time required for planting often beyond the optimal time-limit and insufficient input of various factors of production, the root-cause of all these being the shortage and/or insecurity of irrigation-water.

Labour-force locally available in the Project-area is estimated at around 980 heads and to both intensify the degree and expand the scale of farming there mechnication is adjudged indispensable; the current pattern of field-blocking, the conditions of farm-roads and other relevant factors taken into account, however, mechnization programme will need to be chalked out with two-wheel tractor ranging between 10 to 15 HP as a nucleus. Pattern for optimal paddy production based on rational water-management/control and economically justifiable mechnization seems to stem at 25 acres of paddyfield put together as a unit where a team of cultivators will work in unison, adopting thereinto advanced technique as collectively as circumstances may allow.

Upland field available on the highland seems to be currently utilized for production, apart from that of upland rice and tobacco, of subsidiary food crops primarily meant for domestic consumption, with deteriorating productivity resulting from successive cultivation of the same kinds of crops for years on end; introduction of proper rotation system centering around cash crops will bring about beneficiary results.

Not a small number of problems seem to exist in the field of agricultural technology today and new such problems are bound to arise in future as mechnization advances with increased input of factors of production: establishment of Experimentation-cum-Demonstration Farms are accordingly highly commendable in our Project area, side by side with establishment of Farm Machinery Service Station where services such as repair and maintenance of machinery and training on their mechanical as well as operational aspects will be given on the cultivators' behalf.

3. Socio-Economic Aspects

Socio-economic survey covering the whole 307 households in the Project area has been conducted, which provided the Team with very interesting kaleidoscope of its inhabitants since after their settling down in this very Colony. The old map designed by the Government twenty years ago on which some 153 original colonists were each allotted 5 acres of paddy-field and 3 acres of highland per family has been largely re-drawn; the encroachment of the Reserved Land by so many squatters attributed to an emergence of various types of land-tenure on the allotted land, thus leading to social stratification.

Being an assembly of colonists heterogenous in their birth and personal background, the Dewahuwa community seems to be apathetic to the established values in the "purana" villages and yet they have been reproducing the same old socio-economic pattern thereof during the past twenty-years. These contradictory traits seem to have been at work, necessarily affecting their building up a wholesome community of their own. Long-term approach-though very much painstaking and only slowly rewarding - is what is required in developing sound Co-operative movement among them. The Co-operative framework as it stands today is adjudged to be too fragile to be commissioned with the duty as specified in the above and obviously needs to be strengthened in so many ways. Their Co-operatives, to identify itself with the inhabitants of Dewahuwa, will be expected to behave as fore-runner in their endeavorances for production-increase and for higher living-standards. Agro-Industries and Better-Living campaign will profitably be developed on healthy lines as part and parcel of their own Co-operative Movement.

III: ACHIEVEMENTS OF FEASIBILITY SURVEY TEAM

1. This Team, upon assimilating data obtained during its survey as briefed in I above, which has been conducted with the guiding principle to make this Project a 'Community Development' Scheme which might as well be likened to a vehicle running on the wheels of Co-operation among the people, being lubricated so-to-speak by infrastructural betterments and technological modernization in farming. The Team has also kept in mind the ultimate aim of the Project that it shall never be self-complacent but useful as a living model for the people toiling in the Dry-Zone under such circumstances as prevailing in the Dewahuwa Colony so that successful experiments coming out of our Project may readily 'spill-over' towards the adjacent localities and regions bringing about general improvement of socio-economic conditions there.

2. On the basis of those findings and perspectives as outlined in II above, the Team's Report which will help visualizing a comprehensive picture of what our Project should be and would eventually be at different phases of its progress will be completed and submitted to the authorities concerned of the two Governments of Japan and Ceylon by the end of May 1969.

3. Prior to implementation of the Project, however, Team feels it imperative to replenish its study-results with the following:

(a) Designing of improved irrigation system in the immediate Project area (Tracts 1 to 4) including betterment of main-channel for Tracts 5 thru 9:

(b) Designing of upland lift-irrigation facilities within the immediate Project area;

(c) Designing of Experimentation-cum-Demonstration Farms;

(d) Designing of domestic water distribution system on the highland in the immediate Project area, and

(e) Preparation of workable programmes for strenghening Co-operative-Movement among the people of Dewahuwa as a whole.

The work involving designing of facilities and working out of programmes referred to above shall be undertaken by a Japanese Team, in co-operation with the Ceylonese Government, during the period of two months or so, probably starting from June 1969.

4. The Report which will be submitted by the Team at the prescribed time will make reference to estimation, divided into local currency part and foreign currency part, of the expenditure required for the implementation of this Project which is expected to be made more specific after the above-mentioned two-month "on-the-spot" survey will have been completed.

IV: ACTIONS TO BE TAKEN BY THE GOVERNMENT OF CEYLON

1. The Team expects that the Government of Ceylon will take steps necessary to have the following duly completed preferably by the end of May 1969, thereby to facilitate the smooth operation of the work to be undertaken by the team of Japanese experts who are expected to come to Ceylon in connection with the work referred to III (3) above:

(a) To complete the similar kind of socio-economic survey as conducted by this Team with the inhabitants of Tracts 1 thru 4, with those of Dewahuwa Colony in Tracts 5 thru 9, and

(b) To prepare topographic map of Dewahuwa district (8 chains - 6 counter), indicating thereupon location of the existing facilities.

The Team knows that the Rural Development Project envisaged in Dewahuwa is offering our two countries a valuable opportunity to co-operate each other and its success will make significant contributions to cementing the amicable relationships already existing between Ceylon and Japan.

MOTONAGA OHTO

Leader

Japanese Agricultural Feasibility Survey
Team to Ceylon.

Colombo, April 3, 1969

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Appendix: (v)

RECORD OF DISCUSSION BETWEEN THE JAPANESE AGRICULTURAL SURVEY MISSION AND THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF CEYLON

Upon request by the Government of Ceylon made with the Government of Japan, the Japanese Survey Mission organized by the Japan's Overseas Technical Co-operation Agency and headed by Dr. H. Fukuda and Mr. M. Ohto in the latter part of the Mission's tour, visited Ceylon from 26th February to 4th April, 1969, as a sequence to the preceding Agricultural Survey Mission headed by Dr. S. Nasu that visited Ceylon last year, for the purpose of surveying, in line with the report of the said preceding Mission, the scope and method of a feasible technical co-operation by the Government of Japan in a project-area in Ceylon to be jointly chosen with Agricultural Authorities concerned of the Government of Ceylon.

As a result of a series of surveys, exchange of views and conduct of discussions, the Mission and the Agricultural Authorities concerned of the Government of Ceylon reached the provisional understandings as recorded hereunder.

1. For the purpose of contributing to the socio-economic development of agricultural community in Ceylon, there shall be established a Project-Area, approximately 700 acres of paddy field and 100 acres of adjacent highland in Dewahuwa. The two Governments shall co-operate with each other in establishing and operating the Project by means of implementing the following:

(1) Improvement in the agricultural infrastructure in the Project-Area, such as roads and irrigation and drainage facilities;

(2) Improvement in methods and techniques of farming in the Project-Area through increased use of inputs, joint use of agricultural machinery, conduct of experiments and demonstration and extension work;

(3) Improvement in the organization and activities of agricultural co-operatives and cultivation committees for purposes of efficient implementation of the present Project, such as for water management, supply of credit and marketing facilities;

(4) Requisite technical training in the Project-Area for Ceylonese technical personnel engaged in the Project.

2. In accordance with laws and regulations in force in Japan, the Government of Japan shall take necessary measures to provide at its own expense the requisite Japanese experts in fields such as agricultural infrastructure, farming and co-operatives. (Such experts will be decided on in detail through further discussions through appropriate channels).

NOTE:

(1) The Japanese experts will be dispatched to implement the Project at the most convenient date after an agreement between the two Governments has been reached;

(2) The Government of Japan will bear the necessary expenses, such as Japanese experts' living allowances and their international travel expenses between the two countries.

3. The Japanese experts and their families shall be granted privileges, exemptions and benefits no less favourable than those granted in Ceylon to the experts dispatched to Ceylon under the Colombo Plan.

4. In accordance with laws and regulations in force in Japan, the Government of Japan shall take necessary measures to provide at its own expense articles required for the implementation of the Project such as equipment, machinery, tools, spareparts and other materials for construction of roads and irrigation and drainage facilities, and the improvement in farming. (Such articles will be decided on in detail through further discussions through appropriate channels.)

(1) The articles referred to above shall become the property of the Government of Ceylon upon being delivered c.i.f. at the ports of disembarkation to the Ceylonese authorities concerned.

(2) The articles referred to above shall be utilised exclusively for the purpose of implementing the Project through consultation between the Japanese project leader and the corresponding Ceylonese leader.

5. In accordance with technical co-operation scheme in Japan, the Government of Japan shall take necessary measures to receive in Japan Ceylonese technical personnel engaged in the essential part of the Project for necessary technical training.

6. The Government of Ceylon shall undertake to bear claims, if any arise, against the Japanese experts resulting from, occuring in the course of, or otherwise connected with the bona fide discharge of their functions covered under the present Record of Discussion.

7. The Government of Ceylon shall provide at its own expense:

(1) Requisite Ceylonese counterpart service system including technical and other personnel. (Such service system will be decided on in detail through further discussions through appropriate channels.)

(2) Requisite land and buildings in the Project-Area as listed below as well as incidental facilities therefor.

*Two tracts of land for Experimentation-cum-Demonstration Farms, one for paddy and the other for upland crops.

*Workshop for agricultural implements

*Offices with necessary auxiliary living accommodation

(3) Supply or replacement of such equipment, machinery, tools and any other materials necessary for operating the Project as may be lost or damaged as a result of negligence.

8. The Government of Ceylon shall bear:

(1) The expenditure for the construction of roads, irrigation and drainage facilities (except for such equipment, machinery, tools, spareparts and other materials as are provided by the Government of Japan.)

(2) The expenditure necessary for the transportation of the articles provided by the Government of Japan within Ceylon as well as for their installation, operation and maintenance;

(3) All running expenses necessary for the operation of the Project.

9. The Japanese experts shall be responsible for technical matters pertaining to the implementation of the Project while the Ceylonese authorities concerned shall be responsible for the administrative and managing matters relative to the implementation of

the Project. There shall be close co-operation between the Japanese experts and the Ceylonese authorities concerned in connection with the implementation of the Project. This co-operation shall be secured by means of a committee representing the two parties.

10. Some of the articles to be provided by the Government of Japan, such as fertilizer and chemicals, may be delivered at reasonable prices, and such articles as agricultural implements may also be rented at reasonable rates to farmers in the Project-Area. The proceeds from the sale or rental of the articles referred to above shall be credited on the account of the Government of Ceylon to be expended only for the operation of the Project.

11. The Japanese co-operation for the implementation of the Project shall be rendered for the period of five (5) years, but by mutual agreement it may be extended for a further specified period. The Ceylonese authorities concerned will take over the responsibilities of the Project after the expiry of the term of Japanese co-operation.

12. The present Record of Discussion, in part or in whole, is not binding legally either on the Government of Japan or on the Government of Ceylon as the two Governments are to review the said Record of Discussion, to make necessary budgetary provisions respectively upon such review, and to make formal decision to finalize an agreement required for the implementation of the Project between the two Governments. Nevertheless, the gist of the present Record of Discussion is understood to serve as the basis on which the two Governments will finalize such an agreement.

Colombo, 3rd April, 1969.

(Signed)
M. OHTO
Head
Japanese Agricultural Survey
Mission

(Signed)
B. MAHADEVA
Permanent Secretary
Ministry of Agriculture & Food

COPY

Appendix: (vi)

MINISTRY OF AGRICULTURE AND FOOD
No. 330, UNION PLACE, P.O.Box 569
COLOMBO 2.

Mr. M. Ohto,
Leader: Japanese Agricultural Feasibility
Survey Team to Ceylon.

Dear Mr. Ohto,

I am writing with reference to the "Record of Discussion between the Japanese Agricultural Survey Mission and the Authorities concerned of the Government of Ceylon" which was signed in the Ministry of Agriculture and Food on 3rd April, 1969.

2. At the meeting presided over by the Hon. Minister of Agriculture and Food which preceded the signing of this Record of Discussion, I pointed out that the Ceylon Government may have difficulty in accepting the text of paragraph 6 of this Record when the final agreement is signed in terms of paragraph 12 of the Record. I suggested instead that your Government consider the following alternative draft of paragraph 6:-

"When in respect of any act or omission of a Japanese expert done or omitted to be done in connexion with the execution of a task assigned to him under the present Record of discussion, any claim is raised against him, the Government of Ceylon shall make arrangements to assist the said Japanese expert, to obtain legal advice and representation in a Court of Law or Tribunal, and undertake to defray the cost of such expenditure except when such an act or omission was wilful or deliberate.

If in the above cases such Japanese experts become liable by the order of any Court or Tribunal in Ceylon to pay damages or other costs to a third party, the Government of Ceylon undertakes to reimburse such Japanese experts, provided such an act or omission was not wilful, deliberate or due to gross negligence."

3. Please let me know early whether this alternative draft would be acceptable to your Government.

Yours sincerely,

(Signed)
Permanent Secretary.