Table L-5 (1/2) SPECIES LIST OF AMPHIBIANS AND REPTILES IN JAMAICA AND BLACK RIVER LOWER MORASS (From McCoy, 1975, Underwood and Williams, 1959 and NRCD & TGI, 1981)

Species Name	B.R.L.M.[1/]	Remarks
SALIENTIA(Frogs and Toads)		
Bufo marinus	o	Introduced
Calyptahyla crucialis		
Eleutherodactylus alticola		Endemic
E. andrewsi		Endemic
E. cavernicola		Endemic
E. fuscus		Endemic
E. gossei		Endemic
E. grabhami		Endemic
E. jamaicensis		Endemic
E. johnstonei		Introduced
E. junori		Endemic
E. leuteolus	o	Endemic
E. nubicola		Endemic
E. orcutti		Endemic
E. pantoni		Endemic
E. planirostris		Introduced
Hyla marianae		Endemic
H. septentrionalis	o	Introduced
H. wilderi	o	Introduced
Osteopilus brunneus		Endemic
Rana catesbeiana	o	Introduced
TESTUDINES(Tortoises)		
Chrysemys terrapen	o	Endemic
SAURIA(Lizards)		
Ameriva dorsalis		Endemic
Anolis garmani	o	Endemic
A. grahami	o	Endemic
A. lineatopus	o	Endemic
A. opalinus	o	Endemic
A. reconditus		Endemic
A. sagrei	o	
A. valenciennsi	o	Endemic
Aristelliger praesignis		
Cyclura collei		Endemic
Diploglossus barbouri		Endemic
D. crusculus		
D. duquesneyi		Endemic
D. hewardi		
D. microblepharis		Endemic
D. occiduus		Endemic,extinct
Sphaerodactylus argus	o	
S. gilutorques		Endemic
S. goniorhynchus		Endemic

1/ The Black River Lower Morass

Table L-5 (2/2) SPECIES LIST OF AMPHIBIANS AND REPTILES IN JAMAICA AND BLACK RIVER LOWER MORASS (From McCoy, 1975, Underwood and Williams, 1959 and NRCD & TGI, 1981)

Species Name	B.R.L.M.	Remarks
SERPENTES(Snakes)		
Alsophis ater		Endmic,extinct
Arrhyton callilaemus		Endemic
A. funereum		Endemic
A. polylepis		Endemic
Epicrates subflavus		Endemic
Typhlops jamaicensis		Endemic
CROCODYLIA(Crocodiles)		
Crocodylus acutus	o	

Table L-6 NUMBER OF CROCODILES SIGHTED BY THE NIGHT-LIGHT COUNTS (6 - 18TH SEPT. 1984)

Date	Time	Duration	Distance				Speed of Boat	No of Croco.	Density of Croco.
			Black R.	Middle Q. R.	Broad R.	Total			
		h m	km	km	km	km	km/h		No./km
Sept. 6	18:30 -21:50	3.20	20.0		13.0	33.0	14.1	1	0.03
Sept.10	19:30 -21:30	2.00	10.0	8.0		18.0	9.0	3	0.17
Sept.12	19:10 -21:50	2.40	26.0		13.0	39.0	14.6	8	0.21
Sept 15	18:00 -22:40	4.40	30.0	8.0		38.0	8.1	4	0.11
Sept 17	19:10 -21:30	2.20	3.0		23.0	26.0	11.1	9	0.35
Sept.18	19:50 -21:00	1.10	10.0	8.0		18.0	15.4	5	0.28
Total		16.10	99.0	24.0	49.0	172.0		30	
Average		2.41					12.1		0.19 *

Note: * Average density is 0.22/km in case of excluding the data of 6th Sept.

Table L-7 SPECIES LIST OF BUTTERFLIES COLLECTED IN THE BLACK RIVER LOWER MORASS AND COLLECTING SITES SEPT. - OCT., 1984

Family and Species Name	Collecting Sites 1/ A	B	C	D	E	F	G	H	I	J	K	L	M	N
DANAIDAE														
Danaus eresimus			o		o	o								o
SATYRIDAE														
Calisto zangis												o		
NYMPHALIDAE														
Mestra dorcas	o				o			o			o		o	o
Precis evarete					o		o	o		o	o		o	o
Anartia jatrophae	o	o	o	o	o	o	o	o		o	o		o	o
Siproeta stelenes						o		o		o				
HELICONIIDAE														
Heliconius charitonius								o		o			o	o
Dryas iulia	o							o						
Dione vanillae	o	o	o	o	o	o		o		o	o		o	o
LYCAENIDAE														
Hemiargus hanno	o		o					o					o	
PIERIDAE														
Ascia monuste	o													o
Eurema nicippe	o					o							o	
E. lisa		o		o	o	o	o			o	o		o	o
Kricogonia lyside											o			
Phoebis sennae		o	o				o	o					o	o
PAPILIONIDAE														
Papilio andraemon					o	o					o		o	
HESPERIIDAE														
Urbanus proteus	o		o					o					o	o
Achlyodes thraso	o													
Ephyriades brunnea	o													
Pyrgus oileus			o	o			o	o		o	o		o	o
Hylephila phylaeus			o											
Euphyes singularis			o				o	o		o				
Nyctelius nyctelius										o				

1/ Names of the collecting sites are followings.
A;Spring Hill, B;Estuary of the Black River, C;Port of Call, D;Fullerswood, E;Vineyard, F;Arlington, G;Burned Savanna, H;Lacovia, I;Holland, J;Slipe, K;Salt Spring Bridge, L;Frenchman, M;Holiday Pen, N;Parotee Pond.

Table L-8 PRESENT VEGETATION AND IRRIGABLE AREAS

(Unit: ha)

Vegetation and Land Use	Holland/Lacovia and Y.S. River Basin	Middle Quarters and Estuary of Black River	Hatfield, Slipe Frenchman and Holiday Pen	Broad River Left Bank	Broad River Right Bank	Total
1. Forest	300 (0)	460 (0)	360 (110)	500 (0)	40 (5)	1,660 (115)
Mangrove Forest	10 (0)	410 (0)	0 (0)	70 (0)	10 (0)	500 (0)
Swamp Forest	140 (0)	10 (0)	40 (40)	0 (0)	0 (0)	180 (40)
Secondary Forest	150 (0)	50 (0)	320 (70)	430 (0)	30 (5)	980 (75)
2. Pasture/Grassland	390 (90)	630 (0)	730 (0)	640 (0)	370 (5)	2,760 (95)
3. Cultivated Area	970 (290)	30 (0)	420 (0)	320 (0)	60 (0)	1,800 (290)
Trees/Village/Pasture	10 (0)	20 (0)	90 (0)	60 (0)	20 (0)	200 (0)
Upland Crops/Pasture	50 (0)	10 (0)	320 (0)	260 (0)	40 (0)	680 (0)
Sugarcane Field	910 (290)	0 (0)	10 (0)	0 (0)	0 (0)	920 (290)
4. Herbaceous Swamp	880 (120)	1,560 (0)	810 (810)	980 (780)	1,000 (840)	5,230 (2,550)
Crinum/Sagittaria Zone	0 (0)	0 (0)	170 (170)	0 (0)	0 (0)	170 (170)
Scirpus Olney Zone	0 (0)	520 (0)	0 (0)	0 (0)	0 (0)	520 (0)
Hummocky Swamp	190 (0)	320 (0)	0 (0)	0 (0)	0 (0)	510 (0)
Thick Cladium Zone	80 (0)	150 (0)	110 (110)	0 (0)	0 (0)	340 (110)
Typha Zone	320 (0)	20 (0)	140 (140)	0 (0)	0 (0)	480 (140)
Typha Hummocky Swamp	0 (0)	0 (0)	0 (0)	400 (290)	300 (300)	700 (590)
Cladium/Sagittaria Assoc.	0 (0)	0 (0)	0 (0)	550 (490)	690 (540)	1,240 (1,030)
Typha/Thalia Zone	0 (0)	0 (0)	160 (160)	0 (0)	0 (0)	160 (160)
Cladium/Conocarpus Zone	0 (0)	470 (0)	0 (0)	0 (0)	0 (0)	470 (0)
Unclassified Swamp, etc.	290 (120)	80 (0)	230 (230)	30 (0)	10 (0)	640 (350)
Total	2,540 (500)	2,680 (0)	2,320 (920)	2,440 (780)	1,470 (850)	11,450 (3,050)

Remarks: Figures in ( ) show proposed irrigation areas.

Table L-9 COMPARISON OF WATER QUALITIES IN BLACK RIVER LOWER MORASS BETWEEN 1977 AND 1984

(Unit: ppm)

Parameter	Location					
	Lacovia		Black River Bridge		Y.S. River	
	1977	1984	1977	1984	1977	1984
Calcium (Ca)	41-66	73	56-128	58	39-56	42
Magnesium (Mg)	5-22	5.3	48-172	33	5-17	6.3
Sodium (Na)	4-23	4.3	1,000-1,040	152	1-3	3.1
Pottassium (K)	1-12	2.37	-	8.72	1-10	0.86
Manganese (Ma)	-	-	-	-	-	-
Iron (Fe)	0.1-0.3	-	-	-	0.2-1.5	-
Free Ammonia (NH_2)	0.02-0.10	-	-	-	0.01-0.09	-
Nitrates (NO_3)	0.9-4.0	2.7	-	1.8	0.9-4.9	2.3
Sulphates (SO_4)	-	9.6	-	16	-	3.6
Chlorides (Cl)	10-50	12	106-2,600	380	9-14	10
Fluorides (F)	-	-	-	-	-	-
Phosphates, Total (PO_4)	0.03-0.28	0.17	0.0-0.08	0.07	-	0.11
Phosphates	-	0.08	-	0.04	-	0.06
Nitrites (NO_2)	-	0.06	-	0.04	-	0.03
C.O.D.	-	12	-	26	-	7
D.O.	4.4-6.6	5.4	3.8-4.6	5.2	-	7.8
B.O.D.	2-13	1.2	3-6	1.2	-	0.9
Conductance (m.m hos/cm @25°C)	270-520	380	2,460-8,240	1,570	270-360	270
Solid, Total dissolved	-	230	-	910	-	160
Hardness, Total	136-236	202	372-964	280	147-220	132
Alkalinity, Total	119-208	186	163-204	160	126-161	130
Alkalinity, Bicarbonate	-	186	-	160	-	130
Alkalinity, Carbonate	-	0	-	0	-	0
Alkalinity, Hydroxide	-	0	-	0	-	0
pH Value	7.2-7.9	7.34	7.3-7.6	7.39	7.8-8.0	7.85

Table L-10 PRESENT STATE OF WATER QUALITY AND THE WATER QUALITY STANDARD

Station[1]	BOD	COD	DO	pH	SS	P[2]	N[3]
Black River							
A	1.2	26.0	5.2	7.4	6.8[4]	0.07	1.8
B[4]	1.3	-	-	7.5	5.4	0.25	2.1
C	1.1	5.0	3.8	7.1	-	0.15	2.1
D	1.2	12.0	5.4	7.3	48.5[4]	0.17	2.7
Y.S. River							
E[4]	3.5	-	-	7.1	18.8	0.12	0.9
F	0.9	7.0	7.8	7.9	21.4[4]	0.11	2.3
M.Q River							
G[4]	1.7	-	-	7.4	44.8	0.13	0.8
Broad River							
H[4]	1.5	-	-	7.5	2.1	0.09	1.5
I	0.5	17.0	4.6	7.3	-	0.04	1.5
J[4]	1.8	-	-	7.1	5.1	0.05	3.9
WF[5]	< 5.0	-	> 5.0	6.5-8.5	10.0	-	-
WE[6]							
- River	< 5.0	-	> 6.0	6.7-8.5	25.0	< 0.10	-
- Lake	-	< 5.0	> 6.0	"	3.0	< 0.05	-

Remarks: Results in ppm excepting pH.

1/ Refer to Fig. L-10 2/ Phosphates, 3/ Nitrates, 4/ Source, NRCD and TGI (1982)[13], 5/ "Water Quality Standard for Fishery", 6/ "Water Quality Standard for Fishery Environment".

Table L-11 CHEMICALS APPLIED TO CROPS IN THE PROPOSED AGRICULTURE

Crop	Common Name	(Trade Name)	MT[1/]	TAA[2/]
	(Herbicide)			
Rice	Bentiocarb	(Saturn)	Os	B
	2,4 D	(2,4 D)	Os	A
Soya bean	Diphenamid	(Dymid)	Os	A
	Pentagon	(Basagran)	Os	A
Peanut	Prometryne	(Gesagard)	Os	A
	Praquat	(Gramoxone)	Ps	A
Corn	Prometryne	(Gesagard)	Os	A
	Paraquat	(Gramoxone)	Ps	A
Onion		(Tok E) 3/		
Carrot		(Tok E)		
	(Pesticide)			
Rice	Trichlorfon	(Diplerex)	Ds	B
	Fenitrothin	(Sumithion)	Os	B
	Mancozeb	(Dithane)	Os	A
Soya bean	Monocrotophos	(Nuvacron)	Os	A
Peanut	Diazionon	(Basudin 40% WP)	Ds	B-S
Corn	Monocrotophos	(Nuvacron)	Ds	A
Onion	Dimethoate	(Rogor 40 EC)	Os	B
Carrot	Diazionon	(Basudin 40% WP)	Ds	B-S

1/ MT ; Mammalian Toxicity
Os ; Ordinary substance
Ps ; Poisonous substance
Ds ; Deleterious substance

2/ TAA ; Toxicity to aquatic animals. Refer to Table J-11.

3/ MT and TAA of Tak E are unknown. However it is widely recommended for use in these crops.

Table L-12 STANDARD FOR SAFE APPLICATION OF CHEMICALS

1) Mammalian Toxicity (MT)

	Oral (toxicity) LD 50	Dermal (toxicity) LD 50	Inhalation LD 50
Poisonous substance (PS)	less 30 mg/kg	less 100 mg/kg	less 200ppm (1 hr)
Deleterious substance (DS)	30 - 300 mg	100 - 1,000 mg	200 - 2,000 mg (1 hr)
Ordinary substance (OS)	substance except PS, DS and special poisons		

2) Toxicity to Aquatic Animals (TAA)

A class: No problem of toxicity under usual method of application carp (fish): over 10 ppm, 200-plankton over 10 ppm

B class: Less effect under usual method of application take special precaution in application on a wide scale at the same time carp: 10 - 0.5 ppm
take special care of B-s in B class.

C class: Carp: less than 0.5 ppm

Where there is a possibility of applied chemicals scattering of flowing in rivers and lakes, do not use. And also in other places, do not use on a wide scale at the same time.

D class: Do not use in prohibited area of application.
Submit request for applying within an area of limited application.

Table L-13 IRRIGATION AREAS, RESERVED SWAMP AREAS AND THEIR RATES TO PRESENT SWAMP AREAS IN RESPECTIVE CASES

(Unit: ha)

Alternative Plans	Irrigation Area	Swamp** Area	Altered Swamp	Reserved Swamp Area	% of Reserved Swamp Area	Remarks
Alternative No. 1						
Total	3,080	5,550	2,515	3,035	55	Holland
*A	560	1,180	0	1,180	100	Black River Left Bank
B	0	680	0	680	100	Broad River Right Bank
C	920	1,170	920	250	21	and Broad River Left Bank
D	1,600	2,520	1,595	925	37	
Alternative No. 2						
Total	2,280	5,550	1,715	3,835	69	Holland
*A	560	1,180	0	1,180	100	Black River Left Bank
B	0	680	0	680	100	and Broad River Right Bank
C	920	1,170	920	250	21	
D	800	2,520	795	1,725	68	
Alternative No. 3 and 3-a						
Total	1,480	5,550	920	4,630	83	Holland
*A	560	1,180	0	1,180	100	and Black River Left Bank
B	0	680	0	680	100	
C	920	1,170	920	250	21	
D	0	2,520	0	2,520	100	

Remarks: *A: Holland/Lacovia and Y.S. River Basin
B: Middle Quarters River and Estuary of Black River
C: Hatfield/Slipe/Frenchman and Holiday Pen
D: Broad River Basin
**: Swamp Area; Herbaceous Swamps including Forests

Table L-14 COMPARISON OF PROPOSED NATIONAL PARK SITES
(from NRCD, 1984)

Criteria	Black River	Negril	Canoe Valley	Portland Bight	Hellshire	Blue Mountain	Cockpit Country
Description	Coastal Ecosystem Morass and Swamp Forest	Coastal Ecosystem Morass and Swamp Forest	Coastal Ecosystem Morass and Forest	Morass and Clays	Coastal Ecosystem Morass and Forest	Forest	Forest
Biology Diversity (types of habitat)	5	3	5	5	5	5	5
Biology Uniqueness Jamaica	5	2	4	2	4	5	5
(Genetic resources) Global	4	1	3	2	3	5	5
Contribution to Productivity (Economic)	5	4	5	5	4	4	4
Recreational Potential (local and foreign tourism)	5	4	5	5	5	5	5
Scenic Value	5	5	5	4	5	5	5
Existing Park Type Use/ Development	4	4	5	2	2	4	1
Ecological Unit Integrity	3	3	4	4	4	5	5
Proximity to Population Centres	3	5	4	4	5	4	4
Threat from other Developments	5	5	1	1	4	4	4
Total	44	36	41	34	41	46	43

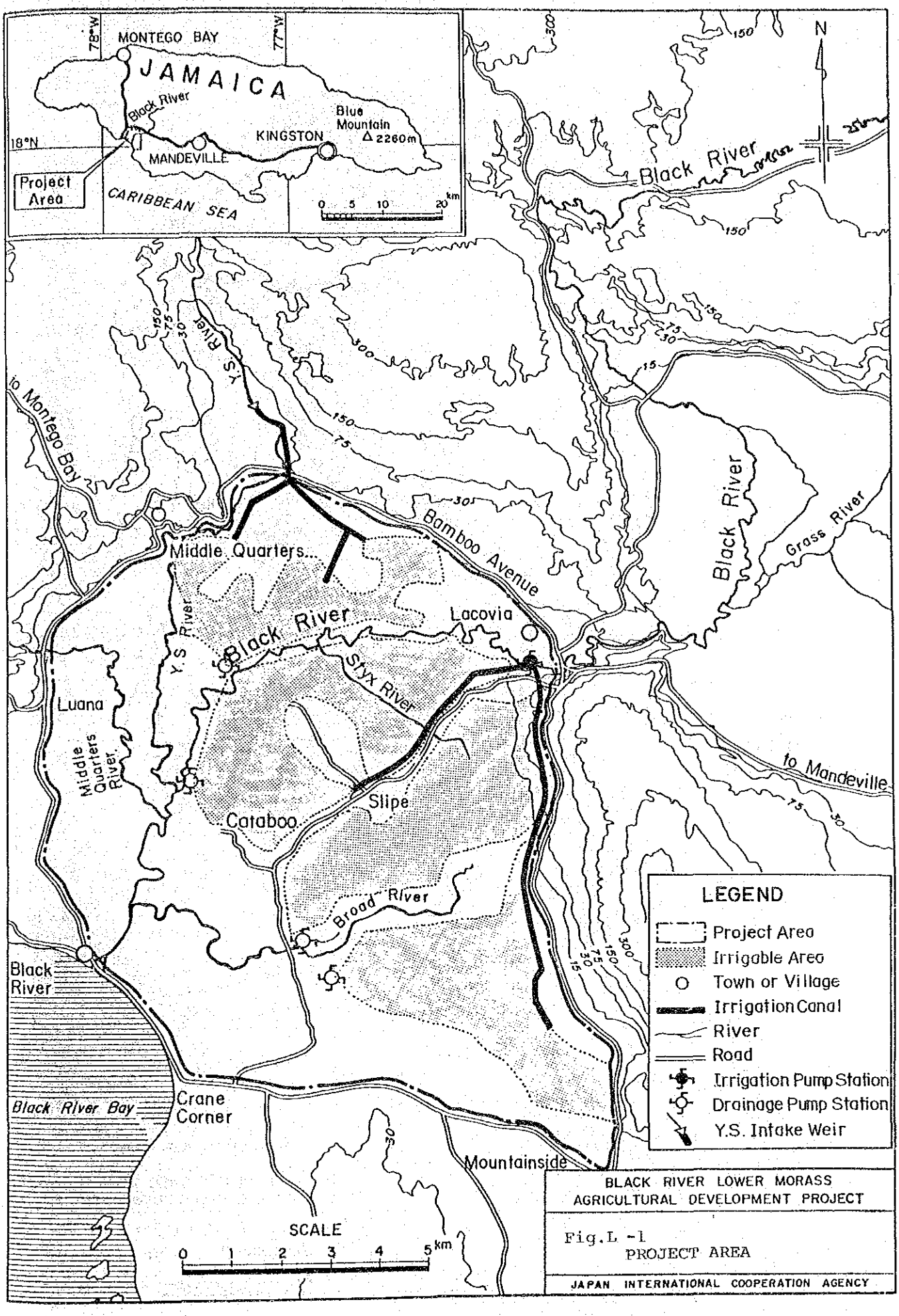
Source: NRCD, 1984

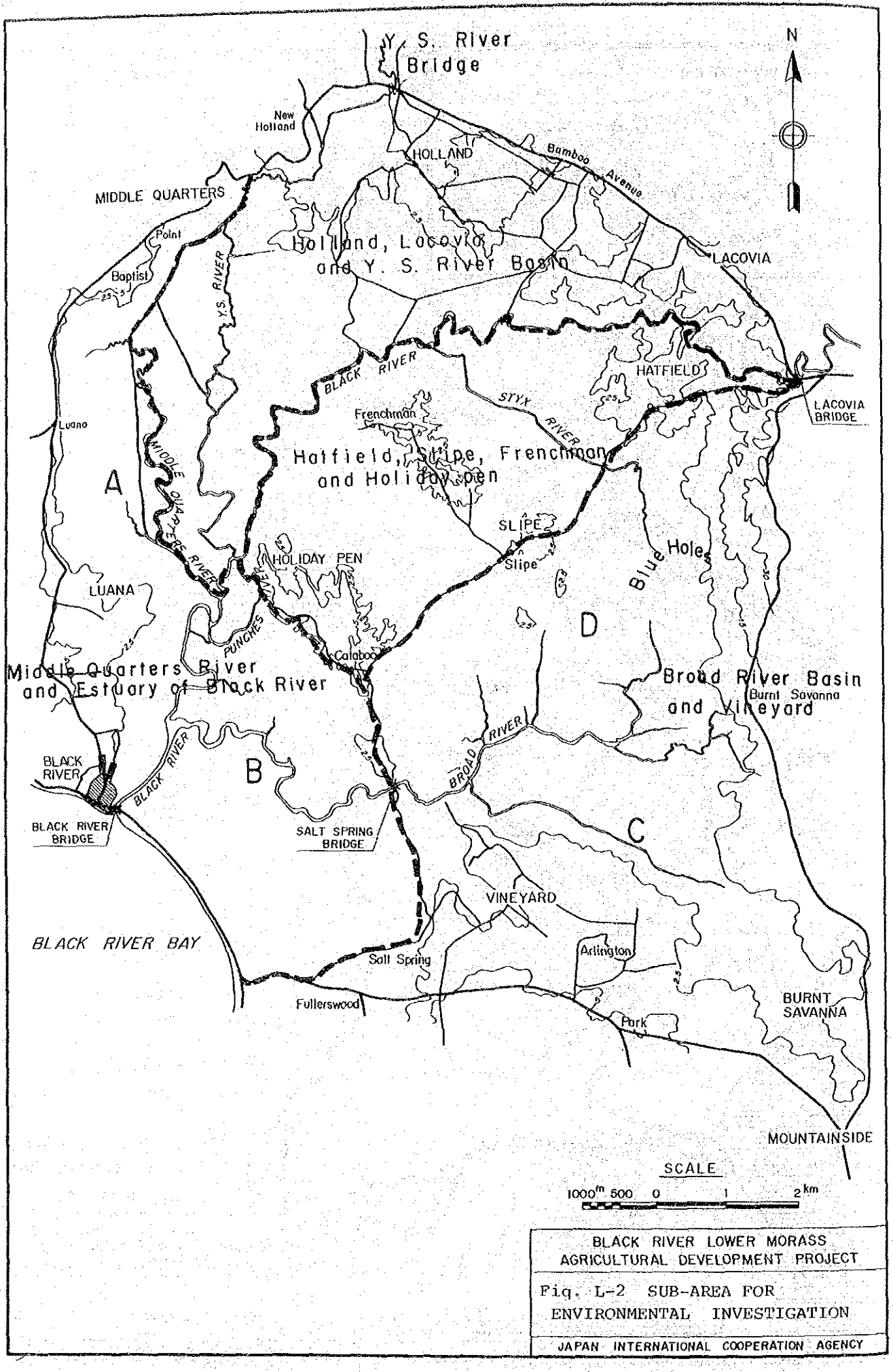
Table L-15 BLACK RIVER PROPOSED NATIONAL PARK COMPARED TO EVERGLADES NATIONAL PARK

Criteria	Ranking
1. Scenic quality	++
2. Environmental significance, Jamaica	++
" , Global	=
3. Recreational potential	+/=
4. Multiple use potential	=
5. Area	- -

Source: NRCD, 1984

Remarks: +: greater
=: equal
-: less

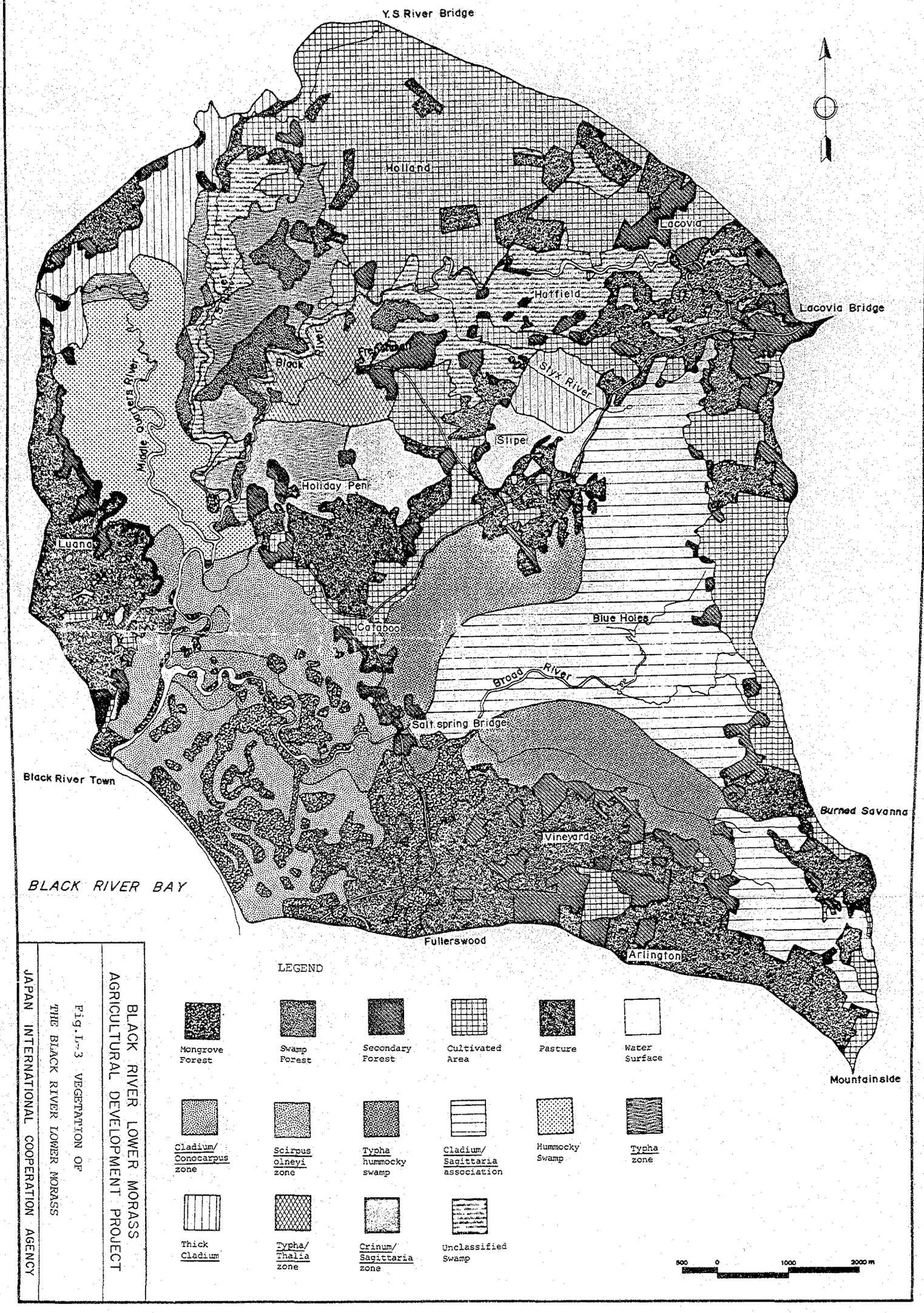

JAMAICA
MONTEGO BAY
78°W
77°W
18°N
Black River
KINGSTON
Blue Mountain
Δ 2260m
MANDEVILLE
Project Area
CARIBBEAN SEA
0 5 10 20km
N
Black River
Y.S. River
to Montego Bay
Bamboo Avenue
Middle Quarters
Lacovia
Grass River
Styx River
Luana
Middle Quarters River
to Mandeville
Cataboo
Slipe
Broad River
Black River
Black River Bay
Crane Corner
Mountainside
SCALE
0 1 2 3 4 5km
LEGEND
Project Area
Irrigable Area
Town or Village
Irrigation Canal
River
Road
Irrigation Pump Station
Drainage Pump Station
Y.S. Intake Weir
BLACK RIVER LOWER MORASS AGRICULTURAL DEVELOPMENT PROJECT
Fig.L -1
PROJECT AREA
JAPAN INTERNATIONAL COOPERATION AGENCY



BLACK RIVER LOWER MORASS AGRICULTURAL DEVELOPMENT PROJECT

Fig. L-2 SUB-AREA FOR ENVIRONMENTAL INVESTIGATION

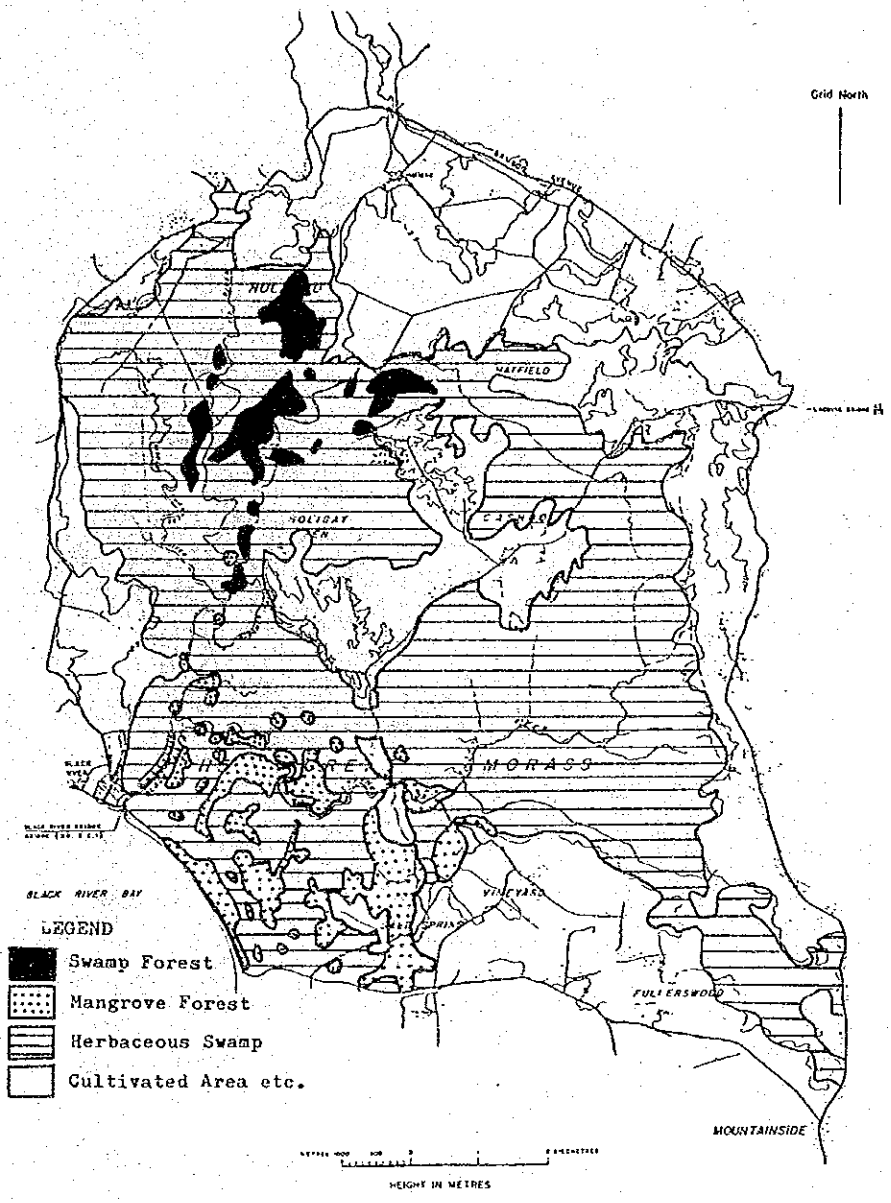
JAPAN INTERNATIONAL COOPERATION AGENCY



BLACK RIVER LOWER MORASS
AGRICULTURAL DEVELOPMENT PROJECT

Fig.L-3 VEGETATION OF
THE BLACK RIVER LOWER MORASS

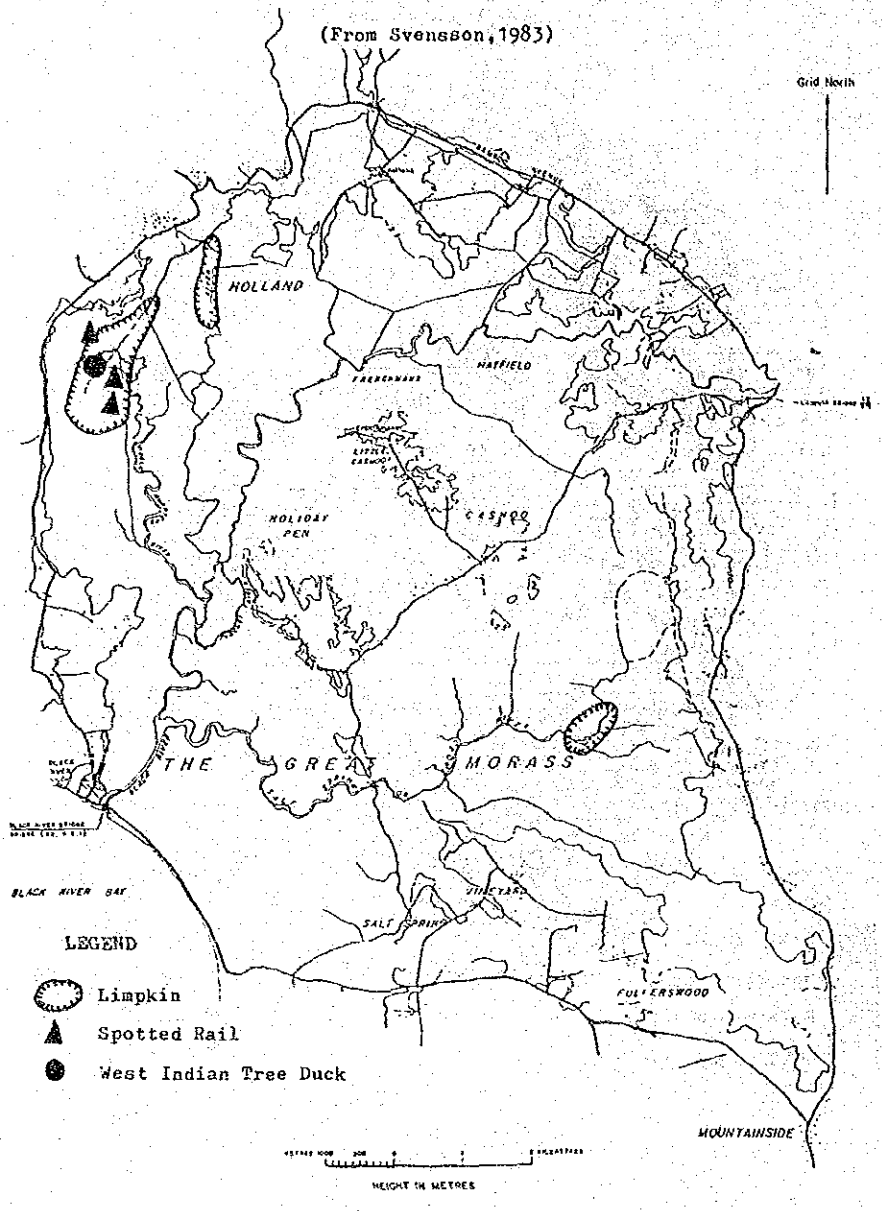
JAPAN INTERNATIONAL COOPERATION AGENCY



BLACK RIVER LOWER MORASS
AGRICULTURAL DEVELOPMENT PROJECT

Fig.L-4
OUTLINE OF VEGETATION

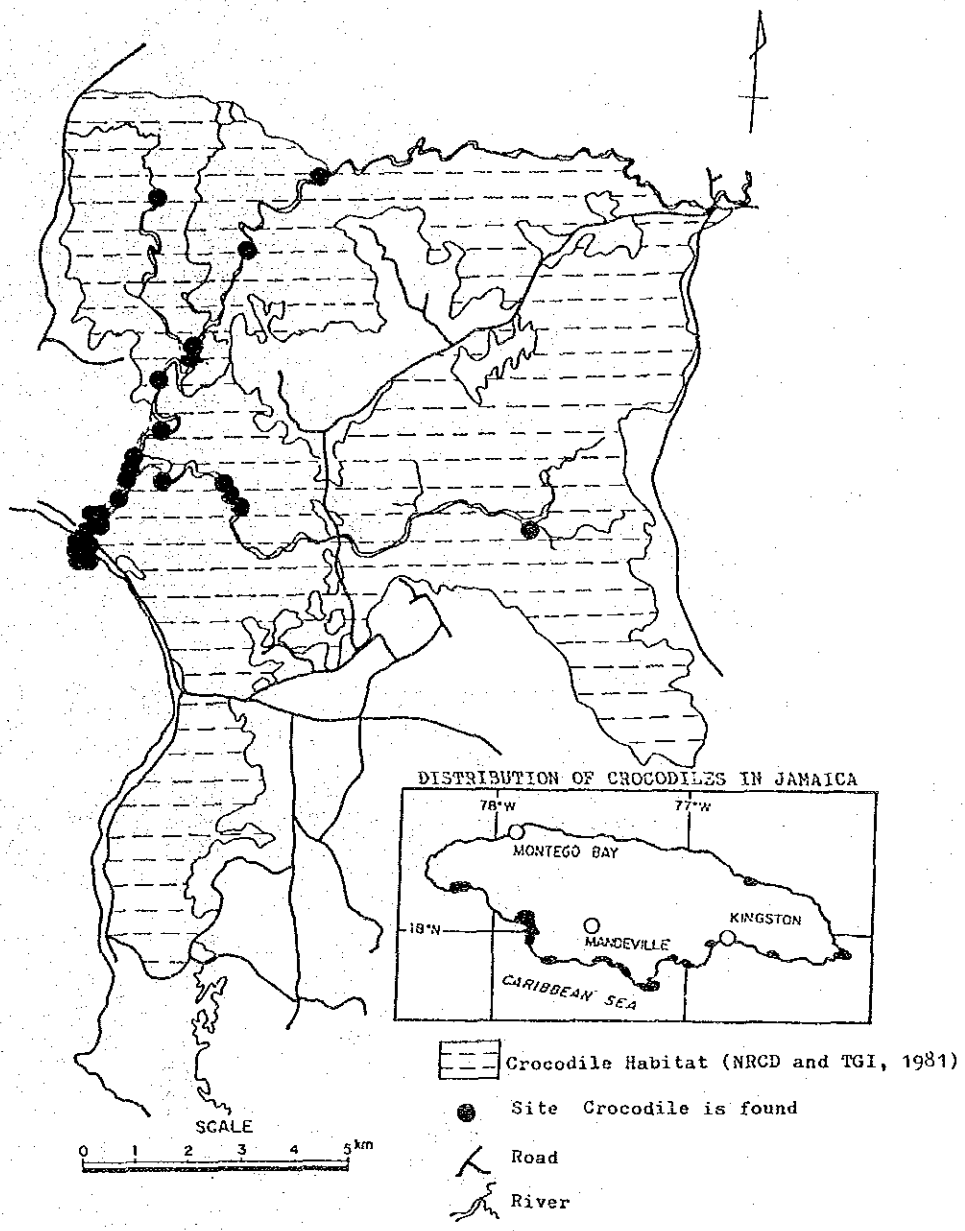
JAPAN INTERNATIONAL COOPERATION AGENCY



BLACK RIVER LOWER MORASS
AGRICULTURAL DEVELOPMENT PROJECT

Fig. L-5 SITES OF RARE BIRD SPECIES

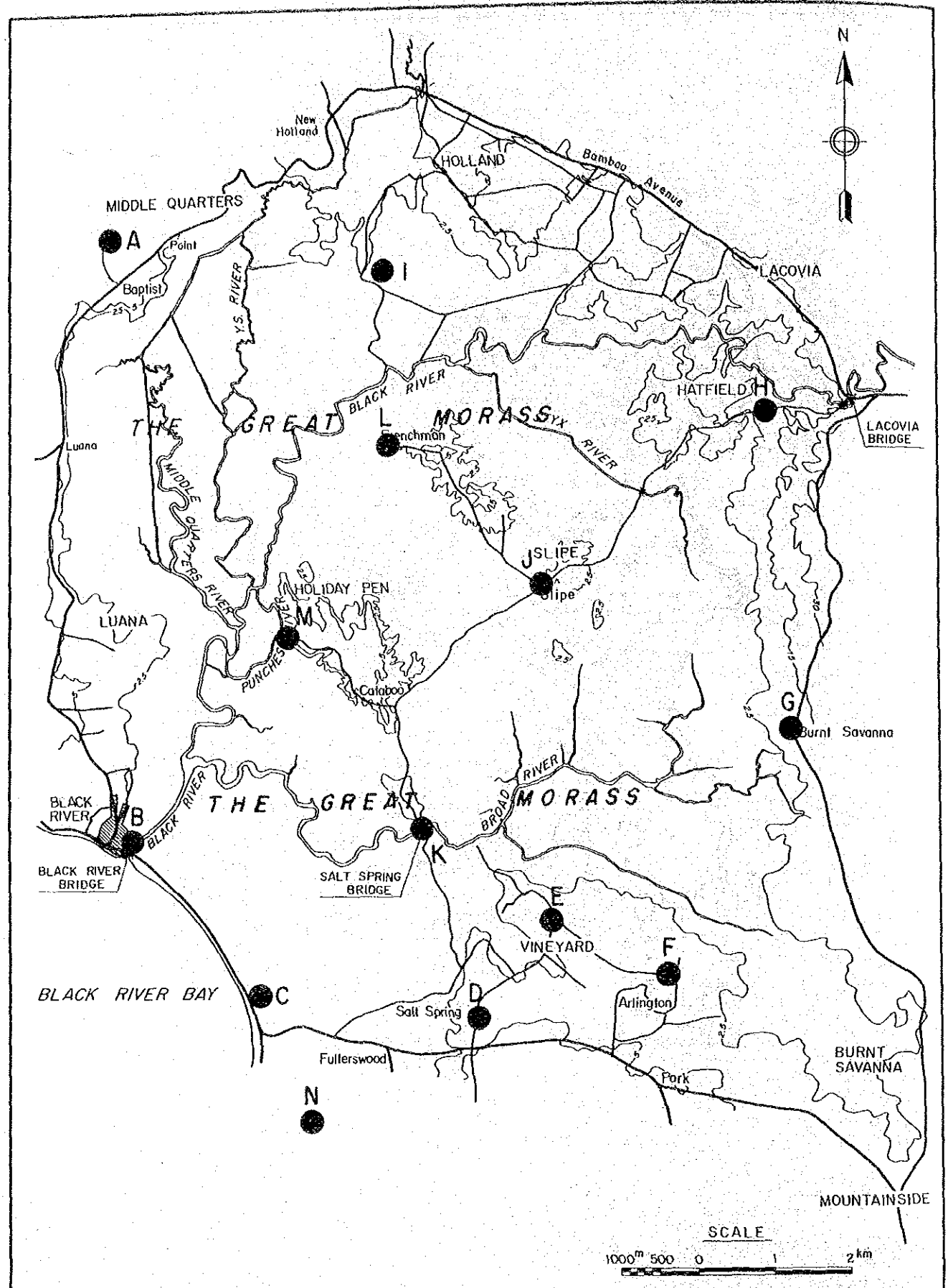
JAPAN INTERNATIONAL COOPERATION AGENCY



BLACK RIVER LOWER MORASS
AGRICULTURAL DEVELOPMENT PROJECT

Fig.L-6 AREAS OF SUITABLE CROCODILE HABITAT AND SITES WHERE CROCODILES WERE OBSERVED

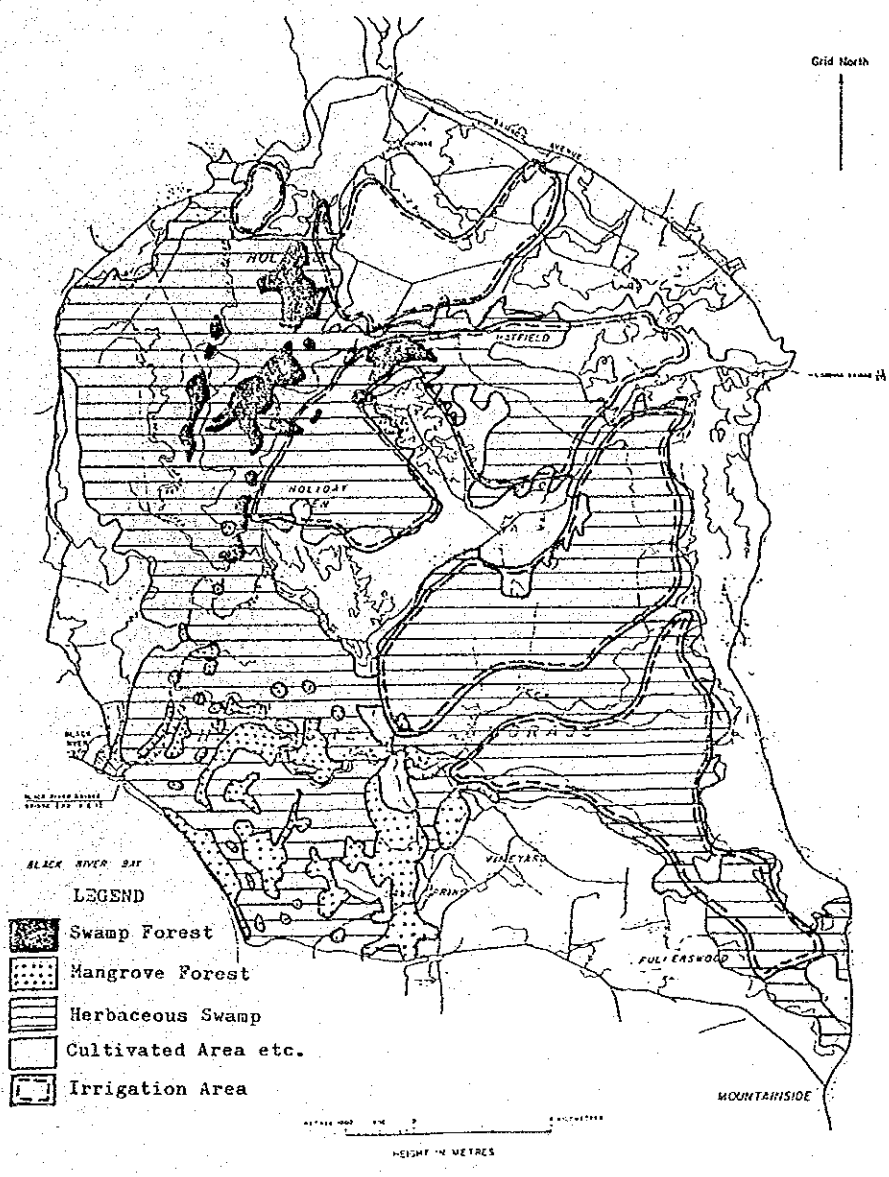
JAPAN INTERNATIONAL COOPERATION AGENCY



BLACK RIVER LOWER MORASS AGRICULTURAL DEVELOPMENT PROJECT

Fig. L-7 COLLECTING SITES OF BUTTERFLIES

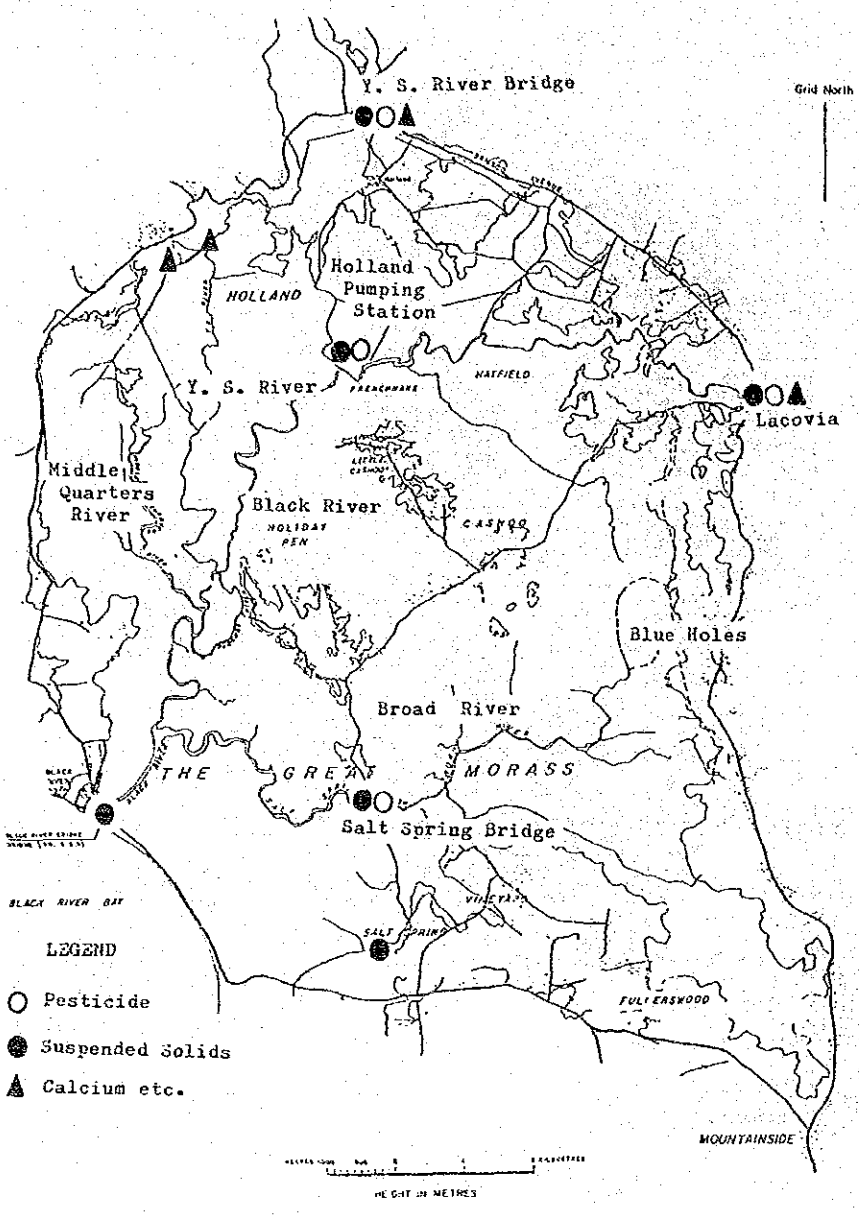
JAPAN INTERNATIONAL COOPERATION AGENCY



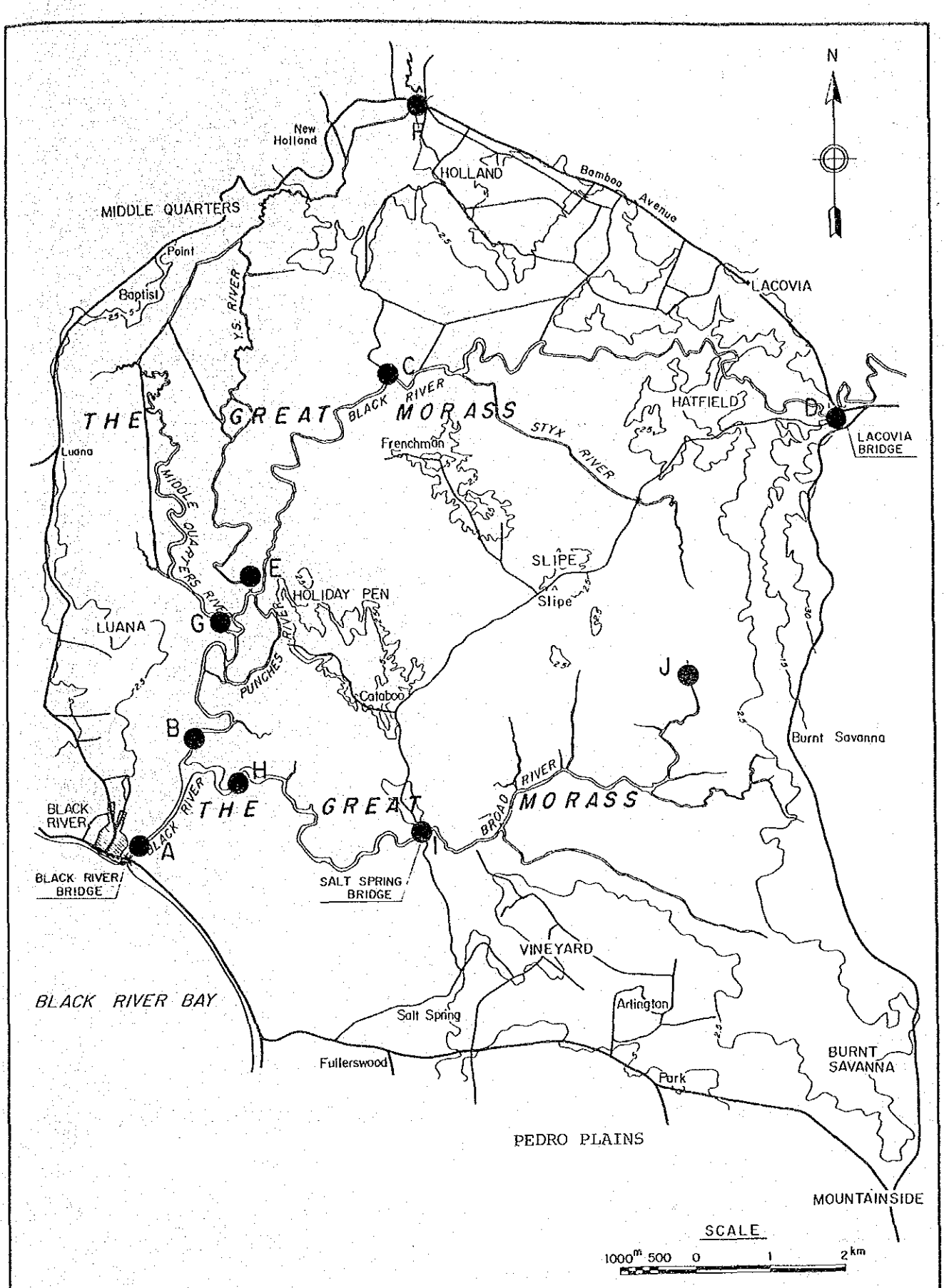
BLACK RIVER LOWER MORASS
AGRICULTURAL DEVELOPMENT PROJECT

Fig. L-8 OUTLINE OF VEGETATION AND IRRIGATION AREAS

JAPAN INTERNATIONAL COOPERATION AGENCY



BLACK RIVER LOWER MORASS AGRICULTURAL DEVELOPMENT PROJECT
Fig.L-9 SAMPLING SITES OF WATER
JAPAN INTERNATIONAL COOPERATION AGENCY

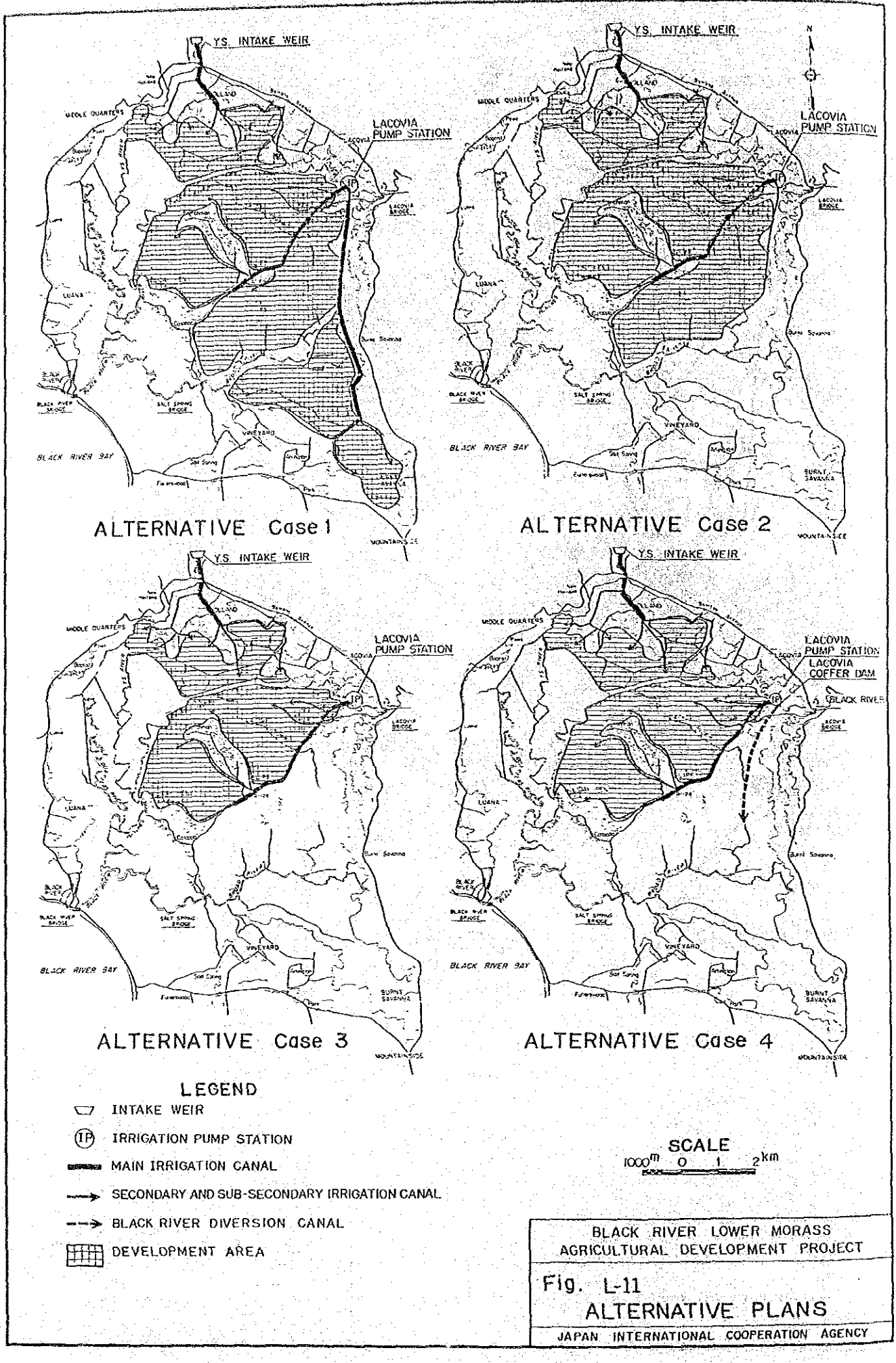


BLACK RIVER LOWER MORASS AGRICULTURAL DEVELOPMENT PROJECT

Fig. L-10

STATIONS OF WATER ANALYSIS

JAPAN INTERNATIONAL COOPERATION AGENCY



BLACK RIVER LOWER MORASS AGRICULTURAL DEVELOPMENT PROJECT

Fig. L-11
ALTERNATIVE PLANS

JAPAN INTERNATIONAL COOPERATION AGENCY

ANNEX M

PROJECT ORGANIZATION

ANNEX M

PROJECT ORGANIZATION AND MANAGEMENT

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ANNEX M

PROJECT ORGANIZATION

1. PROJECT ORGANIZATION AND MANAGEMENT

1.1 Development Policies

In planning this management and settlement structure, the government has contributed the accumulated experiences of a history of such programmes and, more recently, the experience of AGRO 21 in divesting the Meylersfield Rice Project as well as other joint venture projects developed by the Jamaica National Investment Bank (formerly Jamaica National Investment Co. and a government organization) and by the private sector like Jamaica Agri Products Ltd., among others.

Certain policies of the Government have been evolved from such experience. They have also helped the Government to adopt new concepts in agricultural development. Some of the concepts and policies are cited below:

(i) the private sector should be the engine of growth;

(ii) development programmes should be viable, export oriented or designed towards foreign exchange saving;

(iii) each farmer, before settlement, should be recruited, trained and selected;

(iv) the recruitment process should include selection by an accepted set of criteria, and should be done by a comittee appointed for the purpose;

(v) lands allocated to settlers should have the potential of producing a net income of J$10,000 to 12,000 per annum;

(vi) such projects should be structured around a central unit which will provide all the support services - farm inputs, land preparation and reaping services, credit support, water management, all these in a system of supervised credit, extension and marketing. This will be the role of the mother farm; and

(vii) administration and support services already in the government sector should be utilized, where possible.

1.2 Background to Organization Plan

The project area for agricultural development comprises 4 distinct geographical sections as set out below:

1.	Black River Right Bank	560 ha (1,380 acs.)
2.	Black River Left Bank (Hatfield, Styx, Frenchman-Holiday Pen)	920 ha (2,270 acs.)
3.	Broad River Right Bank	800 ha (1,980 acs.)
4.	Broad River Left Bank	800 ha (1,980 acs.)
		3,080 ha (7,610 acs.)

The project is concerned firstly with a construction stage in which the irrigation and drainage infrastructure, roads, workshops and offices be built. This is to be followed by an operation and maintenance stage in which rice will be grown in rotation with soya bean.

The size of the project area and the technical nature of the development recommend that the project be managed by two Companies, Holding Company and Farm Development Company, comprising a strong multi-disciplined Board of Directors with a strong private sector component appointed by the Government. This organization of the two Companies will be autonomous, adhering to strict commercial principles since the project must be operated as a profitable enterprise.

The new agricultural development system of the project will replace a system of rice growing operated by small farmers under primitive conditions with very poor yields (under 1,100 kg of paddy per ha per crop) for many years.

A production programme that will improve the standard of living and quality of life of these farmers, will require them to have the capacity to manage a larger acreage than they now control, within the framework of an institution of the two companies which will assist them with an effective extension service and technical package, proper water management, supervised credit provided in kind, machinery for land preparation and reaping, and a marketing management that will purchase their paddy at an agreed unit price. It is obvious, therefore, that farmers aspiring to this level of management and production

from levels already described must be carefully screened and selected for settlement only after a period of intensive training.

The project, consequently envisages to establish "the two Companies" as a large central farm, either fully government owned or in joint venture with the private sector which will be involved in production but which will provide the services listed above to the farmers concerned. The central farm may here be regarded as a "mother" farm, playing the role of "mother" and "model" and providing the production and support services to the "children" or "satellite" farmers. It will own and operate all equipment, own and manage the post harvest services, and market the product.

Part of the project will include a Pilot Farm for research and observation as well as an allotment for training.

Sound water management will be so essential that it will be necessary to establish a special unit for its control. The unit and staff will be responsible for maintaining the drainage and irrigation system and providing all farmers with water at a rate to be decided.

While the unit field size, for purposes of irrigation and drainage management, will be 0.5 ha (1.2 acres), the size of each satellite holding will 3 ha (7.4 acres) on the mineral soil and 5 ha (12.3 acres) on the peat soil with the central farm having a total of 800 ha (1,980 acres) though not all in one location. As the project will be divided into 5 major agricultural management units, it is proposed that the central farm be divided likewise.

A project of this size and complexity will succeed to the extent that both farmers and staff, those who produce and those who provide a service, work jointly towards the goals of the project. Such mutual trust will come only from mutual understanding derived from the identification and acceptance of common goals and a common modus operandi. To achieve this, not only will we need a firm but considerate management, but an association of farmers through which these goals and methods can be discussed, common problems solved and which, in turn, will lead its members into areas of cooperation among themselves and

the maturity to apply such social controls and sanctions as will be necessary for the good of the project. The staff should likewise be trained not only technically but also to appreciate and apply this mutual trust.

1.3 Organization Structure

As the organizational structure representing a combination of government and private sector involvement is complex, the organization is represented in modular form for simplicity. (see Fig. M-1)

1.3.1 The Holding Company

The Holding Company represents the stage concerned with construction as well as recruitment, training, selection and settlement of farmers, the development of the pilot farm and land lease and management. These functions are essentially those of the Government and the proposed structure is that they be accommodated in a Holding Company of the Government.

This company will require a Board of Directors appointed by the Government. Its membership should not exceed 7 and should include:

- the Permanent Secretary, MOA or his nominee
- the Commissioner of Lands
- a representative from the Ministry of Finance
- a representative from the Jamaica National Investment Bank
- a representative from the National Water Commission, and
- two other nominees.

The Company would be organized into two department:

1) Technical Department

This department will be headed by Technical Manager working through five units. Its functions of these units are:

a) Construction unit under a project engineer responsible for:

- design and preparation of plans
- arranging for tenders and award of contracts
- monitoring and supervising construction
- recommendation for payment

b) Farm equipment procurement unit under an agricultural engineer responsible for:

- procurement and installation of machinery and equipment

c) Pilot farm unit under a research officer responsible for:

- designing research areas
- organizing the farms

d) Irrigation and drainage unit under an irrigation engineer responsible for:

- maintaining the drainage and irrigation system
- monitoring the supervision of the maintenance of those secondary and tertiary canals to be maintained by the farmers
- ensuring that the pumps and other equipment are serviced
- monitoring the use of fuel
- ensuring that water is supplied and rates collected

e) Farm settlement unit under a settlement officer responsible for:

- developing criteria for recruiting farmers
- selection and training of farmers
- settling of farmers

2) Administration Department

This department will be managed by Company Secretary and will consist of three units. The functions of each unit will include;

a) Finance and account unit under a financial manager responsible for:

- financing and repayment of loan to the project

- all the money affairs associated with the project construction, operation and maintenance
- payment of salaries

b) Personnel and allied services unit under an administrative officer responsible for:

- having the acts and ordinances observed that regulate personnel
- training of administrative staff and specialists
- promotion of staff and employees
- recruiting of seasonal labour

ç) Land management unit under a lands officer responsible for:

- valuation of duration of lease and annual rental
- preparation of lease contracts

These areas of responsibility will be determined through negotiations between government and the private sector. The structure is therefore only a guide as the Company would design its own organization.

1.3.2 Farm Development Company

The Farm Development Company would represent the private sector either on its own or in joint venture with the government, being responsible for developing the mother farm, managing the milling and marketing functions of the project and providing certain prescribed services as part of a contract to the satellite farmers who would have been trained and settled by the Holding Company. Such functions would be carried out through the Development Company which would lease the land and either lease or purchase the other facilities from the Holding Company. Should the private sector/joint venture attempts not materialize then the functions of the Farm Development Company, perhaps with slight modification, would be taken over by government.

This company through its General Manager would have areas of responsibility as set out below.

1) The Mother Farm Department supervised by a Farm Manager and 4 Farm Supervisors would be responsible for:

- agricultural development of the farm
- producing some 170 metric tons of seed rice annually for planting
- collaborating in the recruitment, training, selection and settlement of farmers, and
- extension.

2) The Farm Supplies Department headed by a Farm Supplies Manager would be responsible for:

- supplying the fertilizers
- supplying the agro-chemicals
- supplying the small tools, etc.

3) An Operations and Maintenance Department headed by an O and M Manager and would have two units. The functions of each unit would be:

a) Workshop unit under a mechanical engineer would be responsible for:

- operating the workshop
- operating 5 service and repair centres, one for each of the 5 agricultural management units
- securing and controlling the use of tools and equipment within the workshops
- servicing the rice processing facilities and all the other machines and vehicles.

b) Farm equipment services unit under an agricultural engineer responsible for:

- managing the movement and use of all items of farm equipment and vehicles
- controling items like the use of petrol, oils, tyres, etc.
- ensuring proper maintenance and servicing
- keeping operational records
- keeping inventory of equipment
- monitor and supervising the drivers
- licencing and insure vehicles where necessary

4) Commercial Department having three units headed by a commercial manager with the following functions for each unit are:

a) Purchasing and stores unit under a store keeper responsible for:

- purchasing the paddy from the farmers
- operation and management of drying and storage facilities

b) Milling unit under a plant manager responsible for:

- operation and management of the rice mill

c) Marketing unit under a marketing officer responsible for:

- making general policies for commercial affairs
- marketing of rice to whole country
- studying the domestic market situation with respect to production, imports and consumption.

1.3.3 Farmer's association

This concerns the establishment of an association of farmers on the 5 farm development area for their mutual benefit. The Association would organize regular meetings for farmers to discuss management; would provide a cooperative negotiation body with the Farm Development Company; and would promote agricultural extension and credit, etc. As there are branches of the Jamaica Agricultural Society in the study area it might well be that the farmers might organized themselves through this body.

1.3.4 Coordination and liaison

Though the Holding Company and the Farm Development Company are separate entities there must be wide areas of collaboration between them for mutual benefit. For example, the Managing Director of the Holding Company ought to be a member of the Development Company and the Farm Manager be represented on the sub-committee responsible for the selection, training and settlement of the farmers. In this way, matters of common interest like irrigation and drainage, selection and settlement of farmers among others, can be discussed.

1.4 Staffing and Expatriate Assistance

The required staffing for the Holding Company and Farm Development Company over a six (6) year period is set out Tables M-1 and M-2.

The required staffing of the Holding Company at the full operation stage will be 34. This does not include the construction staff on contract or part-time staff.

The number of the staff required by the Farm Development Company at the full operation stage will be about 169. In addition, a considerable number of seasonal labourers will be required.

In view of the shortage of experienced personnel in Jamaica, some expatriate specialists will be needed as counterparts to Jamaicans for transfer of technology throughout the design and construction stage and at the initial stage of operation and maintenance. The number of the expatriate staff required at each stage is shown in Table M-3.

Table M-1 STAFF OF HOLDING COMPANY

Staffing	Yr.1	Yr.2	Yr.3	Yr.4	Yr.5	Yr.6
I. Management						
1. General Manager	1	1	1	1	1	1
2. Secretarial Staff	2	2	2	2	2	2
II. Technical Department						
1. Technical Manager	1	1	1	1	1	1
2. Construction unit						
- Engineer	1	2	2	2	-	-
- Assist. Engineer	2	4	4	4	-	-
- Administrator	1	1	1	1	-	-
3. Farm equipment procurement unit						
- Agricultural Engineer	1	1	1	1	-	-
- Clerical Officer	2	2	3	3	-	-
4. Pilot farm unit						
- Research Officer	1	1	1	1	1	1
- Clerical Officer	1	1	1	1	1	1
5. Irrigation and drainage unit						
- Irrigation Engineer	-	1	1	1	1	1
- Civil Engineer	-	1	1	1	1	1
- Mechanical Engineer	-	1	1	1	1	1
- Asst. Engineer	-	1	3	6	6	6
- Clerical Officer	-	1	2	3	3	3
6. Farm settlement unit						
- Settlement Officer	-	1	1	1	1	1
- Extension Officer	-	1	7	7	7	7
- Clerical Officer	-	1	2	2	2	2
III. Administration Department						
1. Finance and accounts unit						
- Financial Manager	1	1	1	1	1	1
- Clerical Officer	1	1	1	1	1	1
2. Personnel and allied services unit						
- Administrative Officer	1	1	1	1	1	1
- Clerical Officer	2	2	2	2	2	2
3. Land management unit						
- Land Officer	1	1	1	1	1	1
Total	19	30	41	45	34	34

Table M-2 STAFF OF FARM DEVELOPMENT COMPANY

Staffing	Yr.2	Yr.3	Yr.4	Yr.5	Yr.6
I. Management					
1. General Manager	-	1	1	1	1
2. Secretarial Staff	-	2	2	2	2
II. Mother Farm Department					
1. Farm Manager	-	1	1	1	1
2. Farm Supervisor	-	1	3	5	5
III. Farm Supplies Department					
1. Supplies Manager	-	1	1	1	1
2. Clerical Officer	-	1	1	1	1
IV. Operation and Maintenance Dept.					
1. O & M Manager	-	1	1	1	1
2. Workshop unit					
- Workshop Manager	-	1	1	1	1
- Mechanics	-	1	3	6	6
- Asst. mechanics	-	1	5	10	10
- Operators	-	20	35	95	95
- Clerical Officer	-	1	1	1	1
3. Farm equipment services unit					
- Agricultural Engineer	-	1	2	2	2
- Asst. Agricultural Engineer	-	1	3	6	6
- Clerical Officer	-	1	1	1	1
V. Commercial Department					
1. Commercial Manager	-	1	1	1	1
2. Purchasing and stores unit					
- Manager	-	1	1	1	1
- Store keeper	-	1	2	5	5
- Operator	-	2	5	9	9
- Asst. operator	-	2	6	10	10
- Clerical officer	-	1	2	2	2
3. Milling unit					
- Plant Manager	-	1	1	1	1
- Operators	-	2	4	4	4
- Asst. operator	-	2	4	4	4
4. Marketing unit					
- Marketing officer	-	1	1	1	1
- Clerical officer	-	1	1	1	1
Total	-	50	87	169	169

Table M-3 REQUIRED NUMBER OF EXPATRIATE STAFF

Speciality	No. of Personnel
I. Detailed Design Stage	
1. Project director	1
2. Team leader	1
3. Irrigation and drainage planning engineer	1
4. Design engineer	3
5. Survey engineer	2
6. Soil mechanical engineer	1
7. Mechanical engineer	1
8. Electrical engineer	1
9. Construction engineer	1
10. Specification expert	1
11. Specialist as required	L.S.
II. Construction Stage	
1. Project director	1
2. Team leader	1
3. Design engineer	2
4. Mechanical engineer	1
5. Construction engineer	1
6. Specialist as required	L.S.
III. Initial Operation and Maintenance Stage	
1. Agronomist	1
2. Extension specialist	1
3. Mechanical engineer	1
4. Farm machinery engineer	1
5. Water management expert	1

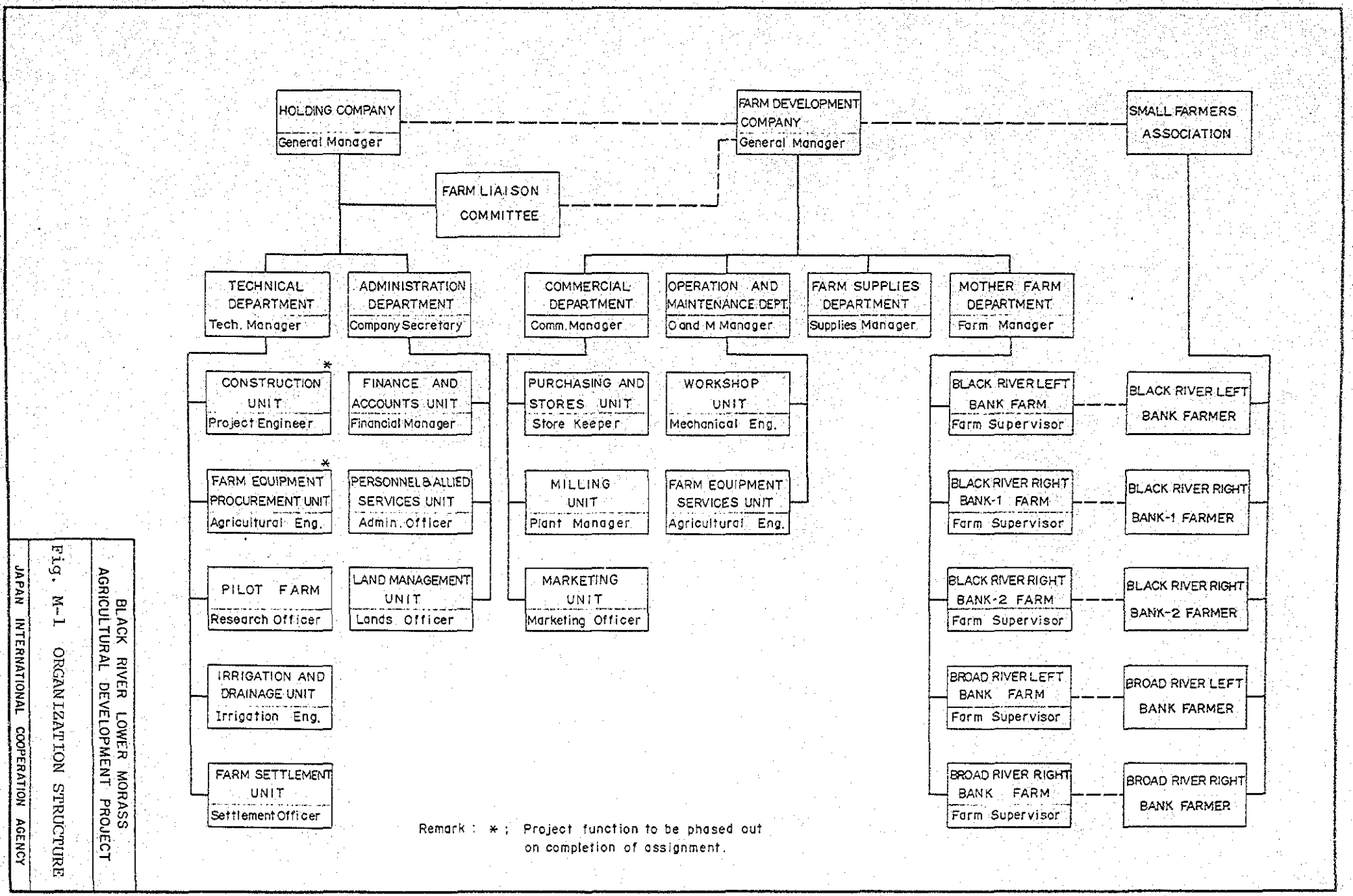

Fig. M-1 ORGANIZATION STRUCTURE

BLACK RIVER LOWER MORASS AGRICULTURAL DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

ANNEX N

IMPLEMENTATION PROGRAMME AND PROJECT COST

ANNEX N

IMPLEMENTATION PROGRAMME AND PROJECT COST

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ANNEX N

IMPLEMENTATION PROGRAMME AND PROJECT COST

1. IMPLEMENTATION PROGRAMME

1.1 Basic Considerations of Project Implementation

The implementation programme for the Black River Lower Morass Agricultural Development Project is worked out on the basis of the following basic considerations:

(1) The project consists of four areas: the Holland (560 ha), the Black River left bank (920 ha), the Broad River right bank (800 ha) and the left bank areas (800 ha).

(2) From the viewpoints of soil conditions, agricultural productivity, and easier development works, both Holland and Black River left bank areas are to be implemented in first phase and the both banks of the Broad River be implemented in the second phase after confirmation of ground water regime evaluated by field measurement and computer modelling.

(3) A mechanized construction method will be principally introduced as the civil works include a large volume of earthworks.

(4) Since there are few local contractors in Jamaica with sufficient experience and enough equipment for this kind of works, it is proposed that the construction works including land leveling works will be undertaken by qualified international contractors selected through international competitive bidding.

(5) The consultant will be engaged by the Project Office for preparation of the detailed design and tender documents, the supervision of the construction works, assistance and guidance in operation and maintenance of the project facilities, and farm guidance to the Development Company and farmers.

(6) Although most of the project areas belongs to the Government, some areas such as Vineyard, Hatfield and Slipe belong to the private person. The land necessary for irrigation and drainage canals in above mentioned areas is to be compensated by the Government. Land acquisitions for such canal and facilities shall be settled prior to the commencement of the works.

(7) The special attention must be paid to avoid the environmental pollution resulted from the constructive activities. The expense for the care of the environmental impact is to be included in the project cost.

1.2 Implementation Programme

The project implementation schedule is shown in Fig. N-1. It includes the project preparatory works and the construction works for each scheme. The project preparatory works will last 12 months including the time necessary for survey works, detailed design works and project mobilization including selection of the Contractors. The construction works of the total area lasts 60 months including prime operation and adjustment of the facilities as shown in Fig. N-2.

The construction works for the Holland area will be commenced earlier than others because its size is comparatively smaller and its clayey ground is more stable than others, and the existing cultivated area is involved in it. The embankment of polder dikes and construction of drainage pump stations for the Holland areas and Black River left bank will be carried out in parallel. In order to obtain irrigation benefits as early as possible, the headworks and canal system for the Holland area will be completed first and followed by its on-farm works. The on-farm work will be commenced for about 260 ha in the Holland area, at first, in the third year, and completed by the end of third year for the entire Holland area. In order to start the on-farm work in the Black River left bank area as early as possible, the construction of drainage canals and operation of temporary drainage pumps will be necessary. The on-farm work will be started in the area of about 350 ha in the early third year and completed in the middle of forth year.

As for the Broad River basin, however, it is proposed that the investigation and analysis on confirmation of the hydrogeological regime in both the Broad River basin and the Pedro Plains by the computer model simulation be carried out prior to the implementation.

In this connection, it is proposed to dig observation wells and to measure ground water flow regime and chemical contents. And about one year and a half is required to carry out above investigations (see Annex C and Table C-8).

Thus, the phased implementation is proposed for the entire construction works. Consequently both banks of Broad River areas will be commenced one year and a half later than that of the Black River left bank area. The on-farm work in the Broad River right and left bank areas would be started in the middle of the fourth year and completed in the sixth year.

Based on the above implementation schedule, the cultivable area would be increased year by year as shown below. (See Fig. N-1)

- 3rd year fall rice 260 ha
- 4th year spring rice 910 ha
- 4th year fall rice 1,480 ha
- 6th year fall rice 2,280 ha
- 7th year spring rice 3,080 ha

1.3 Construction Plan

1.3.1 Work quantities and construction materials

The quantities of major works are estimated as follows:

	Unit	Holland	Black Left	Broad Right	Broad Left	Total
Excavation	10^3m^3	295	656	300	422	1,673
Embankment	10^3m^3	286	642	375	329	1,732
Concrete	10^3m^3	2.2	2.8	1.9	1.8	8.7
Lining concrete	10^3m^3	4.6	7.0	3.0	3.5	18.1
Soil cement	10^3m^3	3.0	6.0	5.5	5.5	20
Form	10^3m^2	11.3	14.2	9.3	9.0	43.8

The major construction materials required for the Project are as follows:

	Unit	Holland	Black Left	Broad Right	Broad Left	Total
Cement	10^3t	2.1	3.3	2.0	2.1	9.5
Reinforcement bar	t	110	140	100	90	440
Gravel for concrete	10^3m^3	6.7	10	5	5.3	27
Sand for concrete and soil cement	10^3m^3	6.8	11.7	8.6	8.9	36
Marl for road pavement	10^3m^3	87	65	57	56	265
Timber for form works	m^3	100	110	70	70	350
Fuel	kℓ	330	550	470	470	1,820
Gate (steel)	t	3	7	5	4	19

1.3.2 Construction plan and method

Inundated peat is predominant in the project area. As main work items proposed are the earth works such as the construction of polder dikes, irrigation and drainage canals and road net-work systems, due attention must be paid to determine construction method of these earth structures. Taking into account the unique characteristics of peat land, it is proposed that the stage construction method in which embarkment works will be done in several times be introduced as stated in Annex E.

1) Construction time of polder dike

Polder dikes will be constructed on the peat of which the maximum depth is expected to be about 4 m, and the staged construction will have to be done in about 3 times. The consolidation time required for one stage construction is estimated at about 180 days as shown in Annex E. Accordingly, the period of one year and a half is needed for the construction of polder dikes on the peat.

2) Construction time of land reclamation

The construction time for land reclamation will be determined by the work quantities and the necessary time for drainage of excess water on the land. Although it is difficult to estimate precisely drying up times, considering the special nature of peat soil under the such tropical oceanic climate as in Jamaica, one year is expected to be needed for the drainage of farm land. The effect of drainage will be brought in the nearby places to the pump station or the places easily drained in elevated land. The land reclamation work will be commenced from such places drained well. The construction time of land reclamation required would be about two years for such peat soil area.

Five years including the period of mobilization and prime operation and adjustment is proposed as the total construction time for this project as shown in Fig. N-2.

3) Care of the environmental conservation

As stated in ANNEX L, the Black River Lower Morass provides ecological, scientific and educational values. It is, therefore, necessary to conserve the natural environment during the construction works as well as the normal operation period after completion of the entire project.

The plan to counter environmental pollution during the construction period is mentioned here, as that of the latter period is discussed in ANNEX G and L, AGRICULTURE AND ENVIRONMENTAL ASSESSMENT respectively.

The pollution during the construction period is mainly concerned with the drain water to the river, particularly to the Broad River. The turbidity of the drain water is to be measured periodically so that the proper monitoring can be practiced. For such care of drainage from the major structure sites, particularly pump stations during the construction period, the water drained should be diverted to the settling basin some distance from the river banks to remove unwanted sediment before discharge into the river.

1.3.3 Workable days

Earth works are mostly governed by rainfall distribution. In establishing the construction time schedule, the workable days for each month are estimated based on the assumptions that the following time lengths to suspend the works are set for the respective range of daily rainfall, by applying the average rainfall data recorded at the Lacovia rainfall station from 1979 to 1983.

Daily Rainfall Depth (mm)	Time to be suspended (day)
0 to 10	0
10 to 30	0.5
30 to 50	2.0
more than 50	3.0

The average annual total days to suspend the works are estimated to be 66 days as shown in Table N-1. Deducting 4 holidays every month from the above workable days, the annual workable days for the construction works are estimated to be 250 days.

1.4 Construction Machinery

The major civil works of the project would principally be carried out by construction machinery. The type and number of construction machinery to be employed for the major civil works are estimated based on the work quantity, construction time schedule and the construction method.

In the excavation work, ordinary construction equipment is not recommendable due to low trafficability of the ground. As the stage construction method will be adopted for the construction of polder dikes, the first stage construction of polder dikes and main drain canals have to be made in the inundated area without any drain work. Consequently, the special equipment such as amphibious excavators are to be employed. Immediately after the first stage construction of polder dikes and drain canals was made, drainage pumps are to be operated. As for the second stage embankment of the polder dike and excavation of drain canal after provisional drainage,

The materials excavated from the drain canal are utilized for embankment of the polder dikes. The embankment materials are required to be strong enough to maintain the certain form of embankment itself. The excavation work has to be carefully made not to disturb the excavated materials. The excavation by dredgers are not recommendable as the materials excavated will be extremely disturbed. Therefore, amphibious clamshells are proposed to be used as a main construction equipment of this marshy land development. The swamp type backhoe and bulldozer are also proposed for the work on soft clayey ground. The major construction equipment needed for the project are shown below:

Equipment	Specifications		Number of Equipment
Amphibious clamshell	0.4 m^3	125 HP	7
Super swamp dozer	12 t	93 HP	5
Swamp type backhoe	0.4 m^3	92 HP	10
Swamp type bulldozer	13 t	112 HP	10
Backhoe	0.7 m^3	130 HP	2
Backhoe	0.4 m^3	85 HP	3
Tractor shovel (wheel)	1.0 m^3	75 HP	3
Dump truck	8 t	242 HP	15
Bulldozer (with Ripper)	21 t	211 HP	4
Motor grader	2.5 m	76 HP	4
Rubber-tire roller	10 t	89 HP	4
Concrete mixer	0.2 m^3	7 HP	5
Aggregate plant (crushing and screening)	165 t/day		1
Truck crane	15 t		2
Cargo truck with crane	3 t		4
Fuel tanker	6 kℓ		3
Water tanker	6 m^3		2
Batcher plant	20 m/hr		1
Agitator truck	1.5 m^3		7
Water pump	8 "		5

2. PROJECT COST

2.1 Conditions

The costs for implementation of the project are estimated on the basis of preliminary design of the project facilities, taking into account the construction method to be applied, productivity of labour and machinery and also based on the following assumptions:

(1) The exchange rate used in the estimate is:

US$1.00 = J$4.00 = ¥240

(2) The main construction works will be carried out by contractor(s) selected through international competitive bidding. The construction machinery and equipment required for the construction works are procured by the contractor(s).

(3) Taxes on the construction materials, machinery and equipment to be imported from abroad, if needed, are exempted from estimation of the construction cost.

(4) The unit prices of works are divided into foreign and local currency portions. Local currency portion is estimated based on the current prices of the materials in 1984 in Kingston and Black River as well as on the cost data of on-going civil works obtained from the Government authorities concerned. Foreign currency portion is estimated based on the CIF prices at Kingston, making reference to FOB prices of materials and equipment in Japan in 1984. The classification of local and foreign currency portions is defined as follows:

Local currency portion

- Labour force,
- Sand, gravel, stone and wooden materials,
- Cement,
- Inland transportation costs,
- General expenses provided by the Government, and
- Land acquisition cost.

Foreign currency portion

- Depreciation costs of construction machinery and equipment,
- Plants to be installed for the project as pumps, motors, engines, etc.
- Reinforcement bar and steel gates,
- Fuel and lubricant,
- Contractor's general expenses and profits for foreign contractor(s),
- Expenses and fees of engineering and farm guidance services by foreign consultants, and
- Procurement costs of O & M equipment of the facilities.

(5) Physical contingencies related to the construction quantities, 10% of the direct construction cost, is included.

(6) Price contingency; 5% per annum for the foreign currency portion and 10% per annum for the local currency portion,[1/] is also included.

(7) The associated costs to be financed by the Government, such as the costs for strengthening the extension services, facilities of the water users' association, and improvement of the social structures are not included in this estimate.

2.2 Cost Estimate

The total construction costs of the project are estimated at US$43.4 million equivalent, which comprises US$17.2 million equivalent of local currency and US$26.2 million of foreign currency as shown in Table N-2. The annual disbursement schedule is worked out based on the construction time schedule, as shown in Table N-3. US$9.5 million equivalent is estimated as a price contingency.

The direct construction cost of four areas is summarized and shown in Table N-4, and their breakdown is shown in the Table from N-5 to N-8. The breakdown of direct construction cost of office and quarters is shown in Table N-9. The procurement cost of major operation and maintenance equipment is estimated as shown in Table N-10.

1/: According to the Consumer Price Indices, average annual increase rate of the consumer price index during three years from 1981 to 1983 is estimated at 9.2% though it is estimated at 16.7% in 1983.

In case of providing canal capacity to cover irrigation water required for the Pedro Plain Project, about US$1.3 million equivalent will be increased as follows:

Item	Foreign Currency	Local Currency	Total
Cost for pumping equipment	320	90	410
Cost for canals	180	220	400
Physical contingency	50	30	80
Price contingency	100	300	400
Total	650	640	1,290

The general expenses for the administration of construction work is estimated and shown in Tables N-11 and N-12, respectively. The cost for the engineering and farm guidance service made by foreign consultants is tentatively estimated as shown below.

i) Engineering service includes preparation of detailed design, tender documents, tender evaluation and construction supervision.

Foreign engineers: 270 M/M
Local engineers : 481 M/M

ii) Farm guidance includes advice on actual farm operation, extension service, workshop service, farm machinery operation and water management.

Foreign advisors : 210 M/M

The total cost of the above two services was estimated at US$6.1 million equivalent including US$4.9 million equivalent for foreign currency.

The prices of basic materials and labour wages used in the estimate and the unit rates for the major works are shown in Tables N-13 and N-14, respectively.

2.3 Annual Operation and Maintenance Costs

The annual operation and maintenance costs include the salaries of the project administrative and water control staffs, the materials and labour costs for repair and maintenance of project facilities, the costs for operation, repair and maintenance of O & M equipment, and the running costs of project facilities.

The annual operation and maintenance costs at the full development stage of the project is estimated at US$1.1 million. The summary of these costs are shown in Tables N-15 and N-16.

2.4 Replacement Costs

Some of the facilities, especially mechanical and electrical facilities have a shorter useful life than civil works and have to be periodically replaced. The replacement costs and useful lives of these facilities are listed in Table N-17.