CHAPTER 4 MAJOR IMPROVEMENTS AND QUALITATIVE BENEFIT BY THE RIVER BASIN INFORMATION SYSTEM

As described in Sectors II and III, RBIS will facilitate access to a more consistent and comprehensive river basin information, reducing the time and manpower for river basin management works. At the same time, RBIS will improve the quality of information and enable the river administrator to have a more sound engineering justification on the river basin management works. RBIS will also expand the users of the information including the government and non-government users so as to improve mutual understanding and cooperation on the river basin management works. Details of these improvements by RBIS are as described hereinafter.

(1) Quick Acquisition of Information

River basin gauging information such as rainfall, river stage/discharge and water quality is the essential information for the river management system. However, it presently takes a long period to obtain such information. The water quality of Perak River in particular has serious problems of delay from the water sampling until the completion of laboratory test. As described in Subsection 3.2.3, when Federal DOE undertakes a series of water sampling laboratory test, and data processing and storing into the database, it takes one or two months after water sampling until the State DOE gets the results of water quality test and execute the necessary pollutant control.

As for the hydrological gauging data (rainfall and river stage/discharge data), some parts are currently gauged on the real-time base through the flood forecasting and warning system. The real-time data is, however, assembled only by the State DID and not monitored at Federal DID as well as other related government agencies. Moreover, the present telemetry gauging data contains many reading errors and, therefore, could not be used as the basic data for the study on river development plans. Due to these circumstances, the river management works other than the flood forecasting and warning apply the hydrological gauging data stored at the Federal DID on the non-real time base, and it takes a few months to acquire such non-real time hydrological data after gauging.

Due to the delay of the gauging data, difficulties arise in taking the appropriate measures for control of the river flow and pollutant sources. The proposed river basin information would get rid of such delay of data acquisition through the

dynamic technical improvement utilizing the optical fiber system as data transmission device and the futuristic gauging facilities such as rainfall radar gauge and the automatic water quality gauge.

(2) Easy Access to Information

The river development plans generally require a comprehensive river basin information including map information and the database information. Since these information are massive and currently scattered into the various government and/or semi-government agencies without on-line linkage, plenty of time and manpower are spent to access those information. The proposed RBIS will substantially reduce such time and manpower through the proposed optical fiber system for data transmission and the integrated database system supported by the Geographic Information System (GIS).

(3) Qualitative Improvement of Information

The proposed system will improve the quality of information in a wide range as given in Table V-9. The principal improvements are as enumerated below:

(a) The coverage of gauging data is extended to provide further dynamic visual and audible scenes of the remote field on real-time base which effects the disaster management in particular.

(b) Most of the information stored in the database are supported by map information which enables the river administrator to well clarify the various river basin characteristics.

(c) The proposed system unifies all related information to realize a more consistent river basin management. For instance, at present, the information on water intake from the river are currently dispersed in DID (for irrigation water supply) and PWD (for domestic/industrial water supply); therefore, nobody knows the total water intake volume from the river causing difficulties in managing the water supply and water resources development. The proposed system will unify all water intake information to facilitate a consistent water supply management. Likewise, the monitoring points for river flow discharge and river water quality are currently not unified causing difficulties in

establishing river flow conditions. The proposed system will unify the gauging points and provide integrated information.

(4) Improvement of Engineering Justification Relative to River Basin Management Works

The State DID of Perak directly executed about twenty (20) river management works and/or plans in 1997. In addition, the State DID was requested to make a technical justification on numerous projects closely related to river management works such as bridge construction, land development along the river course, and river sand mining works. According to the interview survey, however, such engineering justification is not always efficiently made due to the limited number of river engineers and the difficulty in obtaining the desired basic information. Items (1) to (3) above will enable the river administrator to have a more sound engineering justification on river basin management works through the improved gauging facilities, data transmission system, and data processing system.

(5) Expansion of Users

Most of the existing information related to river basin management are separately stored by the different government agencies and seldom exchanged among them. The proposed system will integrate the scattered information and distribute them to the related government agencies. Such expansion of government users will provide better and common understanding and cooperation on the river management to the related government agencies and thus facilitate a consistent and comprehensive river basin management. The cooperation of the public on the river basin management will also be one of the significant benefits of the proposed system. Through opening of the river basin information, the river administrator could disseminate the background and purposes of the river basin management and reflect the public opinions in them, thus intensifying the smooth relationship between the river administrator and the public.

CHAPTER 5 ECONOMIC EVALUATION ON THE RIVER BASIN INFORMATION SYSTEM PROPOSED IN MASTER PLAN

5.1 Economic Benefit

The economic benefit by RBIS will accrue from both the real-time information and the database information disseminated by RBIS. The contents of each economic benefit are as described below.

5.1.1 Economic Benefit of Real-time Information

RBIS will disseminate the telemetry hydrological gauging information on real-time base. Such hydrological gauging information could be availed both for water supply management and water flood mitigation.

(1) Economic Benefit in Water Supply Management

As described in Sector II, the water deficit in Perak river basin may possibly occur, as experienced in 1990, with a recurrence probability of 5-year return period. This water deficit is attributed to lack of integrated hydrological monitoring system between DID and TNB. RBIS will release the real-time information on river discharge at the downstream from the hydropower dams to TNB so that TNB could have more flexible reservoir operation of the existing hydropower dams and solve the probable water deficit with minimal reduction of power reduction. The water deficit causes reduction of irrigation water supply leading to reduction of paddy production. The annual average value of the production loss is estimated at RM 0.34 million that could be regarded as the annual average economic benefit of RBIS (refer to Subsection 6.1.2 in Sector II).

(2) Economic Benefit in Flood Mitigation

Among the existing hydropower dams, Kenering and Chenderoh dams currently have no flood mitigation effect to the lower reaches from the dams. However, the hydrological information (storm rainfall and flood river flow discharge) by RBIS could avail the reservoir operation of the two dams for flood mitigation without adverse effect to power generation.

The detailed study on the potential flood mitigation effect by Kenering and Chenderoh dams are made in Chapter 6 of Sector II. According to the results of the

study, the annual flood damage value is estimated at RM 2.6 million under the present reservoir operation of Kenering and Chenderoh dams. On the other hand, the value is reduced to RM 2.0 million when RBIS starts to provide the real-time information and, Kenering and Chenderoh dams effect the flood mitigation in the lower reaches. The reduced value of RM 0.6 million is regarded as an annual average economic benefit of RBIS.

5.1.2 Economic Benefit of Database Information

The reduction of time and manpower is expected, in particular, for the study and/or formulation of river development plans. The reduction of such time and manpower by the proposed system is rather intangible, and it is virtually difficult to accurately estimate their value. An attempt was, however, made to estimate a part of the value from the current annual expenditure for the river development plans by State DID of Perak. The annual expenditures as well as their corresponding man-month for the river development plans in 1991 to 1997 was estimated, referring to the State DID Annual Reports, as shown in Table V-10. Then, the proposed system is assumed to reduce about one-third of the actual expenditures and man months in 1997 that are currently spent on average for access and collection of the basic information for the river development plans. This assumption is made according to the interview survey from State DID and the experience of the Study Team. As the results, the following reduction of expenditures and man-month are estimated as the benefit of the proposed system.

Reduction of annual expenditure	RM 0.5 million
Reduction of annual man-month	
Professional Engineer	17 M/M/year
Assistant Engineer	34 M/M/year
Technician	63 M/M/year
Total	119 M/M/year

The national expenditure for river management tends to remarkably increase as seen in the expenditure of DID in the Five-year Malaysia Plan. In line with such increment of national expenditure, the expenditure for the river development plans of Perak River is going to certainly increase, and that also leads to the increment of the above benefit by the proposed system. In due consideration of these conditions, the annual economic benefit for the project is estimated as below:

(a) The annual benefit as of 1997 will increase in the future with a rate of 13.8% per year, which is the average growth of expenditure for river management in the recent 30 years.

(b) The increase of the above annual benefit will continue until the year 2020 which is set as the target of the long-term national development plan in Malaysia as described in Malaysia Vision 2020.

(c) A part of the above full benefit will be generated during the implementation of the project. The ratio to full benefit generated during the implementation is assumed as the ratio of accumulated investment cost to the total investment cost.

5.2 Economic Cost

The project financial cost as estimated in Chapter 3 is converted into its corresponding economic cost by multiplying the conversion factor of 90% which is assumed, referring to "National Parameters for Project Appraisal in Malaysia". As the results, the economic cost for RBIS proposed in Master Plan is estimated as below:

Description	Financial Cost	Economic Cost
Investment cost (System procurement and installation cost)	RM 19.56 million	RM 17.63 million
Annual operation and maintenance cost (full operation)	RM 4.00 million	RM 3.60 million

The annual disbursement of economic cost is further estimated in the following manner:

(a) The 5-year investment in each Malaysia Plan is made in accordance with the project implementation schedule as described in Sector IV.

(b) The annual operation and maintenance cost consists of the maintenance cost of the system devices, the manpower cost for the system operation, and the lease cost of the communication system (the optical fiber communication system and the satellite communication system). Among them, the annual maintenance cost and the operation cost is allocated according to the accumulated investment cost. The lease cost for the optical fiber system is also allocated throughout the project period, while the lease cost for the satellite communication system is allocated after the year 2015 in accordance with the implementation schedule of the project.

5.3 Economic Internal Rate of Return of the Project

The economic evaluation for the project is made based on the economic internal rate of return (EIRR), using the annual flow of economic benefit and cost given in Table V-11. In the annual flow, the project period is assumed to be 10 years after completion of the project in due consideration of durability of the system devices. As the result, the EIRR for the proposed project is estimated at 10.8% and judged to be within the applicable opportunity cost (10 to 12%). Thus, the EIRR shows that the proposed project is economically justifiable.

Moreover, the benefit for the above EIRR is only limited to the reduction of expenditures for the river development plan of DID. However, the project will contain other additional intangible benefits as enumerated below, and therefore, the potential EIRR for the project will be far higher than the above value of 10.1%:

(a) The EIRR is subject to the economic cost estimated from the current market price of system devices. However, the current price, in particular, the price of computer will be certainly reduced in the future due to the expansion of users and the technology improvement.

(b) The government agencies such as DOE and PWD other than DID also undertake the study and/or formulation of river development plans and, therefore, the cost reduction for their study and plan formulation could be added to the benefit.

(c) In addition to the cost reduction for the river development plan, the project could improve the current river management works due to quick and easy access to the related information.

(d) The project could also expand the users of the information inducing better understanding and cooperation of the government agencies as well as the public on the river management works.

CHAPTER 6 ECONOMIC EVALUATION ON THE OPERATIONAL SYSTEM ESTABLISHED DURING THE STUDY PERIOD

6.1 Economic Benefit

As described in Chapter 4, the RBIS proposed for the Master Plan contains the following three kinds of economic benefit:

(a) Improvement of water deficit by dam reservoir operation that could be realized through the real-time information on the low river flow discharge in the lower reaches;

(b) Reduction of flood damage by dam operation that could be realized through the real-time information on the basin-wide storm rainfall and the flood river flow discharge; and

(c) Reduction of time and manpower for formulation of river development plans that could be realized by the database information.

The Operational System is equipped with the telemetry river flow gauging system which could have the same function for water supply management as the RBIS proposed in the Master Plan. Accordingly, the Operational System could achieve the same economic benefit for the above item (a) as the RBIS.

As for the above item (b), the RBIS is equipped with the radar rainfall gauge that could enable to clarify the wide area states of rainfall effecting the objective flood control of the item. However, such radar rainfall gauge is to be installed in line with the long-term development plan and, therefore, has not been employed in the Operational Plan. Due to the lack of radar rainfall gauge, the Operational System could hardly fulfill the above item (b).

In connection with the above item (c), RM 0.5 million/year was estimated as the present annual average economic value by the RBIS proposed for the Master Plan. The Operational System is equipped with the comprehensive database information on river basin management and, therefore, could achieve the same economic benefit (RM 0.5 million/year) as the RBIS proposed for the Master Plan. It is further assumed that the RBIS proposed for the Master Plan would increase the present economic benefit on item (c) in the future as the expenditure for river management increases. However, the Operational System will hardly realize such increment of the benefit due to its limited data processing capacity.

In due consideration of the above conditions, the annual average economic benefit by the Operational System is estimated as below:

Item		Annual Average Benefit (RM million/year)
(1)	Improvement of water deficit by real-time information on low river flow discharge in the lower reaches	0.34
(2)	Reduction of flood damage by real-time information on basin-wide storm rainfall and flood river flow discharge	-
(3)	Reduction of time and manpower for formulation of river development by database information	0.50
Total		0.84

6.2 Economic Cost and Economic Return of the Project

In the same way as the aforesaid Master Plan Study, the project financial cost of these investment cost and the annual operation and maintenance cost estimated in Sector IV are converted into their corresponding economic cost by multiplying with the conversion factor of 90%. As the result, the economic cost for the Operational System is estimated as below:

Description	Financial Cost (RM million/year)	Economic Cost (RM million/year)
1. Investment cost		
1.1 Procurement of hardware	RM 0.36 million	RM 0.32 million*
1.2 Procurement of software	RM 0.45 million	RM 0.41 million*
1.3 Development of software	RM 0.14 million	RM 0.14 million*
1.4 Initial Data Input	RM 0.94 million	RM 0.85 million*
1.5 Cost for planning and designing (by JICA Study Team)	RM 1.03 million	RM 1.03 million
Total	RM 2.92 million	RM 2.92 million
2. Annual operation and maintenance cost		
2.1 Manpower cost	RM 0.02 million/year	RM 0.02 million/year*
2.2 Lease cost of ISDN line (64kbps)	RM 0.05 million/year	RM 0.05 million/year*
2.3 Maintenance cost of hardware (15% of the item 1.1)	RM 0.05 million/year	RM 0.05 million/year*
2.4 Data renewal cost (10% of Item 1.4)	RM 0.09 million/year	RM 0.08 million/year*
Total	RM 0.21 million/year	RM 0.21 million/year

* Multiplied with conversion factor of 0.9

The economic evaluation for the project is made based on the economic internal rate of return (EIRR), using the annual flow of economic benefit and cost given in Table V-12. In the annual flow, the initial investment cost is disbursed within the first year as made in this

Study, and the annual operation and maintenance cost accrues from the second year onward. The project period is assumed to be 10 years after completion of the project in due consideration of durability of the system devices. As the result, the EIRR for the proposed project is estimated at 17.1% and judged to be within the applicable opportunity cost (10 to 12%). Thus, the EIRR shows that the proposed project is economically justifiable.

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TABLE

Table V-1 CONSUMERS' PRICE INDEX (1997=100)

Year	Index
1966	29.80
1967	31.18
1968	31.11
1969	31.03
1970	31.57
1971	32.10
1972	33.10
1973	36.64
1974	42.93
1975	44.85
1976	46.08
1977	48.31
1978	50.61
1979	52.46
1980	55.99
1981	61.44
1982	64.98
1983	67.36
1984	70.05
1985	70.28
1986	70.81
1987	70.97
1988	72.81
1989	74.81
1990	76.80
1991	80.18
1992	83.95
1993	86.94
1994	90.17
1995	94.93
1996	98.31
1997	100.00

Table V-2 GROSS NATIONAL PRODUCT AND POPULATION IN MALAYSIA

Year	Gross National Project (GNP)		Population		Per Capita GNP	
	Annual Amount (RM million)	Annual Growth (%/year)	Population (million)	Annual Growth (%/year)	Annual Amount (RM million)	Annual Growth (%/year)
1986	94,351		16.11		5,857	
1987	105,230	11.5%	16.53	2.6%	6,366	8.7%
1988	117,808	12.0%	16.94	2.5%	6,954	9.2%
1989	129,243	9.7%	17.35	2.4%	7,449	7.1%
1990	144,215	11.6%	17.76	2.4%	8,120	9.0%
1991	153,096	6.2%	18.18	2.4%	8,421	3.7%
1992	166,506	8.8%	18.61	2.4%	8,947	6.2%
1993	178,034	6.9%	19.06	2.4%	9,341	4.4%
1994	195,474	9.8%	19.65	3.1%	9,948	6.5%
1995	221,308	13.2%	20.69	5.3%	10,696	7.5%
1996	241,424	9.1%	21.17	2.3%	11,404	6.6%
Ave.	158,790	8.9%	18.37	2.5%	8,500	6.2%

Note: GNP and Per Capita GNP are expressed in 1997 price.

Table V-3 FEDERAL ANNUAL REVENUE AND DEVELOPMENT EXPENDITURE
(1997 PRICE LEVEL)

Year	Revenue		Development Expenditure	
	Annual Amount (RM million)	Annual Growth (%/year)	Annual Amount (RM million)	Annual Growth (%/year)
1986	27,562		28,349	
1987	25,565	-7.2%	28,443	0.3%
1988	30,170	18.0%	29,957	5.3%
1989	31,899	5.7%	31,593	5.5%
1990	32,015	0.4%	31,441	-0.5%
1991	42,468	32.7%	35,289	12.2%
1992	46,755	10.1%	38,208	8.3%
1993	47,952	2.6%	37,055	-3.0%
1994	54,838	14.4%	38,887	4.9%
1995	53,675	-2.1%	38,526	-0.9%
1996	57,470	7.1%	42,501	10.3%
1997	60,778	7.1%	41,413	7.5%
Ave.	42,596	6.3%	35,139	3.2%

Table V-4 DEVELOPMENT EXPENDITURES OF DEPARTMENT OF IRRIGATION AND DRAINAGE ALLOCATED TO EACH FIVE-YEAR MALAYSIA PLAN (1997 PRICE LEVEL)

Category	1st MP 19966-70	2nd MP 1971-75	3rd MP 1975-80	4th MP 1981-85	5th MP 1986-90	6th MP 1991-95
Irrigation	840.4	369.1	601.7	385.8	81.6	109.8
Agricultural Drainage	80.8	105.5	305.8	193.1	108.3	108.1
River(Flood Mitigation)	22.6	36.9	110.5	243.9	277.7	578.0
Water Resources (Hydrology)	-	-	-	6.4	2.7	9.2
Coastal Programs	-	-	-	-	16.9	115.8
Other Programs	25.9	42.2	69.0	273.9	33.3	98.5
Total	969.7	553.7	1087.0	1103.1	520.6	1019.3

Note:

* Expenditures in the Malaysia Plans except the 6th MP are the actual amounts finally disbursed, while expenditures in the 6th MP are the estimated values in the Mid-term Review.

* Expenditures for Water Resources in the 1st MP to the 3rd MP are allocations to other categories.

TableV-5 INVESTMENT COST FOR RIVER BASIN INFORMATION SYSTEM PROPOSED IN MASTER PLAN

Devices	Unit Cost ('000 RM)	Quantity	Cost ('000RM)	%
1. Gauging/monitorind				
Radar rainfall gauge	4,230 /unit	1 unit	4,230	21.6
Real-time water quality gauge	160 /unit	5 units	800	4.1
Industrial television (ITV)	247 /unit	4 units	987	5.0
Portable information terminal (PIT)	7 /unit	1 unit	7	0.0
Sub-total			6,025	30.8
2. Data processing				
Setver machine (UNIX)	76 /unit	9 units	684	3.5
Computer for radar analysis	6,840 /unit	1 unit	6,840	35.0
Computer for water quality analisis	1,100 /unit	1 unit	1,100	5.6
Input device	126 /unit	2 units	252	1.3
Output device	32 /unit	1 unit	32	0.2
Terminal Adopter	6 /unit	2 units	12	0.1
Software	Lamp sum		705	3.6
Audio Machines	828 /unit	2 units	1,656	8.5
Sub-total			11,281	57.7
3. Data Transmission				
Maltiplex radio wave for rainfall radar	1,320 /unit	1 unit	1,320	6.7
Telemetry divice for water quality	90 /unit	5 units	450	2.3
Telemetry line for water level gauge	60 /unit	8 units	480	2.5
Sub-total			2,250	11.5
Grand Total			19,556	100

Table V-6 PROCUREMENT COST OF HARDWARE AND SOFTWARE FOR THE OPERATIONAL SYSTEM

Item	Quantities	Unit Cost RM	Cost RM
1. Hardware			
(1) Workstation	2 units	111,490	222,980
(2) Personal Computer	2 units	10,980	21,960
(3) Digitizer	1 unit	15,480	15,480
(4) Plotter	1 unit	23,300	23,300
(5) Laser Jet Printer	2 units	3,760	7,520
(6) HUB(10Mb)	2 units	690	1,380
(7) HUB(100Mb)	1 unit	2,940	2,940
(8) Modular Router	2 units	11,700	23,400
(9) 4 mm Type Driver	1 unit	4,930	4,930
(10) CD-R Driver	1 unit	2.650	2,650
(11) AVR	2 units	260	520
(12) UPS	3 units	4,980	14,940
(13) Ethernet Cable	16 units	50	800
(14) Power Supply Cable	3 meters x 3	25	75
(15) Power Supply Cable	5 meters x 3	40	120
(16) Ethernet Card	1 unit	440	440
(17) Consumption	Plotter Ink x 5 sets	690	
(18) Consumption	Plotter Paper x 5 sets	245	
(19) Consumption	CD-R disc x 20 pices	20	
(20) Consumption	Printer toner x 2 set	380	
(21) Consumption	DAT/DDS Type x 1 set	340	
Sub-total			347,660
2. Software			
(1) Arc/Info	1	350,310	350,310
(2) Arc/View	1	36,110	36,110
(3) Web Server Soft	2	33,000	66,000
(4) Printer Server Soft	2	480	960
(5) Installation	1	15,000	15,000
Sub-total			468,380
Grand Total			816,040

Table V-7 COST FOR DEVELOPMENT OF APPLICATION PROGRAM FOR TELEMETRY SYSTEM UNDER THE OPERATIONAL SYSTEM

Description	Unit Cost (RM)	Cost (RM)
1. Data Transmission Application: a. Reprogramming Telewin to enable: • Manual key-in dam data. • Calculating all station's discharge data. • Alarm generation. • Data feeding. b. Installation, Testing and Commissioning. c. Creation of manual.	42,000	42,000
2. Web Server Communication: a. To write data transfer scheduler program. b. Installation, Testing and Commissioning. c. Creation of manual.	25,200	25,200
3. Web Viewer Application: a. Web-page design with generation and web server data integration and application. b. Installation, Testing and Commissioning. c. Creation of manual.	66,920	66,920
Total		134,120

Table V-8 COST FOR INITIAL DATA INPUT TO THE OPERATIONAL SYSTEM (1/2)

Description	Quantities	Unit Cost (RM)	Cost (RM)
1. Digitizing and Data Import of Map Information			
(1) Basin Boundary	28 sheets	2,400	66,900
(2) Contour	28 sheets	5,500	153,400
(3) River	28 sheets	5,500	153,400
(4) District Boundary	28 sheets	3,400	94,400
(5) Major Road and Railway	28 sheets	2,800	78,700
(6) Major Town	13 sheets	2,800	36,500
(7) Major Bridge	9 sheets	2,400	21,500
(8) Real-time Gauging Station	12 sheets	2,400	28,700
(9) Non-real time Gauging Station	23 sheets	2,400	54,900
(10) Mean Monthly Rainfall	5 sheets	2,800	14,100
(11) Location of Channel Stretch	10 sheets	2,800	28,100
(12) Flood Mitigation Scheme	10 sheets	2,400	23,900
(13) Flood Inundation Area	6 sheets	3,100	18,500
(14) Intake Point	2 sheets	2,400	4,800
(15) Domestic/Industrial Supply Area	2 sheets	3,100	6,200
(16) Water Quality Sampling Points	2 sheets	2,400	4,800
(17) Major Pollutant Sources	2 sheets	2,400	4,800
(18) Protected Area	2 sheets	2,400	4,800
(19) Distribution of Aquatic Wildlife	2 sheets	2,400	4,800
(20) River Parks	9 sheets	2,400	21,500
(21) Camp Sites	9 sheets	2,400	21,500
(22) Royal Mausoleums	9 sheets	2,400	21,500
(23) Geology	2 sheets	5,500	11,000
(24) Soil	2 sheets	3,200	6,500
(25) Land Use	2 sheets	3,200	6,500
(26) Structure Plan	1 sheets	3,200	3,200
(27) Future Land Use Plan	1 sheets	3,200	3,200
(28) Forest Reserve	2 sheets	3,200	6,500
Sub-total			904,600

Table V-8 COST FOR INITIAL DATA INPUT TO THE OPERATIONAL SYSTEM (2/2)

Description	Quantities	Unit Cost (RM)	Cost (RM)
2. Data Import and Input of Tabular Information			
(1) Cadastral Map (data conversion)	1,200 files	10	12000
(2) Hydrological Information	1,100 files	10	11,000
(3) Land Registration Table	500 records	6	3,000
(4) Miscellaneous			5,000
Sub-total			31,000
3. Input of Graphic Information			
(1) Rainfall Intensity Curve at IPOH	1 sheet	300	300
(2) Channel Profile 1	1 sheet	300	300
(3) Profile of River Channel Flow Capacity	1 sheet	300	300
(4) Annual Trend of Water Quality	3 sheets	300	800
(5) Historical Logging Volume	1 sheet	300	300
Sub-total			1,900
Grand Total			937,500

Table V-9 QUALITATIVE IMPROVEMENT OF INFORMATION BY THE PROPOSED SYSTEM

Item of Information	Qualitative Improvement
1. Gauging data	(1) Rainfall gauging area is expanded by radar rainfall gauge covering the present blind area particularly in the upper reaches. (2) Gauging of water quality and river flow discharge is unified at the principal gauging points. (3) The dynamic visual and audible scenes of remote field could be monitored by the ITV system.
2. Information related to flood management	(1) Location and structure of previous and on-going flood mitigation works in the entire river basin are made available. (2) The river channel flow capacity of the entire river stretch is newly made available. (3) Extent of probable flood inundation area as well as land use and other socio-economic statistics in the possible flood inundation area are newly made available.
3. Information related to water supply and water resources management	(1) Location and structural features of all water supply and water resource facilities in the river basin are newly made available. (2) All water intake volume for the entire river basin system are integrated into a unified data base (3) All water demands with Perak river as the source are integrated into a unified data base. (4) Perspective of all water intake volume and the river flow discharge are monitored on the real-time base.
4. Information related to environmental management	(1) Information of river morphology (the river channel survey) are newly made available. (2) Integrated information on the ecotourism are newly made available. (3) Inventory of fauna and flora in Perak river are newly made available.
5. Map information	(1) The following map information for the entire Perak river basin are newly made available; (a) Classification of forest reserve area (b) Updated land use map (c) Structural Plan (urban and industrial development plan (d) Cadastral map

Table V-10 ANNUAL EXPENDITURES FOR RIVER DEVELOPMENT PLANS BY STATE DID OF PERAK

Year	Expenditure	Man-month of Required Stuffs			
	(RM million)	Professional Engineer	Assistant Engineer	Technician	Total
1991	0.82	30	61	121	212
1992	0.88	33	65	130	228
1993	0.95	35	70	140	246
1994	N/A	N/A	N/A	N/A	N/A
1995	1.15	42	85	169	297
1996	1.12	41	83	166	290
1997	1.39	51	102	205	359

Note: The expenditure is solely for study and/or plan formulation excluding the construction cost.

Table V-11 CASH FLOW OF ECONOMIC COST AND BENEFIT OF RIVER BASIN INFORMATION SYSTEM PROPOSED IN MASTER PLAN

(Unit: RM million)

Year	(1) Investment Cost	(2) Accumulated Investment Cost	(3) Maintenance Cost *	(4) Total Cost (1)+(3)	(5) Full Benefit	(6) Actual Benefit	(7) (1)-(6)	Remarks
2001	0.390	0.39	0.37	0.76	0.84	0.02	0.75	8th Malaysia Plan
2002	0.393	0.78	0.44	0.83	0.95	0.04	0.79	- ditto-
2003	0.396	1.18	0.51	0.91	1.09	0.07	0.83	- ditto-
2004	0.399	1.58	0.58	0.98	1.24	0.11	0.87	- ditto-
2005	0.403	1.98	0.65	1.05	1.41	0.16	0.89	- ditto-
2006	0.409	2.39	0.72	1.13	1.60	0.22	0.91	9th Malaysia Plan
2007	0.415	2.80	0.79	1.21	1.82	0.29	0.92	- ditto-
2008	0.421	3.23	0.87	1.29	2.07	0.38	0.91	- ditto-
2009	0.427	3.65	0.94	1.37	2.36	0.49	0.88	- ditto-
2010	0.434	4.09	1.02	1.45	2.68	0.62	0.83	- ditto-
2011	0.697	4.78	1.14	1.83	3.05	0.83	1.00	10th Malaysia Plan
2012	1.120	5.90	1.33	2.45	3.48	1.16	1.29	- ditto-
2013	1.800	7.70	1.64	3.44	3.96	1.73	1.71	- ditto-
2014	2.893	10.60	2.14	5.04	4.50	2.71	2.33	- ditto-
2015	4.649	15.25	2.95	7.60	5.12	4.43	3.17	- ditto-
2016	1.581	16.83	3.41	4.99	5.83	5.56	-0.58	11th Malaysia Plan
2017	0.537	17.36	3.50	4.04	6.63	6.53	-2.50	- ditto-
2018	0.183	17.55	3.53	3.71	7.55	7.51	-3.80	- ditto-
2019	0.062	17.61	3.54	3.60	8.59	8.58	-4.98	- ditto-
2020	0.021	17.63	3.54	3.57	9.78	9.78	-6.21	Project Completed
2021			3.54	3.54	9.78	9.78	-6.23	
2022			3.54	3.54	9.78	9.78	-6.23	
2023			3.54	3.54	9.78	9.78	-6.23	
2024			3.54	3.54	9.78	9.78	-6.23	
2025			3.54	3.54	9.78	9.78	-6.23	
2026			3.54	3.54	9.78	9.78	-6.23	
2027			3.54	3.54	9.78	9.78	-6.23	
2028			3.54	3.54	9.78	9.78	-6.23	
2029			3.54	3.54	9.78	9.78	-6.23	
2030			3.54	3.54	9.78	9.78	-6.23	
Total	17.63	153.28	69.06	86.69	172.33	149.01		
						EIRR=	10.8%	

Note :

Maintenance Cost includes the followings

(1) Maintenance cost of equipment (=15% of the accumulated economic investment cost)

(2) Man-power cost for system operation

(= The financial cost (RM 0.46 million) x economic conversion factor (0.9)) x (Accumulated investment cost) / (total investment cost)

(3) Lease cost of optical fiber system (=The financial lease cost (RM 0.34 million) x economic conversion factor (0.9))

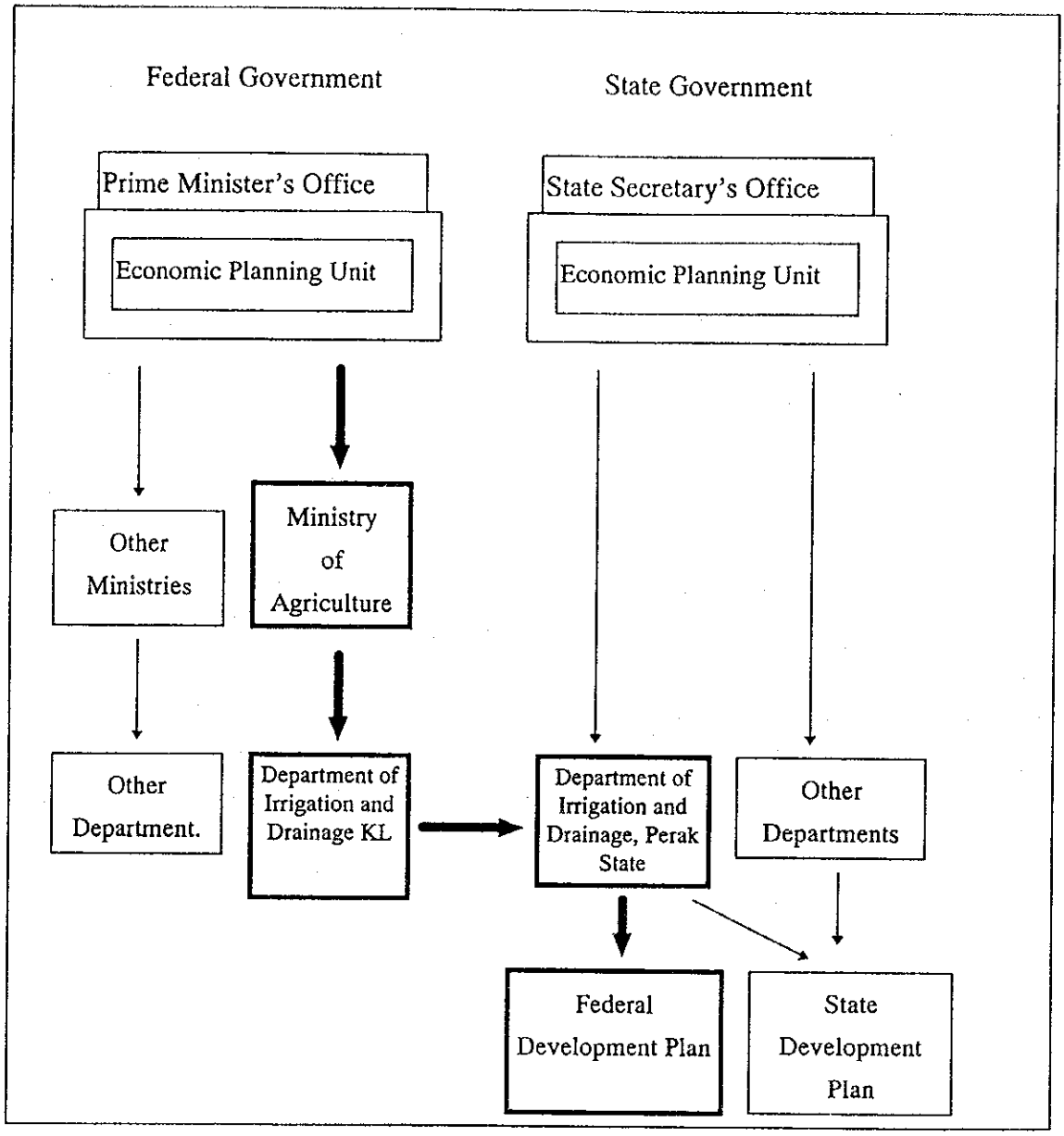
(4) Lease cost of satellite communication system (The financial lease cost (RM 0.2 million) x economic conversion factor (0.9)) only during 11th Malaysia Plan

Table V-12 CASH FLOW OF ECONOMIC COST AND BENEFIT OF THE OPERATIONAL SYSTEM ESTABLISHED IN THE STUDY PERIOD

(Unit: RM million)

Year	(1) Investment Cost	(2) Accumulated Investment Cost	(3) Maintenance Cost *	(4) Total Cost (1)+(3)	(5) Full Benefit	(6) Actual Benefit	(7) (1)-(6)
1998	2.92	2.92		2.92			2.92
1999			0.21	0.21	0.00	0.84	-0.63
2000			0.21	0.21	0.00	0.84	-0.63
2001			0.21	0.21	0.00	0.84	-0.63
2002			0.21	0.21	0.00	0.84	-0.63
2003			0.21	0.21	0.00	0.84	-0.63
2004			0.21	0.21	0.00	0.84	-0.63
2005			0.21	0.21	0.00	0.84	-0.63
2006			0.21	0.21	0.00	0.84	-0.63
2007			0.21	0.21	0.00	0.84	-0.63
2008			0.21	0.21	0.00	0.84	-0.63
Total	2.92	2.92	2.10	5.02	0.00	8.40	
						EIRR=	17.1%

FIGURE



THE STUDY ON THE ESTABLISHMENT OF THE RIVER BASIN INFORMATION SYSTEM IN MALAYSIA	Fig. V-1 FINANCIAL SYSTEM OF MALAYSIA
JAPAN INTERNATIONAL COOPERATION AGENCY	

Items to be Estbalished	8th MP (2001-2005)	9th MP (2006-2010)	10th MP (2011-2015)	11th MP (2016-2020)
1. Gauging/Monitoring System				
(1) Water stage gauging (expansion of the existing netwok)	●			
(2) Portable information terminal (PIT)	●			
(3) Automatic water quality gauge		●		
(4) Radar rainfall gauge			●	
(5) Industrial television (ITV)				●
2. Processing System				
(1) Data base server	●			
(2) Input/output devices	●			
(3) Computer for analysis of real-time water quality data		●		
(4) Computer for analysis of radar rainfall gauge data			●	
(5) Audio Control Server				●
3. Data Transmission System				
(1) Telemetry system (expansion of the existing system)	●			
(2) Optical fiber network (between KL - Ipoh and within the area of KL)	●			
(2) Telemetry system (for real-time water quality)		●		
(3) Maltiplex radio wave system (for radar rainfall gauge)			●	
(4) Optical fiber network (within Perak river nasin)				●

THE STUDY ON THE ESTABLISHMENT OF THE RIVER BASIN INFORMATION SYSTEM IN MALAYSIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V-2 PROJECT IMPLEMENTATION SCHDULE FOR MASER PLAN

THE STUDY ON THE ESTABLISHMENT OF THE RIVER BASIN INFORMATION SYSTEM IN MALAYSIA	Fig. V-3 IMPLEMENTATION SCHEDULE FOR DEVELOPMENT OF THE OPERATIONAL SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY	

SECTOR VI

INSTITUTIONAL SETUP PLAN

SUPPORTING REPORT

SECTOR VI

INSTITUTIONAL SETUP PLAN

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CHAPTER 1 INTRODUCTION

This Supporting Report, Sector VI, Institutional Setup Plan, presents the major issues on the existing institutional framework of river basin management and proposes the institutional setup plan for managing the river basin information system (RBIS).

CHAPTER 2 EXISTING INSTITUTIONAL FRAMEWORK

As in other states, all activities within the Perak river basin must be approved by the State Government, i.e., through the State Executive Council (EXCO), based on the recommendations of the State Planning Committee (SPC) and the State Economic Planning Committee (SEPC) which are all chaired by Menteri Besar. All activities related to river management works are carried out in compliance with the Waters Act 1920 (Revised, 1989) and are managed by various government and semi-government agencies that advise the SPC and SEPC accordingly with regard to safeguarding the requirements of their respective functions.

2.1 Main Direct Users of Perak River

The following are the main users of the river proper:

(1) Tenaga Nasional Bhd (TNB)

TNB's main interest is on the upper reaches of the river where it operates and controls four (4) hydropower dams; namely, Chenderoh at the downstream, Kenering, Bersia and, at the upstream, the Temenggor which has the largest storage capacity. The hydroelectric power supply from this system feeds into the national grid.

(2) Department of Irrigation and Drainage (DID)

The DID is presently operating and maintaining eight (8) extraction points for irrigation supply to 13,113 ha. of double-cropping paddy land. These consist of seven (7) pumping stations and one (1) gravity intake along the Perak River from Kuala Kangsar to Kg. Gajah.

The DID is also in charge of flood forecasting and warning along the Perak River and also has the responsibility of advising the Director of Land and Mines in sand mining.

(3) Perak Water Board (Lembaga Air Perak - LAP)

The Perak Water Board (more popularly known as LAP), which is responsible for the State's domestic water supply, is presently operating and maintaining six (6) water

treatment plants extracting directly from the Perak River. The major one is the Sultan Idris Shah II located in Parit, supplying the Sitiawan area and the City of Ipoh.

(4) Department of Fisheries

The Department of Fisheries presently carry out cage-culture especially for tiger prawn in the lower reaches of the river near the estuary and as such is very much dependent on the river.

Fishing boats, the licensing of which comes under the jurisdiction of the Fisheries Department, are very much affected in their daily movement by the condition of the river especially at the estuary.

(5) Yayasan Perak

Yayasan Perak, a subsidiary of the State Economic Development Corporation of Perak, is involved with ecotourism on the Perak River that includes boat cruise along the river from below the Chenderoh Dam to the estuary at Bagan Datoh. It is responsible to the State Government for preserving the natural conditions along the river.

(6) Marine Department

The Marine Department, which controls navigation on waterways, is presently faced with the siltation problem especially at the estuary.

2.2 Agencies Involved in River Basin Management

These agencies, responsible for implementation, supervision and control of activities that can contribute to changes in water quality and regime of the Perak River, are as follows:

(a) Department of Land and Mines - approval and implementation of Land Schemes where control in soil erosion due to land clearing is necessary. The Department is also responsible for the issue of sand mining license.

(b) Forest Department - supervision and control of logging activities. Controlled deforestation and adequate anti-erosion measures in the construction of access must be properly considered to prevent adverse soil erosion problem.

(c) City/Municipality/Local Councils - the related activities are:

(i) Discharge of sewers and sewerage

(ii) Soil erosion due to earthworks in the development of urban areas.

(d) Public Works Department (PWD) - involved particularly in the construction and maintenance of bridges across the Perak River.

(e) Department of Environment (DOE) - involved in overseeing and enforcement with regard to the effluent discharges from factories/industries.

2.3 Present Situation of River Management in Perak

One of the most important aspects of efficient River Management is the availability of a sound River Basin Information System (RBIS).

Presently the various government and semi-government agencies establish and preserve the river basin information individually. Though there are sharing and exchanges, without a central coordinating body, difficulties and inconveniences arise especially when real-time information is required and redundancies occur in establishing information stations. The following are examples of shortcomings in the present situation:

(1) Flood Mitigation Management

The TNB owns four (4) manual reading hydrological gauging stations (for rainfall and reservoir level) located in the catchment of the Temengor Dam, but no real-time gauging can be made. On the other hand DID has two (2) telemetry rainfall gauging stations in the catchment area of the hydropower dams for the purpose of flood forecasting and warning. However TNB and DID do not have a fixed arrangement to share and exchange their respective gauging data. Although in the past there were consultations in times of floods, due to the absence of an efficient system of joint monitoring, delays and loss of real-time information had resulted in inability to provide more effective forecasting and warning.

(2) Water Resources Management

The main users are the DID and PWB, but there is no definite coordinating body to manage a consistent water allocation. Both agencies operate water extraction for their own needs and in accordance with their own schedule without reference to the other's schedule or the prevailing stream flow.

Even though there is an agreement between TNB and the State Government to guarantee a minimum flow discharge of 4,000 cusec at the Iskandar Bridge, there is no monitoring to confirm the discharge. As a result the TNB releases a constant minimum flow discharge of 3,000 cusec from Chenderoh Dam on the assumption that the remaining 1,000 cusec will be contributed by the tributary, Pelus River.

(3) River Water Quality Management

Other than PWB that is responsible for domestic water supply in the State, the Fisheries Department too is very much concerned in pollution in the river. PWB monitors its own water sampling at all its treatment plants and from time to time get assistance from the DOE. The Fisheries Department is in the process of setting up its own water sampling stations to assist its projects on cage-culture.

The DOE monitors the river water quality but the actual water sampling works, laboratory tests and data base processing of water quality are made by the Federal DOE. This results in considerable delays before the State DOE can have access to the results, thus, making it difficult for quick appropriate measures to be taken when problems are detected.

The water quality in the Perak River generally deteriorates because of effluent discharges from factories, breeding of livestock, processing of agricultural products and sewerage systems in urban areas. There is a need to make available information on the extent of these activities.

(4) River Channel Management

Sedimentation of the Perak River is becoming a serious problem from the middle reaches downstream to the estuary. This has resulted in the reduction of channel flow capacity causing more widespread and longer duration inundation in the monsoon season. Navigation especially in the estuary area is now restricted causing problem especially to fishing boats.

Boat cruises organized for ecotourism by Yayasan Perak face navigation problems in the dry season. Turbidity in the river water has created problems (respiratory problems) related to cage-culture projects implemented by the Fisheries Department and private owners.

The main sources causing this sedimentation problem are land clearing for agriculture and logging activities. The availability of a comprehensive information system of land use in the catchment area will be a useful guide especially to DID River Management Division when processing applications for land development schemes in the Catchment Area.

Presently there is a lack of stations monitoring the rate of siltation and silt loads along the Perak River.

Bank erosion is another problem that needs to be checked and in which Yayasan Perak is very much concerned. In the ecotourism project presently organized along the Perak River, Yayasan Perak has been given the responsibility to preserve the present natural conditions along the river. Historical sites along and close to the riverbanks have been preserved and developed (e.g., the site at Pasir Salak) for tourism.

Bank collapses are generally due to the deflection of river flow caused by sediment deposit in the mid-stream, diverting the flow towards the riverbanks. This normally happens at low stage of the river, and the inconsiderate mining of sand close to the riverbanks further aggravates instability of riverbanks.

2.4 The Need for a River Authority

In the State of Perak even though there are legislation and policies for safeguarding the rivers, the various river related agencies adopt them only for their own functions, working singularly without a common goal. None of these agencies has full authority on river management. For example, the Department of Irrigation and Drainage (DID) which is most directly and closely involved with rivers (in maintenance and flood mitigation works) has no administrative authority on river management, though it is the technical advisor to the State Government on matters pertaining to rivers.

The Perak River at present is relatively clean in terms of obnoxious pollution, but turbidity is already becoming a serious problem. At present there is also no competition in the use of the river water itself, but all this will change as development increases. It can now be seen that ecotourism along the Perak River has received a good response. Ecotourism together with other recreation along the river corridor and the increase in environmental awareness have given a new dimension to river management.

As development in the state increases the present "segmented management" on rivers without a common goal can create various negative impacts on the rivers and can frustrate the ability to achieve a permanent and sustainable river management.

CHAPTER 3 PROPOSED INSTITUTIONAL SETUP PLAN

3.1 Principles of Institutional Setup Plan for the Management of River Basin Information System

The long-term development plan for the river basin information system (hereinafter referred to as "RBIS") for the Perak river basin has been formulated and, further, its pilot system (called "the Operational System") has been established during the study period. In order to manage the RBIS effectively, an institutional setup plan has been formulated, and its details are described in this Chapter.

The Cabinet at its meeting on July 23, 1997 had directed the Ministry of Agriculture to look into the setting up of the National River Authority. The Authority has the task to oversee the comprehensive river basin management including flood management, water supply management, and river environmental management. The RBIS could ultimately facilitate such comprehensive river basin management through its serving of various river basin database as well as real-time hydrological gauging information.

However, the setting up of the Authority will require further time as the existing related legislation and policies need to be reviewed and revised. Moreover, the river basin information system has been initially developed only as a basin-wide system for the Perak river basin, and it will take a substantial time to expand the system to the nationwide scale and to fully support the task of the National River Authority. In due consideration of the these conditions, the following principles are given to formulate the institutional setup plan for RBIS:

(a) RBIS is not to take over the current river basin management practice by the various government/semi-government agencies, or the future river basin management to be controlled by the National River Authority. Instead, the objective of RBIS is to furnish the comprehensive river basin information to support river basin management. Accordingly, RBIS is not to prescribe any institutional setup for the current river management practice and/or the future National River Authority. Thus, the institutional setup plan is formulated as a model case for management of one river basin scale (i.e., Perak river basin) but the future nationwide expandability of RBIS is also incorporated.

(b) The management body of RBIS is also not to take over the data management work that is currently being undertaken by various government and

semi-government agencies. Instead, the management body will have the function to collect and link the existing data information sources so as to maximize the mutual benefits in sharing information among the related agencies as well as the public system users.

3.2 Proposed Institutional Setup Plan

The proposed organization for management of RBIS is composed of tiers with the RBIS Steering Committee as the top, supported by the RBIS Technical Committee as the second level and the RBIS Technical Center as the third level. The formation, roles, composition and functions in each tier are as described hereinafter.

3.2.1 Steering Committee

In Malaysia, information technology is being intensively developed and information is being opened through the wider area network. In fact, RBIS has already been equipped with the wide area network communication system. Moreover, the National Land Information System (NaLIS) and Hydrological Information System (HIS) are going to develop their wide area communication service for land information and hydrological information, respectively. Such progressive information technology will facilitate the easy and effective data communication but at the same time generate several issues as enumerated below:

(a) How to protect data confidentiality and/or copyright of data;

(b) How to standardize and synthesize the related information systems so as to create interchangeability among the systems;

(c) How to develop human resources to cope with the advanced information technology; and

(d) How to import progressive information technology.

RBIS involves various kinds and levels of government and semi-government agencies as its information source. Accordingly, the above items are significant issues on the management of RBIS, and the Steering Committee will determine the policies to cope with the issues and provide the guidelines/directions on utilization of the objective information through coordination with the related government agencies.

The Steering Committee will also monitor the national policies on the information technology through activities of the following related national councils and committees and reflect them to the management of information of RBIS (refer to Tables VI-1 and VI-2).

National Council and Committee Related to RBIS

Name of Council and Committee	Tasks Related to Management of RBIS
National Land Information System (NaLIS) Central Council	Formulate policies on development, implementation and operation on National Land Information system
National Information Technology Council (NITC), and National Committee on Database Processing (NCDP)	• Formulate policies, strategies and standards on the utilization and development of information technology (IT). • Monitor and evaluate the programs, projects and activities pertaining to use and development of IT. • Enhance and encourage the use and development of IT.
National Remote Sensing Committee (NRSC)	Formulate national policy on remote sensing technology
National Mapping Committee	Coordinate and advice all mapping and charting activities undertaken by government agencies

The information center of RBIS is placed at Federal DID under the Ministry of Agriculture, and all information is collected and/or provided through the existing wide area network called "Agrolink" which is under the control of the Ministry of Agriculture. Thus, the Ministry of Agriculture is the core ministry for RBIS. Due to this background, the secretary general of the Ministry of Agriculture is proposed as Chairman of the Steering Committee, and the Secretariat to the Committee is further proposed to be the Information Technology Unit of the Ministry of Agriculture and the River Division of Federal DID. The members of the Steering Committee will be the representatives of the following government agencies closely related to the formulation of the national policy on information technology:

(a) Economic Planning Unit, Prime Minister's Department

(b) Malaysian Administrative & Management Unit, Prime Minister's Department (as representative of the National Data Processing Committee)

(c) Department of Survey and Mapping (as representative of the National Mapping Committee)

(d) Ministry of Land Cooperative Development (as representative of the NaLIS Central Council)

(e) Malaysian Institute of Micro-electric Systems (as representative of the National Information Technology Council))

(f) Malaysian Center for Remote Sensing (as representative of the National Remote Sensing Committee)

(g) National Hydraulic Research Institute, Malaysia

(h) State Representatives

(i) Department of Irrigation and Drainage (as Secretariat to the Steering Committee)

3.2.2 Technical Committee

Based on the aforesaid policies formulated by the Steering Committee, the Technical Committee will determine all technical standards to prescribe the management of RBIS. At the same time, the Committee will undertake all technical monitoring and evaluating works required for the management of the RBIS Technical Center. The detailed tasks for the Technical Committee are as enumerated below:

(a) To determine and update the format, procedure and all other necessary technical arrangement for data input/output through coordination with the information sources and users of RBIS;

(b) To determine and update all necessary protocols for data communication;

(c) To determine the mechanism of system use charges;

(d) To evaluate and approve the technical manual on daily system management prepared by the Technical Center;

(e) To monitor the information technologies practiced in Malaysia as well as import them to the management of RBIS; and

(f) To evaluate the accessibility, availability, quality and effectiveness of information and reflect the results of evaluation to the management of RBIS.

The Technical Committee will be chaired by the Director General of DID, who is also responsible for all systems operation and management. The River Division of Federal DID is also proposed as the competent authority for the Technical Center of RBIS and will act as the Secretariat to the Committee. The members of the Committee will consist of all government and semi-government agencies designated as the information source and/or the users of RBIS. The members will include, but not necessarily be confined to the following:

(a) Federal Agency

(i) Department of Irrigation and Drainage (Hydrology Division);

(ii) National Hydraulic Research Institute, Malaysia

(iii) Department of Survey and Mapping, Malaysia as the data source for topographic map information;

(iv) Department of Agriculture as the data source for land use and soil map;

(v) Department of Environment as the data source for river water quality and basin pollutant source;

(vi) Malaysia Meteorological Service as the data source for meteorological information source;

(vii) Department of Geological Survey of Malaysia as the data source for geographic map information;

(viii) Department of Statistics as the source for socioeconomic census data; and

(ix) Public Work Department as the data source for bridges.

(b) State Agency of Perak

(i) Economic Planning Unit as the data source for state development plans;

(ii) Department of Irrigation and Drainage as the data source for telemetry gauging data, and at the same time, as the water user for irrigation;

(iii) Perak Water Board as the water user for domestic and industrial water supply;

(iv) Forest Department as the data source for basin forest conditions;

(v) Yayasan Perak as the data source for ecotourism on Perak River;

(vi) TNB as the data source for dam information;

(vii) Department of Environment as the data source for river water quality and basin pollutant source; and

(viii) Town and Country Planning Department as the data source for structural plans.

(ix) All other state authorities designated as the data source and/or data user of RBIS.

(x) All local authorities designated as the data source and/or data user of RBIS.

3.2.3 Technical Center

The Technical Center is placed at the office of the River Division of the Federal Department of Irrigation and Drainage, and its sub-center is placed at the State DID in Perak. The task of the Technical Center is to undertake all necessary operation and maintenance of hardware, software, and database of RBIS. The Technical Center will also service the system users, supplying newsletters and highlighting the latest developments in functions of RBIS so as to advertise RBIS. As for the branch center at the State DID, its task is to operate and maintain the telemetry data management system.

In order to ensure the effective daily operation and maintenance, the following staff should be engaged as a minimum requirement:

(a) One (1) system manager, one (1) database manager and one (1) digitizing operator at the Technical Center in Kuala Lumpur; and

(b) One (1) system operator for the telemetry data management system at the Technical Sub-center in Perak State.

All staff will need particular knowledge on the system operation. Among the staff, the system manager in particular has the most important role, taking care of overall operation and maintenance of all hardware and software of RBIS. Other staff will take part in management work; namely, the Database Manager will be in charge of database management; the Digitizing Operator will undertake the actual digitizing works for various map information; and the System Operator will operate and maintain the telemetry management system in the sub-center at the State DID of Perak. Thus, the Technical Center will undertake daily system operation and management. The major items for the daily operation and maintenance are as enumerated below:

(a) To periodically update the database as well as the constants of rating curve (water stage – discharge relation curve) for real-time information in accordance with the instructions in the "System Management and Operation Manual";

(b) To revise the structure of database in order to expand the items of information in the database upon instruction from the Technical Committee;

(c) To update the web homepages in accordance with the revision of contents of the database and/or real-time information;

(d) To update the arrangement of the system IP address in accordance with the altered system users and/or request from the Agrolink network manager;

(e) To review and revise the "System Management and Operation Manual" which has been prepared initially by the JICA Study Team, and to prepare the revised technical manual for approval of the Technical Committee;

(f) To operate the web servers for both database and the real-time information as required;

(g) To undertake system troubleshooting, referring to the "System Management and Operation Manual"; and

(h) To entrust the recovery of fatal system damages to a professional engineering firm (refer to Chapter 5).

3.3 Alternatives to the Composition of the Management Body of RBIS

The RBIS proposed in this Study limits its objective coverage area only to the Perak river basin, although the ultimate goal is to have a nationwide coverage. Thus, proposed is a prototype system that may be expanded in the future.

The composition of members proposed to manage and operate the prototype RBIS for the Perak river basin in Section 3.2 is practicable and easy to set up. However, the set-up may need to be modified depending on the conditions given below:

(a) The RBIS for the Perak river basin could, in principle, be managed at the Federal level. However, as the RBIS expands and increases its coverage of objective river basins, the issues of each river basin and/or each state pertaining to the RBIS will also diversify. To cope with such circumstances, the participation of State Governments will need to be reinforced to involve them as the core members for the management body of the RBIS.

(b) Since a wide-area network information service related to RBIS like the NaLIS is going to prevail in Malaysia, the management body should maintain consistency of information services to ensure more effective information management.

(c) As presented in Section 3.1, the National River Authority may be established to oversee a comprehensive river basin management. Should the National River Authority be established, the management body of the RBIS will need to be attached to the Authority.

In due consideration of the above conditions, several alternatives on the composition of the management body of the RBIS are conceived as presented in the following Subsections.

3.3.1 Alternative 1 (Oriented to Management Body during Transition Period of Expansion of RBIS)

As the RBIS expands its objective river basins, the Federal and State members of the management body will increase as data sources and/or data users. Under such conditions, coordination among the agencies involved is very important to reinforce the functions of the Steering Committee and the Technical Committee.

Among the agencies involved, the Federal Economic Planning Unit (EPU) is the central coordination body for those related to river basin development and water use. It serves as the forum for central policy and decisions on river basin management. Based on this concept, the Chairman and Secretariat of the Steering Committee during the transition period of expansion should come from the Federal Economic Planning Unit.

The membership of the Steering Committee is in accordance with the one proposed in Section 3.2. However, the Steering Committee involves State representatives as members, which may increase as the RBIS expands its coverage over the many state territories. To maintain the appropriate scale of the Steering Committee, the State Representative should be the Chairman of the State Technical Committee (i.e., an executive officer from State EPU).

To clarify and cope with the requirements of various state agencies, Technical Committees will need to be established at the Federal and in each State Level. The Chairman and Secretariat of the Technical Committees will be drawn from the Federal EPU and the State EPUs (UPENs). Such a set-up would ensure a closer relationship between the Federal and State governments and, at the same time, facilitate coordination among DID, PWD, DOE and other various Federal and State agencies involved in water use. The Technical Committee will involve all agencies designated as data sources and/or data users of RBIS as proposed in Subsection 3.2.2.

The Technical Center and its Sub-center are placed, for the present, at the Federal DID in Kuala Lumpur and the State DID of Perak, respectively. During any transition period of expansion of RBIS, the Technical Center would be maintained by Federal DID, while Technical Sub-centers would be established in each State that comes within the coverage of RBIS. The Technical Center and its Sub-centers can be incorporated and/or privatized

through concession, as alternative choice, for effective management and operation. The staffs required for the Technical Center are as described in Subsection 3.2.3.

3.3.2 Alternative 2 (Oriented to Management Body Proposed in NaLIS)

Both NaLIS and RBIS aim at providing the on-line access to land and river basin information, respectively, as index of national resources, and the major users of such information are the State governments. Thus, NaLIS and RBIS are closely related to each other, and a consistent institutional setup for NaLIS and RBIS could facilitate a more effective usage of information.

The NaLIS Central Council (NCC) is proposed as the top-level forum to decide the policy for development, implementation and operation of NaLIS. The Prime Minister is proposed to be the Chairman of NCC considering that NaLIS is a Federal project to achieve the national objectives towards better land management. To maintain consistency with the organization of NaLIS, the Prime Minister is also conceived as the Chairman of the Steering Committee under the RBIS. The proposed Secretariat of NCC is entrusted to the Ministry of Land and Cooperative Development, the technical core agency of NaLIS. In the same way, the Secretariat of RBIS is entrusted to the Ministry of Agriculture, the technical core agency of RBIS.

NaLIS contains the NaLIS Regulatory Authority (NRA) as the second level to oversee data standards, data copyright, data quality, data security, data charges and other regulatory works. Thus, NRA has functions similar to those of the proposed Technical Committee of RBIS. The Chairman and Secretariat of NRA is the Ministry of Land and Cooperation Development at the Federal level and the State Department of Land and Cooperation Development at the State level. In the same manner, the Chairman and Secretariat of the Technical Committee of RBIS proposed under this Alternative is the Federal DID at the Federal level and the State DID at the State level. As for the members of the Steering Committee, Technical Committee and Technical Center, they will be in accordance with those proposed for Alternative 1.

As stated above, this Alternative 2 is oriented to the consistent membership of NaLIS, and would be effective only when NaLIS and RBIS prevail in Malaysia with a substantial coverage area. Due to such conditions, setting up of this Alternative may take time and should follow the set up proposed as Alternative 1.

3.3.3 Alternative 3 (Oriented to River Authority)

As stated in Section 3.1, the Ministry of Agriculture is looking into the setting up of the National River Authority. Upon establishment, the Authority will oversee the nationwide river basin management.

The State DID of Selangor also is now undertaking the "Pilot River Basin Management Study of Selangor River" to formulate an appropriate river basin management plan for Selangor River in particular. The Study proposes the Selangor River Authority (SRA) to undertake actual monitoring and coordinating works for the river basin management. All proposals made by SRA are clarified by EXCO and finally approved by Menteris Besar of Selangor State.

The Study may implicate a model of the institutional setup for individual river basin management. Several state river authorities like SRA may be established, one for each river basin, and the National River Authority will have jurisdiction over such state river basin management bodies.

The RBIS will have the role to provide the necessary river basin information to the National River Authority as well as the State River Authorities. To facilitate such a role, it is proposed that the Chairman and Secretariat of the Steering Committee at the Federal Level of RBIS are the Prime Minister and the National River Authority, respectively. The membership to the Steering Committee will involve the State representatives as well as the representatives of all federal agencies that are closely related to the formulation of the national policy on information technology, as proposed in Section 3.2.

As for the Technical Committee, the Federal Committee and State Committee will be established as proposed in Alternatives 1and 2. As in the Steering Committee, the Prime Minister and the National River Authority will act as Chairman and Secretariat of the Technical Committee at the Federal Level, while Menteris Besar and the State River Authorities will be the Chairman and Secretariat of the Technical Committee at the State Level. The membership of the Technical Committee will involve all agencies designated as data sources and/or data users of RBIS.

The National River Authority also will have jurisdiction over the Technical Center for RBIS, and a Technical Sub-center will be established in each State, controlled by the State River Authority. The Technical Center and its Sub-center could be incorporated and/or privatized

through concession, as alternative choice, for effective management and operation. The staffs required for the Technical Center are as described in Subsection 3.2.3.

This Alternative 3 is subject to establishment of the National River Authority. However, the setting up of the Authority will require further time since the existing legislation and policies need to be reviewed and revised as mentioned in Section 3.1. Moreover, this Alternative may need to be modified according to the condition of NaLIS. Thus, this Alternative is regarded as an issue to be examined in the far future.

REFERENCES

(1) Feasibility Study for National Information System (NaLIS), December 1995, Ministry of Land & Co-operative Development

(2) National Water Resources Study, Malaysia, Vol. 19 Water Laws and Institutions, October 1982, Japan International Cooperation Agency

(3) Federal Constitution

(4) State Constitutions

(5) Water Enactment

(6) Water Supply Enactment

(7) Environmental Quality Act

(8) Local Government Act

TABLE

TABLE VI-1 MEMBERSHIP COMPOSITION AND SUBJECT OF NATIONAL COUNCILS AND COMMITTEES RELATED TO RBIS

Item	Council/ Committee	Subject	Membership Composition
1	NaLis Central Council (NCC)	Land Information	i. Prime Minister (Chairman) ii. Deputy Prime Minister (Deputy Chairman) iii. Ministry of Land and Cooperative (Secretary) iv. Other members from the Federal and State Agencies.
2	National Information Technology Council (NITC)	Information Technology	v. Prime Minister (Chairman) vi. Deputy Prime Minister (Deputy Chairman) vii. Director General, Malaysian Institute of Microelectronic Systems (MIMOS) (Secretary) viii. Malaysian Institute of Microelectronic System (MIMOS) Secretariat ix. Other members from the Public and Private sector.
3	National Remote Sensing Committee	Remote Sensing policies and guideline related to environmental monitoring and data	i. Secretary-general, Ministry of Science, Technology the Environment (Chairman) ii. Representatives from Government Departments (Maximum 10 members) iii. Representatives from Government Research Institutes (maximum 6 members) iv. Representatives from Universities & Institutions (Maximum 6 members) v. Malaysian Centre For remote Sensing (MACRES) (Permanent Secretariat)
4	National Committee On Data processing (NCDP)	Government Computerisation Programmes	i. Deputy Secretary-general, Prime Ministers Department (Chairman) ii. Director-General, Malaysian Administrative & Management Planning Unit (MAMPU)(Alternate Chairman) iii. Director-General, Implementation Coordination Unit, Prime Minister's Department iv. Secretary-general, Ministry of Science, Technology the Environment v. Director, National Institute of Public Administration Malaysia (INTAN) vi. Deputy Director-Generals (Maximum 2 Depts) vii. Director, Information Technology Division (MAMPU) (Secretary) viii. Two (2) representatives from local universities ix. Three (3) computer experts from the Public Sector.
5	Nationl Mapping Committee (NMC)	Mapping	i. Director-General, department of Survey & Mapping Malaysia (Chairman) ii. Director-General, Department of geological Survey Malaysia iii. Representatives from Ministry (Maximum 2 ministries) iv. Directors from other Department (Maximum 10 members) v. Representatives of Vice Chancellors (maximum 3 Universities) vi. Director's Representatives, MARA Institutes of Technology (ITM) vii. Director, Mapping Survey, department of Survey & Mapping Malaysia (Secretary)

TABLE VI-2 MAJOR TASKS OF NATIONAL COUNCILS AND COMMITTEES RELATED TO RBIS

Item	Council / Committee	Major Task
1	NaLIS Central Council	i. Formulate policies on development, implementation and operation of National Land Information System (NaLIS) ii. Supervise the operation of NaLIS undertaken by the NaLIS Clearing House
2	National Information Technology Council (NITC)	i. Formulate strategies for the utilisation and development of IT ii. Establish IT standards iii. Monitor and evaluate the effective implementation of programmes, projects and activities pertaining to the use and development of IT. iv. Support the development of human resources in the field of IT. v. Enhance and encourage the use and development of IT with the objectives of improving the performance of organisations and individuals performance at all levels of society.
3	National Remote Sensing Committee (NRSC)	i. Formulates and recommends the country's policy on remote sensing to the Federal Cabinet. ii. Compiles directory of remote sensing activities on the country
4	National Committee On data Processing (NCDP)	i. Formulate a national information technology policy to develop coordinate and oversee the most beneficial information technology applications for national modernisation, management and development. ii. Provide guidelines for the acquisition and applications of information technology in the public sector. iii. Promote, develop and encourage the establishment and expansion of the local information technology industry in the country. iv. Advise and develop the level of professionalism in the fields of information technology training and applications at all levels in the country. v. Encourage research in the fields / activities related to information technology.
5	National Mapping Committee (NMC)	i. Coordinate all mapping and charting activities undertaken by Government Departments and Agencies. ii. Advise the Government, through the Director of National Mapping on matters related to mapping and charting policies. iii. Advise all Federal Government Mapping Departments and Agencies on mapping and charting priorities. iv. Advise State Governments on mapping matters according to the requirements from time to time.