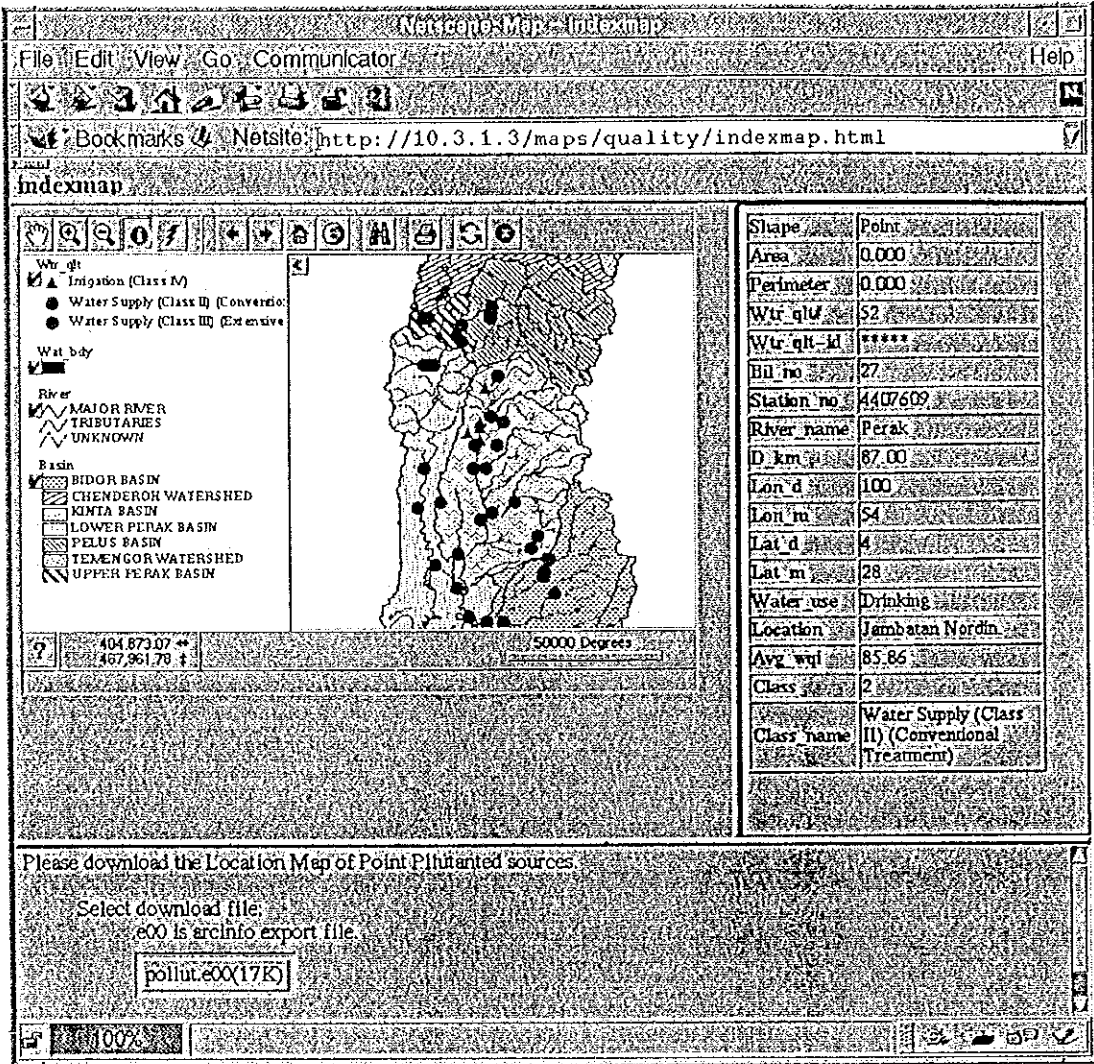
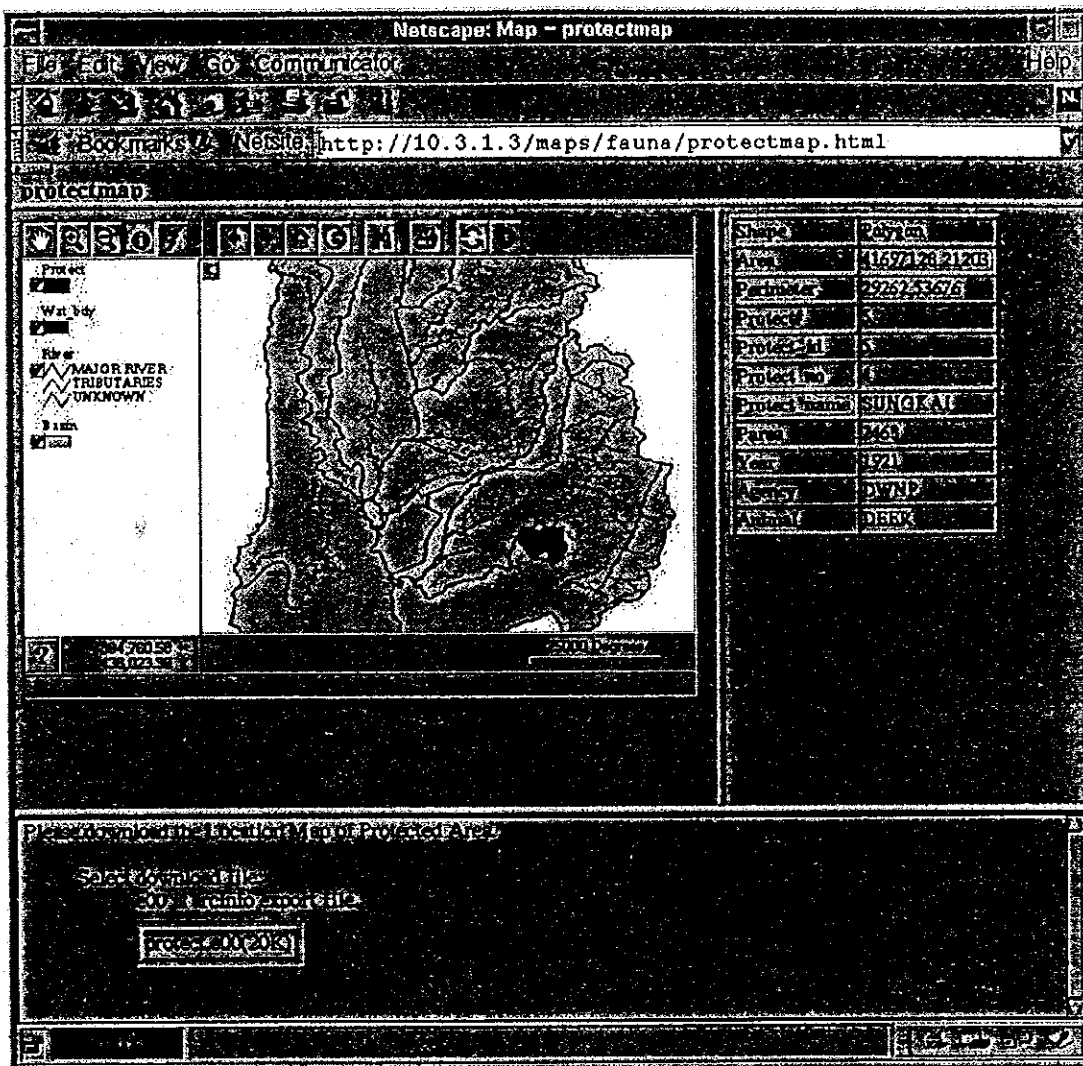


THE STUDY ON THE ESTABLISHMENT OF THE RIVER BASIN INFORMATION SYSTEM IN MALAYSIA

Fig. IV-39 WATER QUALITY INDEX MAP HOMEPAGE

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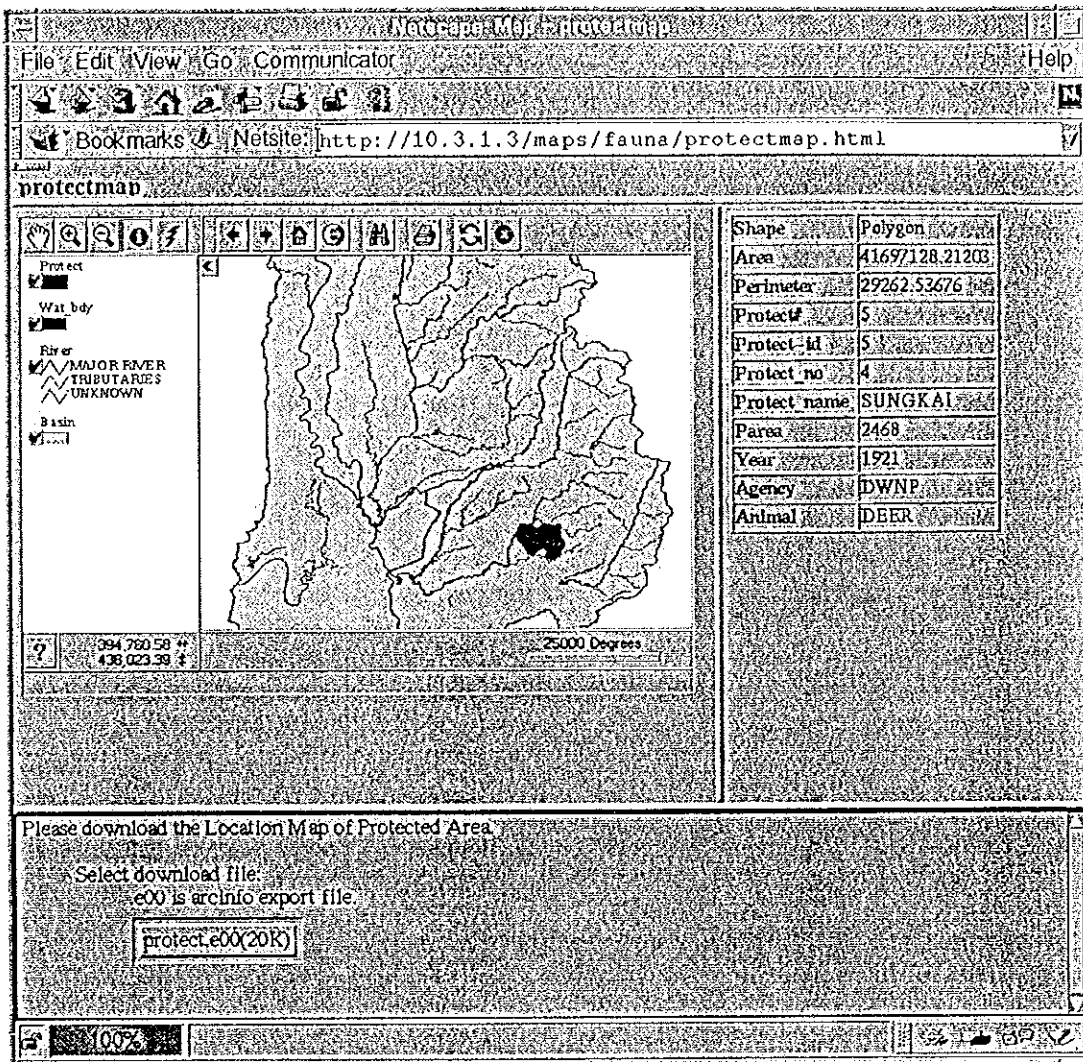


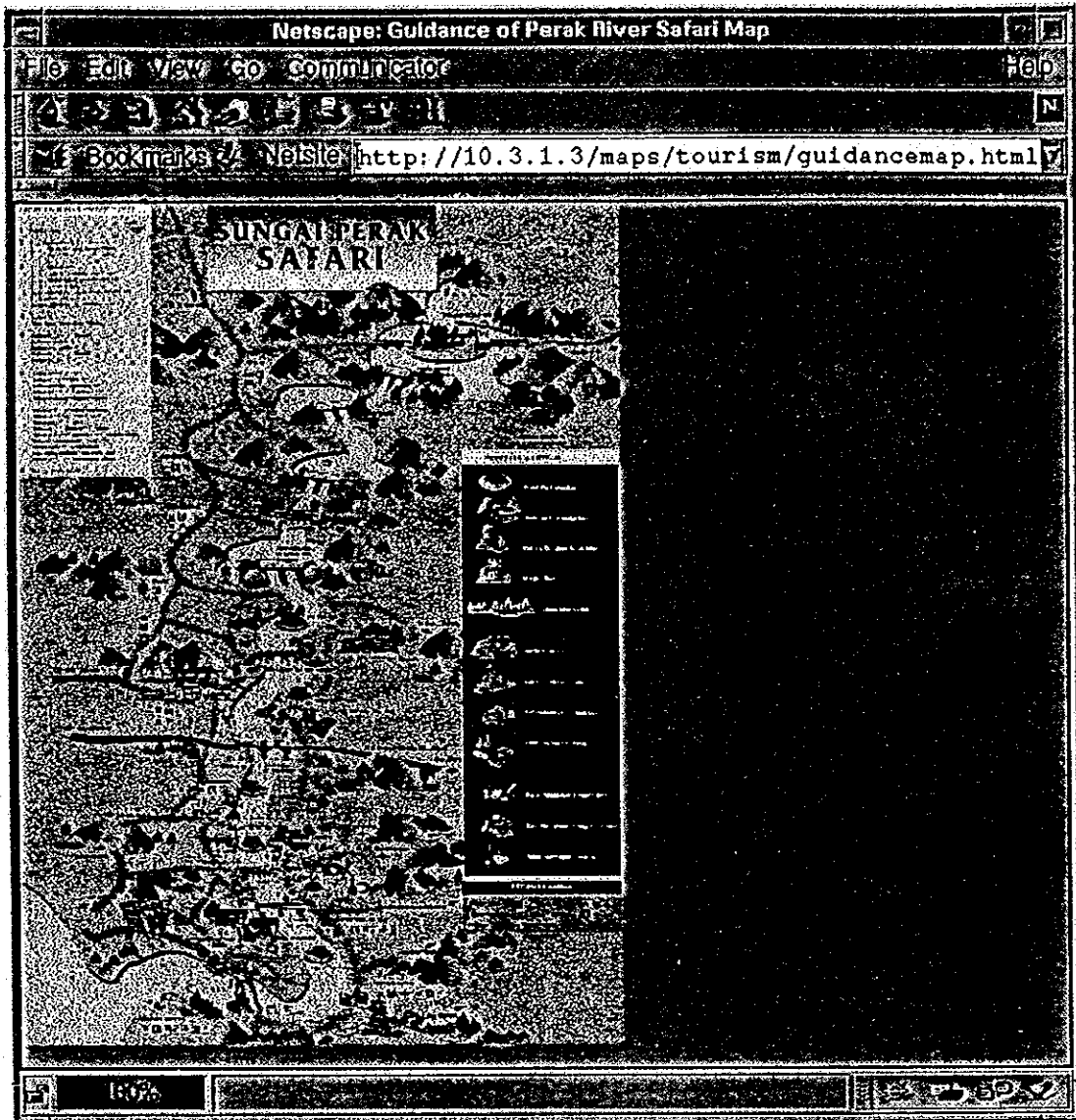


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Fig. IV-40 FAUNA AND FLORA PROTECTED
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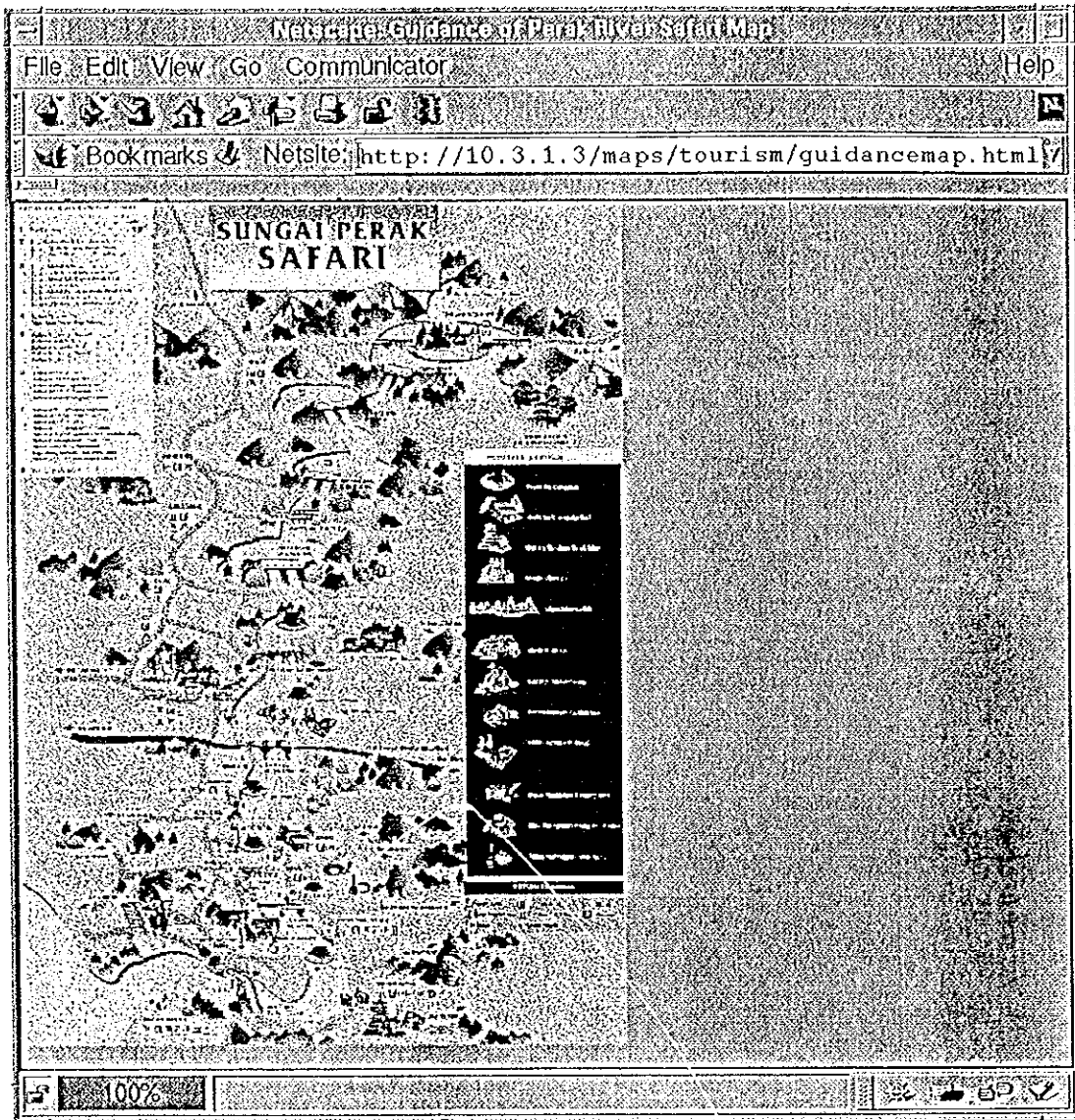


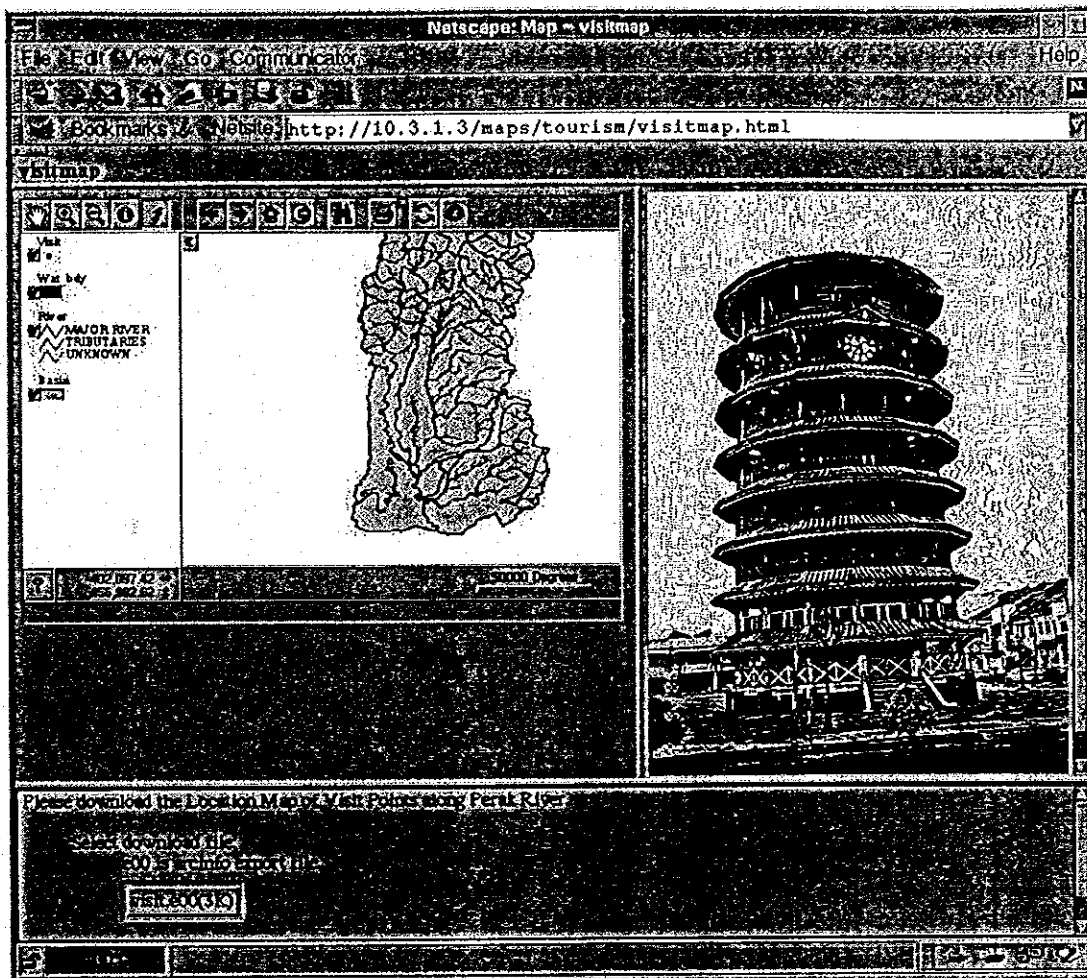


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Fig. IV-41 PERAK RIVER SAFARI GUIDANCE
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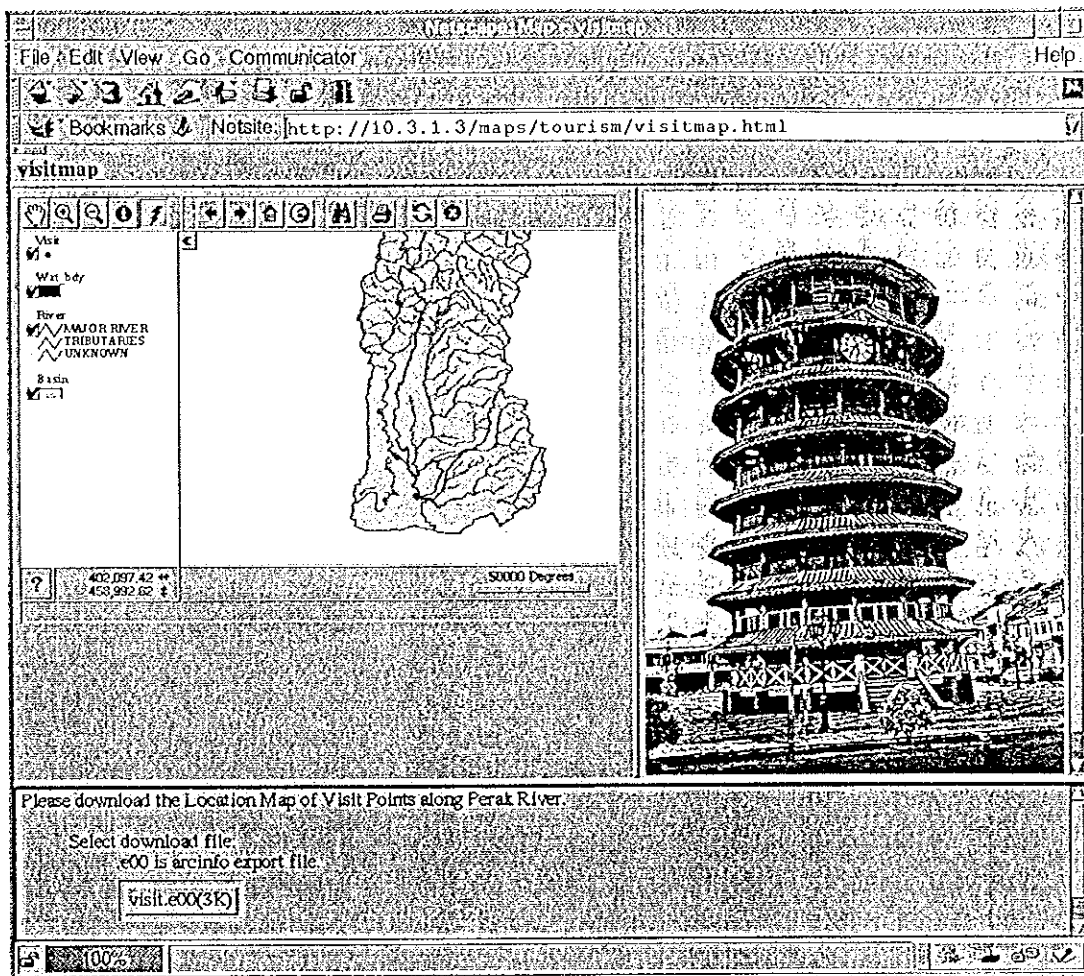


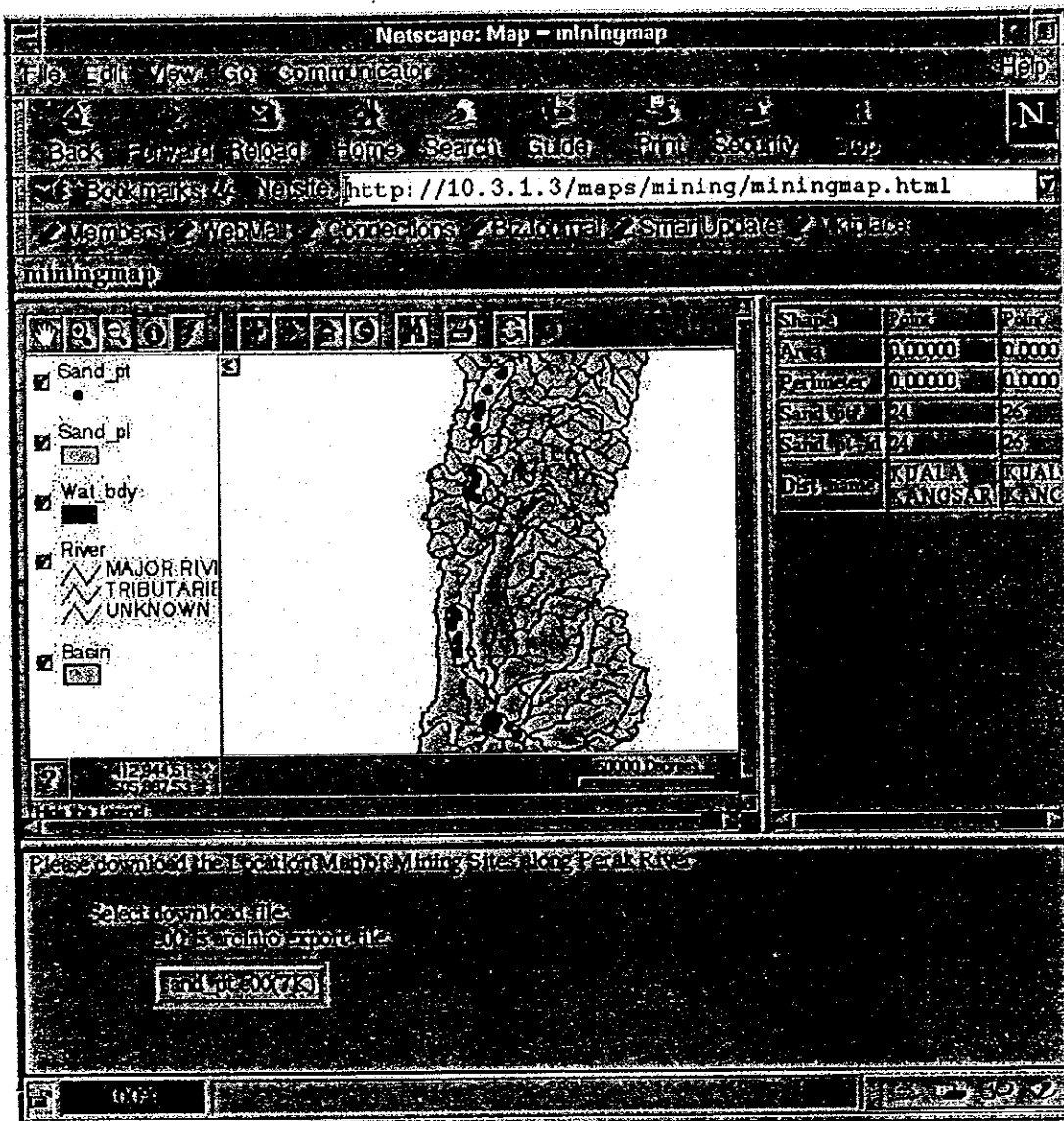


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Fig. IV-42 MAJOR VISITING POINTS MAP
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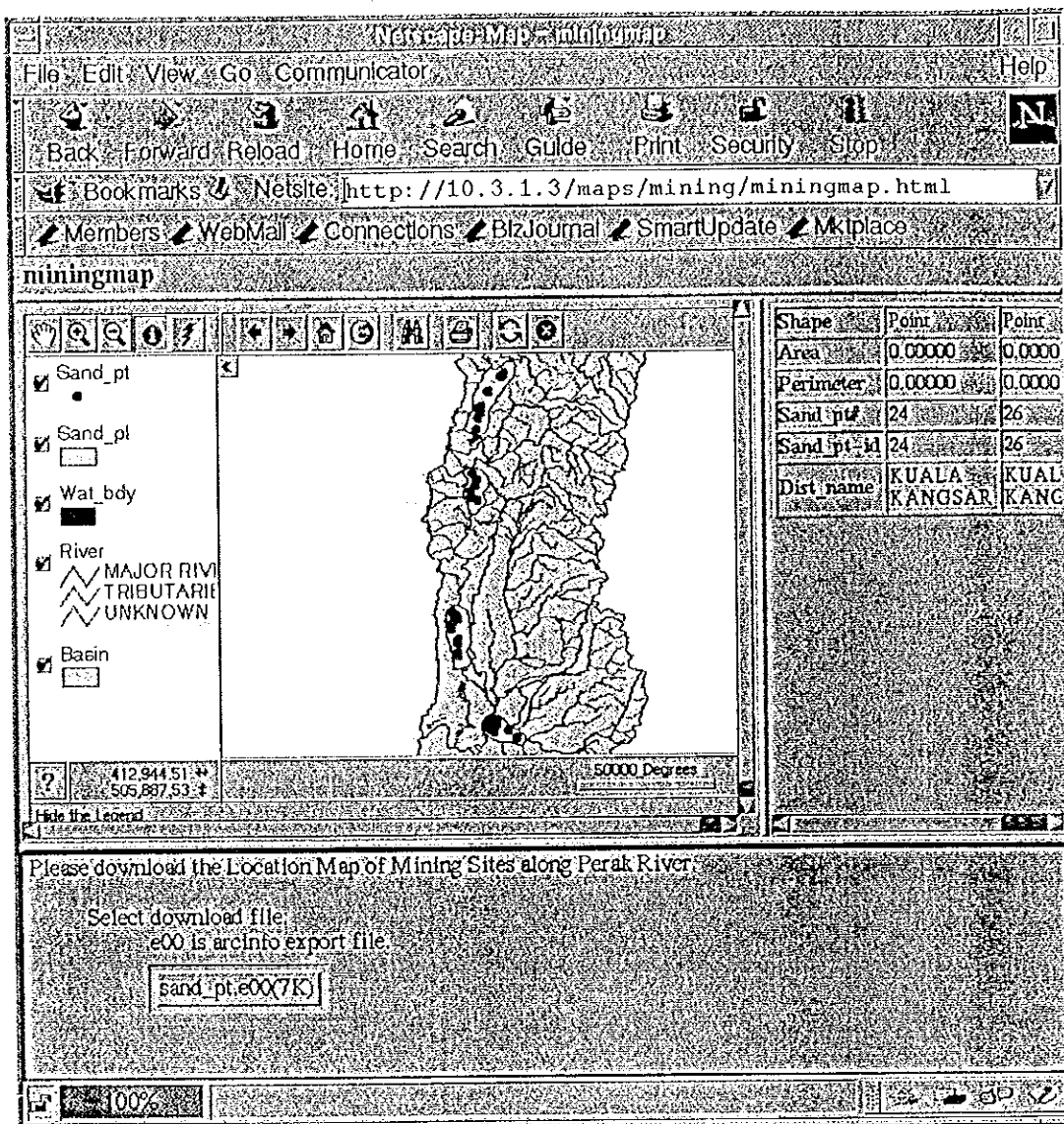


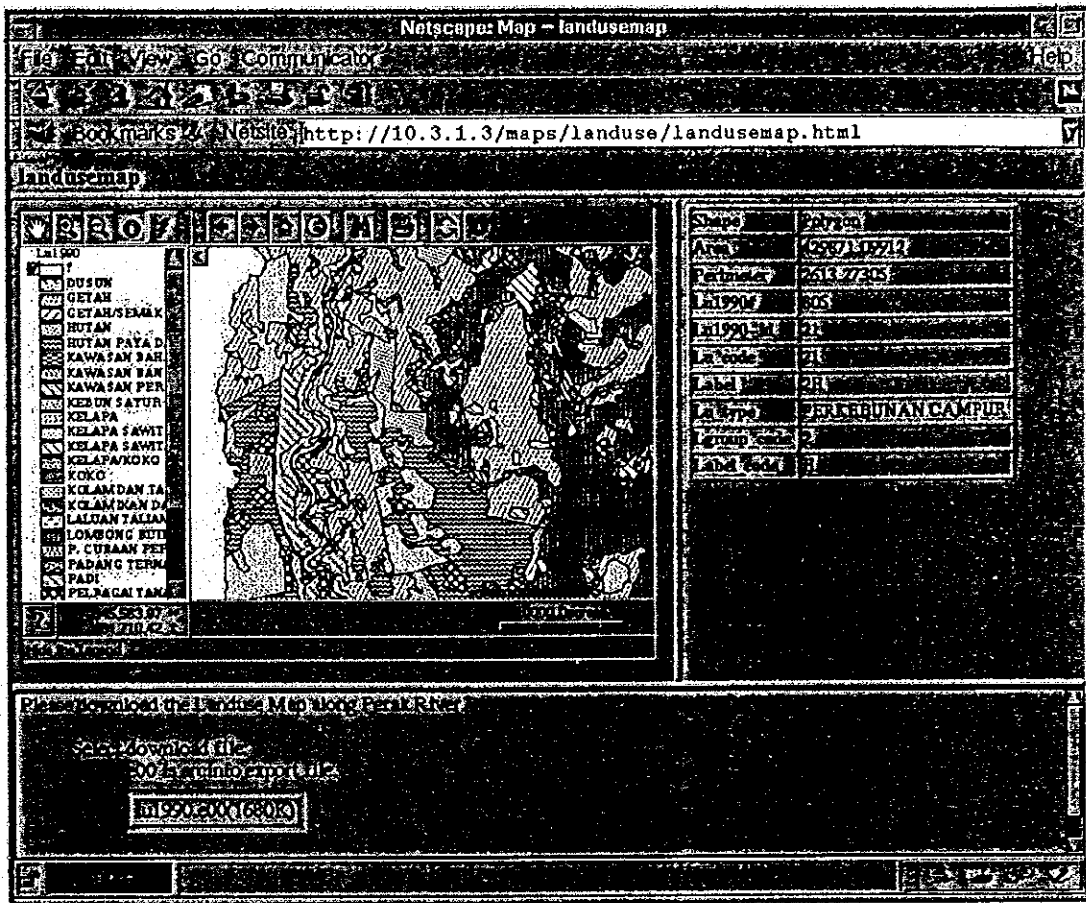


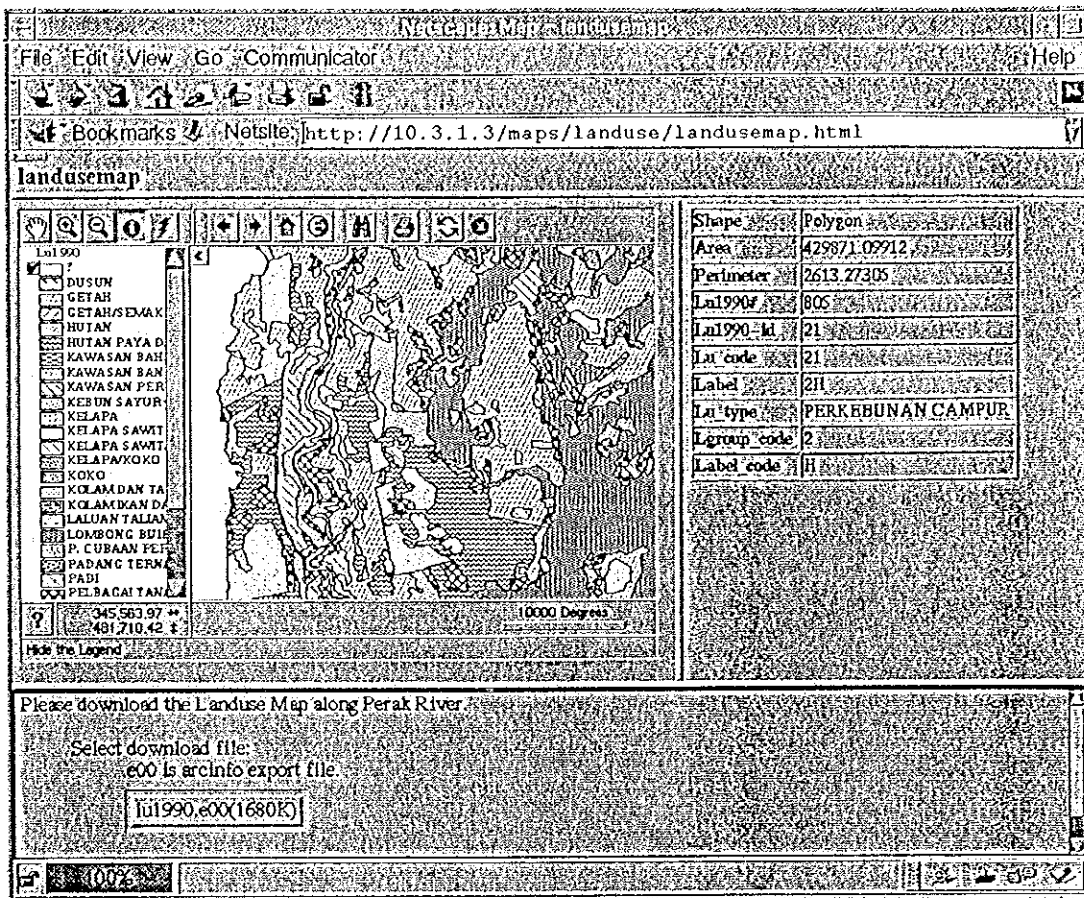
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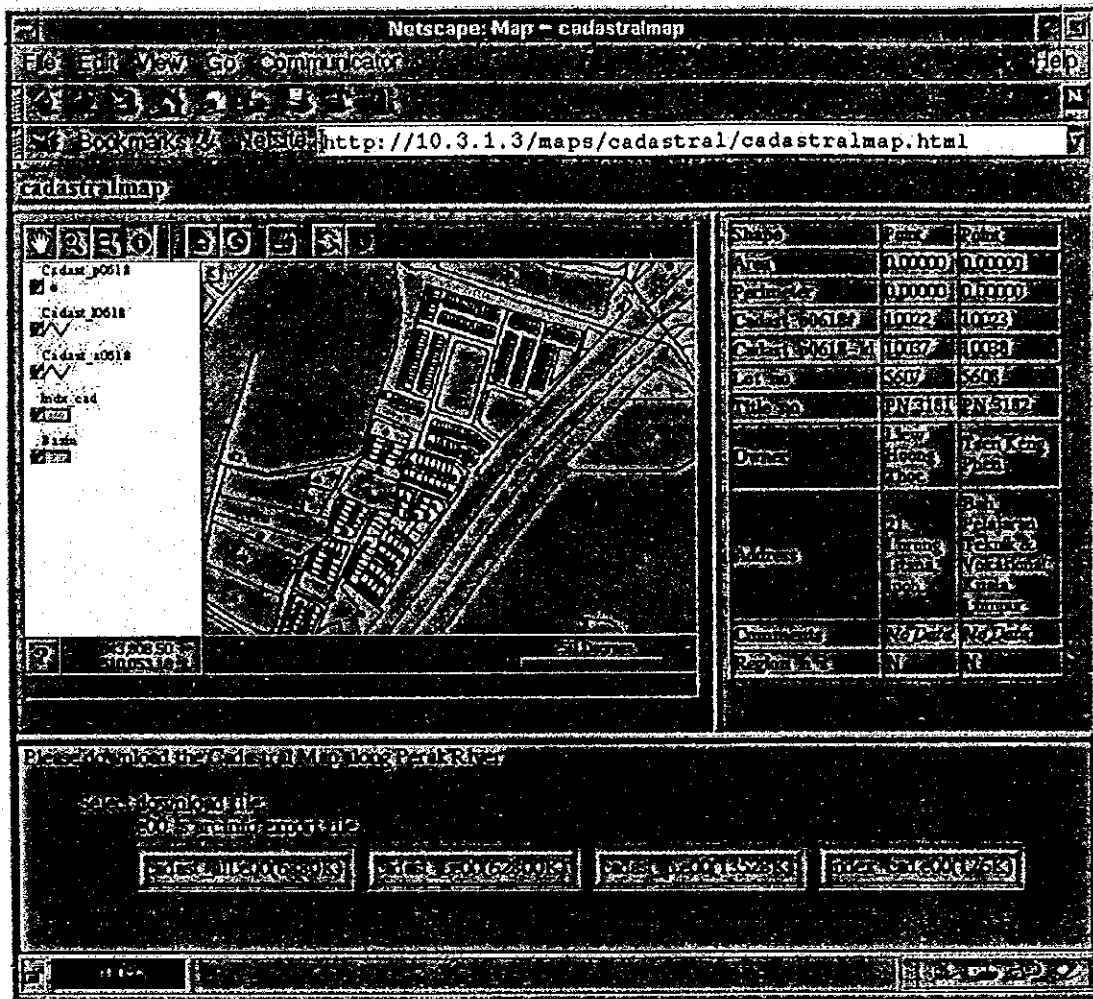
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Fig. IV-43 RIVER SAND MINING MAP HOME-
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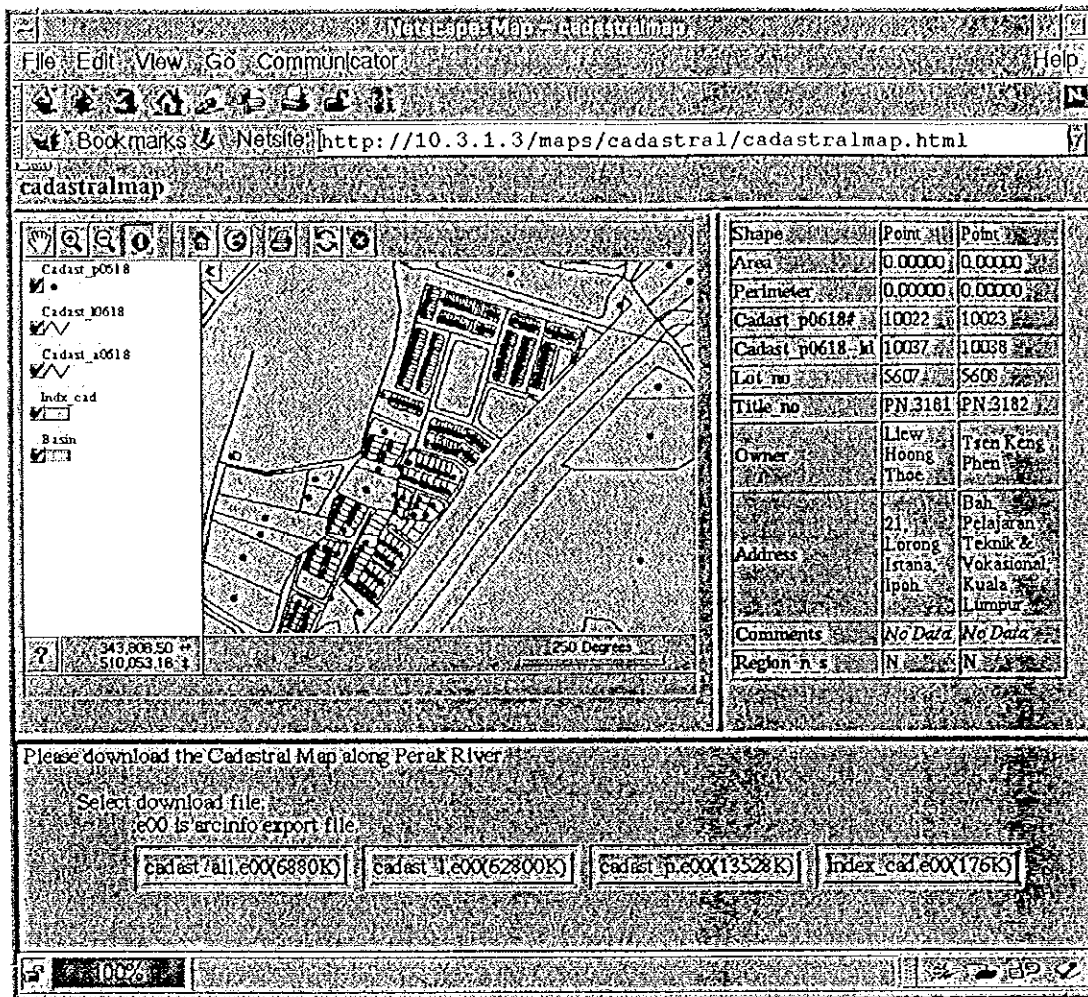




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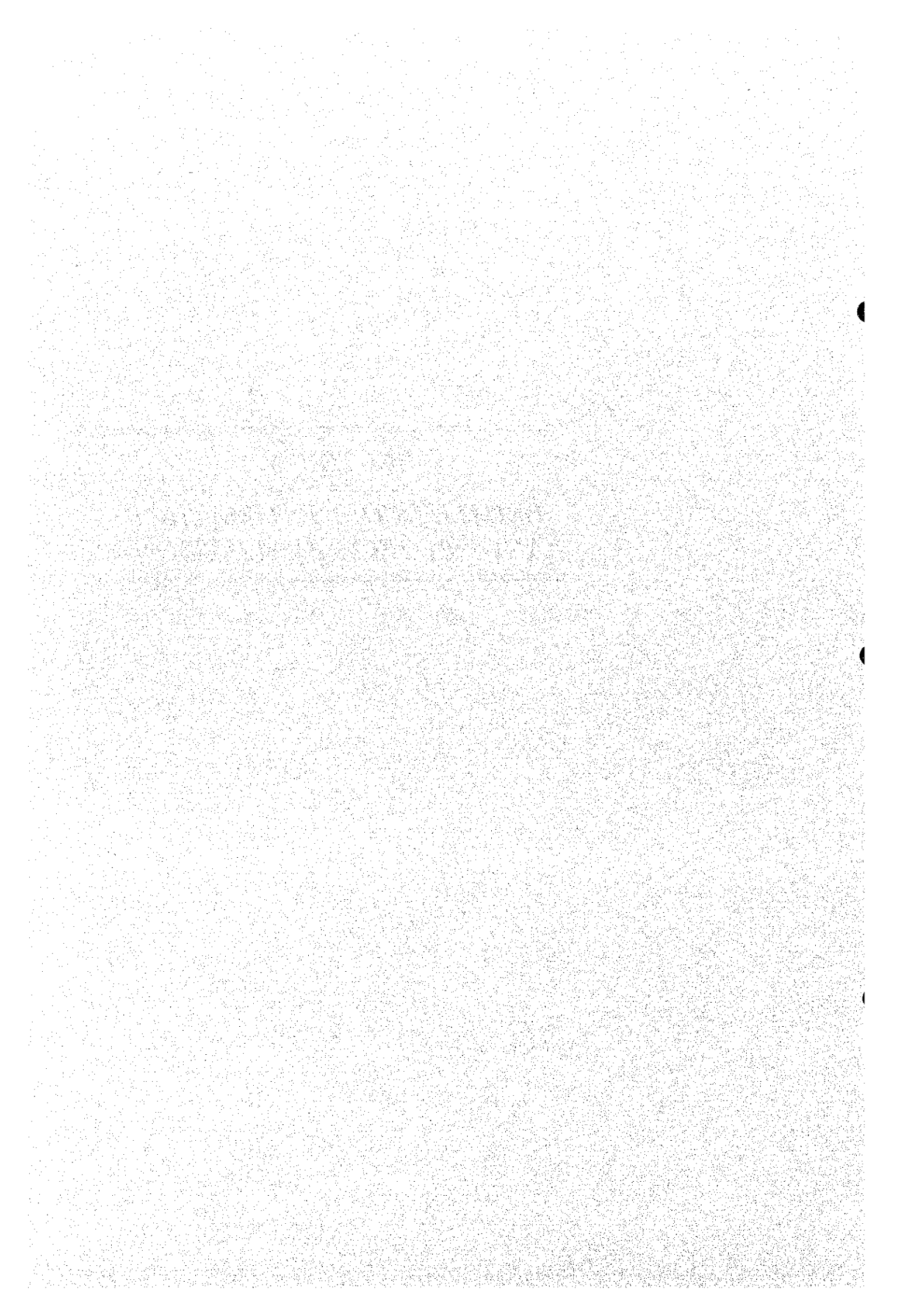
Fig. IV-45 CADASTRAL MAP HOMEPAGE

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SECTOR V

*PROJECT COST ESTIMATION
AND PROJECT EVALUATION*



SUPPORTING REPORT

SECTOR V

PROJECT COST ESTIMATION AND ECONOMIC EVALUATION

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CHAPTER 1 INTRODUCTION

This Supporting Report, Sector V, Economic Evaluation, presents the results of the economic evaluation for the following two river basin information systems:

- (a) The River Basin Information System (RBIS) proposed in the Master Plan; and
- (b) The Operational System established during the study period as a model of the above RBIS.

The contents of the succeeding Chapters are as mentioned below:

- Chapter 2 describes the financial conditions relative to river basin management in Malaysia;
- Chapter 3 describes the project cost and the project implementation schedule for the RBIS and the Operational System.
- Chapter 4 describes the major improvements and qualitative benefits expected of the RBIS as well as the Operational System.
- Chapter 5 describes the results of economic evaluation on the project implementation for RBIS; and
- Chapter 6 describes the results of economic evaluation of project implementation for the Operational System.

CHAPTER 2 FINANCIAL CONDITION RELATED TO RIVER BASIN MANAGEMENT

The financial condition related to river basin management in Malaysia has been analyzed to clarify the economic viability of the RBIS proposed in the Master Plan as well as the Operational System established during the study period. In the analysis, the Gross National Product (GDP) and development expenditures have been estimated on the basis of the 1997 price level. The consumer price indices in Malaysia have been applied to adjust the actual prices to the 1997 price (refer to Table V-1).

(1) Perspective of National Financial Condition

The Gross National Product (GNP) of Malaysia has increased with the annual average growth rate of 8.9%/year for the period from 1986 to 1996 (refer to Table V-2). Moreover, the annual growth rate of national population (about 2.7% on average since 1986) is lower than that of GNP spurring on the improvement of per capita income. These favorable conditions of the national economy increased the income and indirect tax, contributing to the increment of the federal government revenue as well as the federal government development expenditures, which has recorded annual growths of about 8.4% and 3.9% since 1986, respectively (refer to Table V-3).

(2) Expenditure for River Management

The Department of Irrigation and Drainage (DID) is the present major competent authority for river management. The development expenditures of DID have been appropriated through the six (6) terms of the Five-year Malaysia Plan (MP) since 1966. The expenditure was allocated to the federal DID and then a part of it was shared with the state DID, because of the constitutional agreement between the federal and state governments (refer to Fig. V-1).

Among the work items by DID, river management has recorded the highest increment of expenditure during the recent thirty years and taken more than 50% of the total expenditure in the Sixth Malaysia Plan (1991-1995) (refer to Table V-4). The average growth of the expenditure for river management for these 30 years is estimated at about 91.2% per MP (or 13.8% a year) as given below.

Description	1st MP ('66-70)	2nd MP ('71-75)	3 rd MP ('76-80)	4th MP ('81-85)	5th MP ('86-90)	6th MP ('91-95)	Average
Amount (RM million)	22.6	36.9	110.5	243.9	277.7	578.0	211.6
Growth Rate (%)/5years	-	63.2	199.5	120.7	13.9	108.1	91.2

The growth of national economy as well as population will induce intensive use of land and water, leading to the high incremental rate of expenditure for river management even in the future. Should the total government expenditures and the expenditure for river management by DID be able to maintain the previous growth rate (i.e., 3.5% per year for the total government expenditure, and 13.8% for the expenditure of river management), those expenditures will increase in the future as estimated:

Five-Year Malaysia Plan (MP)	(1) Expenditure for River Management (RM million)	(2) Total Government Expenditure (RM million)	(3) [(1)/(2)]
5th MP (1986-1990)	277.2	115,039	0.2% (actual)
6th MP (1991-1995)	578.0	144,366	0.4% (actual)
7th MP (1996-2000)	1,109.8	171,462	0.6% (estimated)
8th MP (2001-2005)	2,130.8	203,642	1.0% (estimated)
9th MP (2006-2010)	4,091.0	241,863	1.7% (estimated)
10th MP (2011-2015)	7,854.8	287,258	2.7% (estimated)
11th MP (2016-2020)	15,081.1	341,172	4.4% (estimated)

The actual expenditure for river management in the 5th and 6th MPs takes only less than 0.5% of the total government development. This percentage is much lower than those of Japan and other countries. Japan has 4.8% as the present sharing rate of expenditures for river management, Germany 2.9% and England 1.7% as enumerated below.

Country	(1) Expenditure for River Management	(2) Total Expenditure	(3) [(1)/(3)]
Japan (as of 1994)	2,200 billion yen	46,108 billion yen	4.8%
Germany (as of 1992)	15.9 billion mark	557 billion mark	2.9%
England (as of 1994)	2.5 billion pound	143.5 billion pound	1.7%

The future expenditure for river management in the 11th MP will reach 4.4% of the total government expenditure, should the previous growth rates of expenditures are maintained. This percentage in the 11th MP is apparently far higher than the actual expenditures in the 5th and 6th Malaysia Plans. The expenditure is, however, most

likely to be realized judging from the rate of expenditure of river management to the total expenditure in other countries.

CHAPTER 3 PROJECT COST AND PROJECT IMPLEMENTATION SCHEDULE

As described in Sector IV, the RBIS were proposed in line with the long-term development plan, and further, the Operational System was designed and developed as a pilot system of the RBIS. In this Chapter, the project cost for the RBIS and the Operational System was estimated based on the system work contents as proposed in Sector IV. Moreover, the development schedule performed for the Operational System was described, and the project implementation for the RBIS was proposed in due consideration of the future development of the information technology.

3.1 Project Cost and Project Implementation Schedule for RBIS

3.1.1 Project Cost

The initial investment cost as well as the annual operation and maintenance cost for the RBIS are estimated as below:

(1) Initial Investment Cost

The initial investment cost for the system is estimated, based on 1997 price level, at about RM 19.6 million as shown in Table V-5. The estimated investment cost include all necessary procurement and installation cost of system devices other than the data transmission devices. The data transmission devices include the optical fiber and the satellite communication. Among them, the satellite communication is made through the lease line by MESAT satellite network. As for the optical fiber communication, the line is also assumed to be leased from the Telekom Malaysia in due consideration of the following items.

- (a) Should the optical fiber line be independently installed by the project, it will require an extremely high investment cost amounting to RM 105 million (or about 84% of the total cost) including RM 75 million for the trunk line and RM 30 million for connection of ITVs. As a result, the total investment cost will come up to RM 124.6 million.
- (b) The existing optical fiber line installed by Telekom Malaysia between Kuala Lumpur and Ipoh could be leased as the trunk communication line for the proposed system.
- (c) There does not exist any optical fiber network in the Perak river basin except the above trunk line. Hence, the optical fiber lines connecting ITV in the field

and the operation room in Ipoh are not currently available. However, the Telekom Malaysia plans to expand the optical fiber network throughout the country by the year 2020 as described in the Telecommunication Vision 2020, so that the proposed ITV will be made practicable in that year.

(2) Annual Cost for Operation and Maintenance

The annual operation and maintenance cost consists of: (a) cost for maintenance of equipment and purchase of spare parts; (b) cost of manpower for system operation; and, (c) cost for the lease of data transmission system. The total cost of these items is estimated at about RM 4.00 million which is allocated as follows:

Description	Annual Cost (RM million)
Maintenance of equipment and purchase of spare parts	3.00
Manpower for system operation	0.46
Lease Cost	0.54
Total	4.00

The bases of estimation of the above annual cost are as described below:

(a) Annual Cost for Maintenance of Equipment and Purchase of Spare Parts

The annual cost is assumed as about 15% of the initial investment cost in due consideration of approximate durability of the equipment.

(b) Annual Cost of Manpower for System Operation

The annual cost of manpower is estimated based on the staff required for system operation, as follows:

Required Staff	Monthly Rate of Emolument (RM/month)	Required Number of Staff	Annual Emolument (RM/year)
River Engineer	9,000	2	216,000
Network Manager	9,000	1	108,000
Database Manager	4,620	2	110,880
Digitizing Operator	2,200	1	26,400
Total		6	461,280

(c) Lease Cost for System Operation

The proposed system will require the lease of optical fiber system and satellite communication. The lease cost for these data transmission systems is estimated on the basis of the current rate as below:

Lease Cost of Satellite Communication	RM200,000
Lease Cost of Optical Fiber System	RM343,200

3.1.2 Project Implementation Schedule

The implementation schedule of the proposed river basin information system is as shown in Fig. V-2. In the implementation schedule, the fundamental devices for the system including the hydrological gauging system, the data processing system and the data transmission system are to be established in the next 8th Malaysia Plan. The devices established in the 8th Malaysia Plan will pledge the full operational condition of the entire system. After the devices in the 8th Malaysia Plan, the following futuristic systems are scheduled in the 9th to 11th Malaysia Plans in due consideration of their features.

Automatic water quality gauging system	9th Malaysia Plan
Radar rainfall gauging system	10th Malaysia Plan
ITV system and satellite communication system	11th Malaysia Plan

The backgrounds of the proposed implementation schedules are as described below.

(1) Work Items in the 8th Malaysia Plan (2001 to 2005)

Scheduled early in the 8th Malaysia Plan, the following items are urgently required to facilitate the river management work. No technical difficulty in implementation is expected.

- (a) Improvement of the existing hydrological gauging stations and the related telemetry communication system;
- (b) Installation of database server system and its input/output devices;
- (c) Establishment of main data transmission system between Kuala Lumpur and Ipoh utilizing the leased optical fiber line; and

(d) Installation of portable information terminal (PIT)

(2) Work Items in the 9th Malaysia Plan

The existing automatic water quality gauging system has technical difficulties in maintenance works and its available monitoring items are limited to temperature, conductivity, pH value, turbidity and dissolved oxygen. Intensive development works are, however, being carried out, and it is anticipated that the present defects of the system will be improved within the 9th Malaysia Plan. Hence, the automatic water quality sensor as well as its related telecommunication and computer systems for the analysis of water quality is scheduled in the 9th Malaysia Plan.

(3) Work Items in the 10th Malaysia Plan

The proposed radar rainfall gauge has a wide gauging range, so that the thirteen (13) radar rainfall gauges could cover the whole country of Malaysia. However, the radar rainfall gauge also requires a high investment cost of about RM 12 million (RM 4.2 million for radar site cost, RM 6.8 million for computer for radar analysis and RM 1.32 for multiplex radio wave), which takes 60% of the total investment cost. In view of the nationwide gauging coverage as well as the high investment cost, it is deemed necessary that the radar rainfall gauge be developed in line with the nationwide development plan instead of the basin-wide development plan. Since the implementation of such nationwide development plan will require a rather long period, the radar rainfall gauge system is proposed in the 10th Malaysia Plan.

(4) Work Items in the 11th Malaysia Plan

The optical fiber network is likely to cover the Perak river basin during the 11th Malaysia Plan in due consideration of the Telecommunication Vision 2020 formulated by Telekom Malaysia. Such optical fiber network is indispensable for Industrial Television (ITV) to transmit the dynamic visual information of the field. Therefore, the ITV together with its data transmission system of optical fiber line is assumed to be established in the 11th Malaysia Plan. In addition to the ITV, the satellite communication system is scheduled as the backup of the optical fiber data transmission system.

3.2 Project Cost and Project Implementation Schedule for the Operational System

3.2.1 Project Cost

The project cost for development of the Operational System is estimated at RM 2.92 million as the total of initial investment cost and at RM 0.21 million/year as the annual operation and maintenance cost. The breakdown of the project cost is as described as below:

(1) Initial Investment Cost

The initial investment cost covers the following four items:

Item	Cost
(1) System planning and designing	RM 1.04 million
(2) Procurement of hardware	RM 0.35 million
	RM 0.47 million
(3) Development of software	RM 0.13 million
(4) Initial data input	RM 0.93 million
Total	RM 2.92 million

The contents of the above investment cost is as below:

(a) System Planning and Designing

The planning and designing of the Operational System was undertaken by JICA Study Team spending about 12 man-months which corresponds to about RM 1.04 million.

(b) Procurement of Hardware and Software

In accordance with the system planning and designing, the necessary hardware and software for the Operational System was procured by JICA through tendering to the local suppliers. As a result, the procurement cost of RM 0.82 million accrued including RM 0.35 million for hardware and RM 0.47 million for software of Arcinfo, Arcview and Arcview IMS (refer to Table V-6).

(c) Development of Software

The development of custom-made software for telemetry system was entrusted to the local consultant with a contact cost of RM 0.13 million (refer to Table V-7).

(d) Initial Data Input

The Operational System contains various map information and texture/numeric

information. Substantial part of these information were not digitized and their digitizing works were made through entrusting to the local consultant. Such digitizing works amounted to about RM 93 million (refer to Table V-8).

(1) Annual Operation and Maintenance Cost

The annual operation and maintenance cost consists of: (a) cost for maintenance of hardware, (b) cost for man-power for system management, (c) lease cost for ISDN line (64kbps) and (d) data renewal cost. The total cost of these items is estimated at RM 0.21 million/year which is allocated as below:

Item	Annual Cost
Maintenance of hardware	RM 0.05 million/year
Man-power for system management	RM 0.02 million/year
Lease cost for ISDN line	RM 0.05 million/year
Data renewal	RM 0.09 million/year
Total	RM 0.21 million/year

The basis of estimation on the above annual cost are as described below:

(a) Maintenance of Hardware

The cost is assumed as 15% of the procurement cost of hardware including the procurement of spare parts in due consideration of durability of the hardware.

(b) Man-power for System Management

The necessary man-power and its annual cost is estimated as below:

Required Staff	Monthly Rate of Emolument (RM/month)	Required Number of Staff	Annual Emolument (RM/year)
River Engineer	9,000	1.0	108,000
Network Manager	9,000	0.3	32,400
Database Manger	4,620	1.0	55,440
Telemetry Engineer	2,200	0.5	13,200
Digitizing Operator	2,200	0.5	13,200
Total		3.3	222,240

3.2.2 Project Implementation Schedule

The development of the Operational System was made within one year as shown in Fig. V-3. In the development period, the system planning and designing by the JICA Study Team took about four (4) months. After the system planning and designing, procurement of hardware

and software was made for about three months including tendering, procurement, delivery and installation/ adjustment of hardware and software. In the mid-term of delivery of hardware and software, DID completed all necessary preparatory works such as preparation of operation room, power supply, and leased ISDN line for a period of 1.5 months. All data input works and programming works was finally made for six month.