CHAPTER 4 DESIGN OF OPERATIONAL SYSTEM

The RBIS system configuration as well as the system design has been proposed in Chapter 3. To realize such a long-term plan, it is indispensable to obtain agreement of all related agencies to link and/or provide their own information to the proposed RBIS. A new institutional setup will also be required for the operation and maintenance of the proposed long-term plan. On the other hand, the digitizing works have not yet been completed on some essential information sources for the proposed river basin information source. Thus, it is virtually difficult to immediately establish the proposed RBIS. However, the present dynamic basin land development requires the early service of an integrated river basin information to support a consistent and comprehensive river basin management. To make up for such shortcoming, an Operational System is designed and its initial operation is to be made within this study. The Operational System will also effect the transfer of technical knowledge on the operation and maintenance of the proposed RBIS.

4.1 Flow of Information

The objective information is classified into the real-time information and the non real-time information. The Operational System will apply the flow diagram for the information in accordance with the long-term plan for the RBIS. That is, the Operational System collects all objective information to the centralized database in Kuala Lumpur, then process and distribute the data to the users as described below (refer to Fig. IV-4).

(a) The hydrological data (rainfall and river stage data) and dam outflow discharge are gauged, as the real-time information, by the Perak State DID, and TNB. The gauged data are transmitted to the State DID Office in Ipoh and finally to the data server of the Operational System in Kuala Lumpur, and disseminated to the government agencies and/or the public users through Intranet.

(b) The non real-time information (statistical and map information) are collected from the related government or semi-government agencies. As described in Sectors I, II and III, a substantial part of the necessary non real-time information is stored as digital data by the existing information system. Then such digital data are imported in the form of data exchange media such as the floppy diskette to the data server of the Operational System located in the Kuala Lumpur. As for the non-digital data, the input works are made by the Operational System every data renewal time, and stored in the system. After

necessary processing works, the non real-time information are disseminated to the government agencies and/or the public users through either on-line system (by Intranet or Internet) or off-line system in the form of CD-ROM or print-outs.

4.2 System Configuration

The Operational System is composed of the data collecting system, the data transmission system, the data processing system and the data dissemination system (refer to Fig. IV-5). The detailed plan of these system components is as described hereinafter.

4.2.1 Data Collection System

In RBIS, the centralized system network is proposed. With such system network, data collection can be realized by transferring the digital data among river information management related government agencies through the Intranet. However, this is difficult at present because the network has not yet been built among the government agencies. In the Operational System, such data collection network can be substituted by collecting the paper map or attribute data, and hand to hand collection of digital data stored in magnetic media. Then the system engineer can convert the data into the Operational System.

The Operational System will collect the objective information from the following four kinds of information sources: (1) the existing hydrological gauging stations, (2) the existing database systems administered by the various government agencies, (3) the non digital map sources, and (4) the published census records.

(1)   Information from Hydrological Gauging Stations

As described in Sector I, the Operational System will collect the following real-time hydrological information as well as the dam outflow discharge data from Chenderoh Dam for the sake of flood forecasting and warning as well as drought management:

(a)   Hourly rainfall, river stage and outflow discharge from Chenderoh Dam during a flood period for the sake of flood forecasting and monitoring.

(b)   Daily river discharge at Iskandar Bridge (Sta. No. 4809943) and outflow discharge from Chenderoh Dam during a drought period to support the drought management.

The above hydrological information are collected through the existing DID telemetry gauging network in the Perak river basin. The network is composed of five (5) rainfall gauging stations and eight (8) water level gauging stations. As for the outflow discharge from Chenderoh Dam, TNB estimates the dam outflow discharge based on the manual computation informing the State DID Office through the public telephone line.

The Operational System will transmit the above hydrological information and dam outflow discharge data to the data server placed in Kuala Lumpur through on-line system (refer to Fig. IV-6). The details of the on-line data transmission are described in the following sections.

(2)   Information from Existing Information System

The existing information system applies various formats such as the DXF (the standard format for CAD system), the Oracle database file format, the Spreadsheet file format (ASCII Text), and the Arc/Info data format. The Operational System on the other hand applies the Arc/Info data format to process the objective non real-time information. Such various formats applied to the existing information could be converted and/or transformed to the Arc/Info data format. These processes are described below (refer to Fig. IV-F-7):

(a)   Spreadsheet file is applied into the application software such as Microsoft Excel and Lotus 1-2-3. Since data in the spreadsheet file is the ASCII data, the Ac/Info could access the data without any data transformation.

(b)   Oracle database file format is one of the standard formats of database. Since the Arc/Info contains an access tool to Oracle database, no transformation work is required on this format.

(c)   DXF (drawing interchange file) is the standard format for CAD system which supports the graphic processing. In the Operational System, DXF could be imported into the Arc/Info Vector data format by the Arc/Info data import tool.

(3)   Information from Non-digital Map Sources and Published Census Record

As described in Sectors I, II and III, part of the objective information for the Operational System will be the non-digital maps or census records owned by the various government agencies. These non-digital information need to be input by

typing and digitizing (refer to Fig. IV-8). The alphabetic and numeric value of information are typed into the spreadsheet type file (ASCII text file) and the paper maps are digitized into Arc/Info digital map data. Then, some of the spreadsheet data are linked to the digital map as its attribute.

4.2.2 Data Processing System

The following equipment is preliminarily proposed in due consideration of the volume of necessary information by the operational system and the scale of equipment to be installed within the study period:

    (a)   Devices Installed at the Federal Level

        (i)   One database server machine (UNIX machine)

        (ii)   One telemetry server machine (UNIX machine)

        (iii)   One client machine (Widows personnel computer)

        (iv)   One set of data input and output equipment (printer, digitizer, etc.)

    (b)   Devices Installed at the State Level

        (i)   One client machine (Windows personnel computer)

        (ii)   One Telemetry Data Server (the existing Hewlett-Packard Personal Computer supported by the memory device CD 6000FEP with RAM memory of 64K will be used also as the telemetry data server.)

        (iii)   Printer

The Operational System processes the real-time information as well as the non real-time information. As proposed in the RBIS, the UNIX workstation is applied as the data server to undertake the processing work on both the real-time information and the non real-time information. Most of the government agencies in Malaysia apply the UNIX workstation as the data processing device because of easiness in connecting to the computer network system, high performance of processing and its reliability. Moreover, most Internet server programs are developed on the premise of the UNIX workstation and most Internet server software are running on the UNIX. On the premise of using UNIX workstation as the data server, the Operational System will have the following system devices as the data processing system (refer to Fig. IV-5).

(a)   Existing TeleWin PC at State Level

This personal computer (called "TeleWin PC") is currently operated by the State DID to receive hydrological data for the sake of flood forecasting and warning. The Operational System will apply this device to receive the flood hydrological data as well as the low flow discharge data on real-time base during both flood and drought periods.

(b)   TM Data Transfer PC / Internet Web Client PC at State Level

The real-time information received by the TeleWin PC will be further transmitted from the state level to the federal level. In order to perform such data transmission, the Operational System needs to have a function to transmit the real-time information to Kuala Lumpur through TCP/IP protocol (protocol for Internet communication). Since the real-time transmission data is smaller than 1KB and the transmission network speed is also slower than 128 Kbps, this function could be done by a personal computer. However, should such function be newly added to the above existing TeleWin PC, the present process of receiving real-time information will be seriously interrupted by the new process to transfer the information to the network. From this viewpoint, one (1) unit of personal computer (called "TM Data Transfer PC") is newly installed at the State DID office to perform the new function. At the same time, this TM Data Transfer PC could be used as an Internet Web Client so as to browse the non real-time information from the GIS Web Server located in Federal.

(c)   TM Data Server/TM Web Server at Federal Level

One (1) unit of UNIX workstation (called "TM Data Server/TM Web Server") is installed at the federal level to receive the real time data transmitted from the state, and disseminate the real-time information. The workstation will also be used as a Web Server to open the real-time information to the Internet through a homepage. The homepage could be made by HTML [Hyper Text Markup Language, the language for presentation in Internet (WWW page)]. These functions require a 2GB hard disk capacity, which could be accommodated by one (1) unit of technical computing UNIX workstation with 8GB hard disk, but not the personal computer.

(d)   GIS Data Server / GIS Web Server at Federal Level

The non real-time information is processed into the prescribed information to be disseminated at the federal level. The processed information is further built into HTML to disseminate it through the Internet. The necessary capacity of hard disk for these data storage works is estimated to be at least 4GB (1GB for raw data, 1GB for GIS database, 1GB for Web Server, and 1GB for work file). Thus, the necessary capacity of CPU for the processing works is rather large and therefore one (1) unit of technical computing UNIX workstation (called "GIS Data Server/GIS Web Server") is applied to undertake such processing works.

(e)   GIS Data Conversion PC / GIS Web Client at Federal Level

The Operational System will involve importing and/or inputting work on the non real-time information into Arc/Info database at the federal level. The importing and inputting work will not require a high CPU performance and large volume of hard disk. Hence, one (1) unit of PC (called as "GIS Data Conversion PC/GIS Web Client)" is installed to undertake the work at the federal level. This PC is also used as an Internet Web Browser for the GIS Data Server through the Internet.

4.2.3   Data Transmission System

The long-term system proposed in the RBIS is subject to the exclusive use of the optical fiber system as its main data transmission system. It is, however, virtually difficult to acquire such exclusive line during this study, and instead, the use of the existing government Wide Area Network called AGROLINK is proposed as the tentative data transmission measure for the Operational System. As described in Chapter 1, the AGROLINK is being developed by the Ministry of Agriculture, and going to be connected from the federal territory to the Perak State in the near future. The AGROLINK is the integrated services digital network (ISDN) with the transmission capacity of 2 Mbyte using the optical fiber cable. The ISDN has an extremely higher data transmission capacity and reliability than the analog lines (maximum data transmission capacity is only 33.6 Kbyte). The present rate of utilization of AGROLINK is about 50% only. Accordingly, the AGROLINK is deemed to be applicable to the Operational System, and communication cost could be minimized.

The Operational System will be equipped with on-line transmission system for the real-time information as proposed in the RBIS. However, most of the non-real time information will be transmitted to the database server of the Operational System in the form of diskette or non-digitized raw data, due to the following reasons:

(a) Digitizing work on some information sources for the Operational System is still under development as stated above;

(b) DOA had completed digitizing works on the land use and soil maps. However, such digitized information are in principle currently exclusively used and not released to the other government agency; and

(c) The non-real time information other than the hydrological gauging information does not require a frequent data renewal and/or updating.

Among the non-real time information, the hydrological gauging information has a possibility to have an on-line linkage using AGROLINK between the existing database controlled by the DID Hydrology Division and the proposed operational system. In this connection, further detailed clarification has to be made on the present data format, the institutional restriction for linkage of information and the availability of AGROLINK.

The Operational System includes the following data transmission systems (refer to Fig. IV-9):

(1) Transmission from Gauging Stations to State DID

The existing telemetry system is applied as the data transmission system to collect the real-time hydrological information from the gauging stations to the State DID. This transmission work is realized by using the radio and the modem.

(2) Transmission from State DID to Federal Operation Center

As described in the Interim Report, the transmission on the real-time information from the State DID to the Federal Operation Center in Kuala Lumpur was assumed to be by the government exclusive WAN (AGROLINK) controlled by the Ministry of Agriculture (MOA). Presently, the AGROLINK links all departments of MOA located in Kuala Lumpur and the states of Penang, Jorhor and Selangor by the optical fiber cable. The MOA has planned to expand the AGROLINK to Perak State within the fiscal year 1997. However, the expansion plan was indefinitely deferred due to

the recent financial constraint. Due to deferment of the expansion plan, the following two (2) alternatives for the data transmission system are assumed to link Ipoh State and Kuala Lumpur:

(a) Alternative 1 (To apply the existing ISDN leased line as the entire data transmission line)

The data is transmitted by leased ISDN line between the State TM Data Transfer PC and the Federal TM Data Server. This specified ISDN line will always be open to real-time data transmission.

(b) Alternative 2 (To apply the ISDN leased line from State DID to the existing access point to AGROLINK in Kuala Lumpur and use AGROLINK from the access point to the Federal Information Center)

This data transmission is through the ISDN leased line from the State TM Data Transfer PC to the Remote Access Server (RAS) of AGROLINK. The RAS can link only 20 lines at the same time. When other public users occupy all of the 20 lines, the State TM Data Transfer PC cannot send real-time information to the Federal TM Data Server.

Between the above two alternatives, Alternative 2 has a major difficulty in securing the data transmission of real-time information; therefore, Alternative 1 is applied as the data transmission system. The Telekom Malaysia now offers three kinds ISDN leased lines: 64Kbpes, 128Kbps and 2Mbps. Among these lines, the Operational System needs to apply the ISDN of 128Kbps as the minimum requirement to secure the dual communication route between the state and federal levels. The cost of ISDN leased line of 128Kbps is RM6,300/month.

(3) Transmission from Related Government Agencies as Data Source to Federal Operation Center

The non-real time information is transmitted from the related government offices to the Federal Operation Center in the form of either the data exchange media (such as floppy diskette) or the non-digitized record/map. Thus, all non-real time information are collected through the off-line data transmission system.

(4) Transmission from Federal Operation Center to System Users

The AGROLINK and the public telephone line are used as the data transmission system for disseminating both the real-time and non-real-time information. Moreover, the Operational System will provide the information to the system users in the form of CD-ROM and the prints upon their request.

4.2.4 Data Dissemination System

Details of the following on-line dissemination system has been studied as the possible measures of dissemination for the Operational System.

All real-time information and the non-real time information other than the map information are disseminated through the Wide Area Network from the server machine to the client machines. The AGROLINK is the most practical Intranet network to link the government agencies under the Ministry of Agriculture. Internet System was also examined to link with other external government agencies and/or the public users.

The system users will access to the aforesaid GIS Web Server for non-real time information and TM Web Server for real-time information through Internet. As for the non-real time information, some are not open to the public users. To classify the government users and the public users, the GIS Web Server will store the IP address for each related government agency and based on the IP address, the server will specify the appropriate contents of information to be given to the users. Moreover, both of the GIS Web Server and TM Web Server are under the control of AGROLINK Intranet system. All servers for the Operational System are under control of AGROLINK Domain system, and protected by the firewall of AGROLINK against any system interference.

4.3 Hardware and Software Design

The main issues on the design of the Operational System are how to import the data sources that are currently administered by different government agencies to the Operational System, and to provide a friendly user interface for any kind of terminal users. In order to cope with these issues, undertaken was the investigation on the existing system. Through the investigation, optimum hardware and software solutions for the Operational System are proposed in Sector II. In accordance with the system configuration, the various hardware and software are installed at the Federal and State Information Centers. The design for these hardware and software were made in due consideration of the existing conditions of the

information system in Malaysia as described in Chapter 2. All hardwares are connected by the Wide Area Network (WAN) which applies the TCP/IP protocol.

(1) Server Machine

In due consideration of reliability of hardware as well as the wide use in the existing information systems, the UNIX server machine for both real-time and non real-time information management in the Operational System is applied as the server machine. The present standard UNIX machine contains the following capacity, which could well accommodate the required work volume of the Operational System:

Description	Capacity
Clock Frequency of RISC CPU	Around 180 to 200MHz
Memory	128 Mb
Hard Disk Capacity	About 8GB

As described in Chapter 1, most of the government agencies in Malaysia apply the UNIX workstation as the data processing device because of easiness in connecting to the computer network system, high performance of processing and its reliability. Moreover, most Internet server programs are developed on the premise of the UNIX workstation and most of the Internet server software are running on the UNIX. In the Operational System, two units of UNIX works stations are installed as the server machine at the Federal Information Center.

(2) Client Machine

Personal computers are applied as the optimum client for the Operational System. The Pentium II/233Mhz model or equivalent class was preferred as the client machine for the Operational System, considering the current wide use of system users as well as the operational condition of data input/output and processing works. Two (2) units of client machines are installed at both the Federal and the State Information Centers. The client machine at the Federal Information Center will be used also as data input and map output controller. The client machine at the State Information Center will be used also as real-time data transmission controller.

(3) Input/Output Devices

In due consideration of the necessary digitizing works on map information and the prevailing devices in the existing system, one (1) unit of A0 size table digitizer and one (1) unit of A0 size color InkJet plotter are applied as the input device for vector

data and the output device for maps, respectively. These devices are installed at the Federal Information Center.

Two (2) units of laser document printers are also installed as output devices for documents at the Federal and the State Information Centers. The printer has to be shared by multi-users, and the printer speed needs to be more than 8 ppm.

(4)   Data Transmission Devices

The Operational System applies the WAN technology which currently comes into wide use as an efficient device for opening of information, and thereby, the AGROLINK was assumed as the data transmission device of WAN for the Operational System. However, the AGROLINK Optical Cable has not reached the Perak State Information Center, and a leased ISDN line (128kbps) is proposed as the data transmission device instead of the AGROLINK Optical Cable for the two-way communication. In the future, the AGROLINK Optical Cable may replace this ISDN.

The Operational System also applies the Office HUB as the transmission device for the LAN at the Federal and State Information Centers. A Modular Router is used for the WAN between Federal and State Information Centers. The type of Modular Router is similar with the existing type applied to the AGROLINK so as to minimize communication trouble.

The following two network cards are installed with the server machine to protect the database; one network card which is protected by firewall of the AGROLINK System has the function to open the information to Intranet; and another card is used to open the information to the public. Thus, the two network cards will create the condition such that the server machine virtually runs as two machines, and the user situated outside of the firewall cannot introduce anything to the Intranet database.

(5)   Power Regulator and Backup Power Supply

Two (2) units of Automatic Voltage Regulator (AVR) and three (3) powerful Un-interruptible Power Supply (UPS) are installed to protect the client, server and other hardware equipment from any electric shock. The UPS could work for more than one hour as the backup power supply. The AVR's power rating is not less than 600VA.

(6) Backup Device for Database

Two (2) kinds of database backup measures are applied; one is a 4-mm Type driver that directly links with the UNIX server, and another is a CD-R driver that links with the Federal Client. Thus, the database is protected by the double backup driver system. Considering the CD-R's writing speed, 4 times writing speed of CD-R driver is applied.

(7) Software

The Arc/Info database software is widely used as the solution for GIS database management in Malaysia, as well as over the world. In due consideration of exchangeability of database between the existing information systems and the proposed Operational System, and further familiarity on operation and maintenance of the software, the Arc/Info is applied as the database software for managing the non real-time information in the Operational System. Moreover, the Arc/View is applied as the tool of input and viewer for GIS to support the Arc/Info. For the real-time information, the current TeleWin32 can be used as the real-time data capture and dissemination software in the State Office. However, for opening the real-time information to the Internet, a new TeleWin Transfer software and TeleWin Internet Server software should be developed for the Operational System.

4.4 Specification of Operational System Devices

The devices specified for the Operational System include:

(a) Necessary functions and quantities of system devices (equipment and software);

(b) Preparatory works for the installation of devices (such as preparation of space for the equipment and data communication lines); and

(c) Schedule of procurement, installation and test run of the Operational System.

Immediately after the mutual agreement on the specified devices was made between the Study Team and the Malaysian Government, JICA procured all necessary system devices other than the data transmission line, and the JICA Study Team undertook the necessary installation work including data input, programming and system test run. Technology transfer on system operation and maintenance to the Malaysian counterparts was also made.

Simultaneous with the above undertakings of JICA and the Study Team, the Malaysian Government was required to undertake the following:

    (a)   To avail of the existing data communication lines to be used by the Operational System such as AGROLINK and the ISDN leased line (128Kbps);

    (b)   To prepare the necessary space for the system equipment together with furniture and power supply; and

    (c)   To assign the staff to operate and maintain the Operational System.

4.4.1 Specification of Hardware and Software

JICA had called for tenders for the procurement, delivery and installation/adjustment of the necessary devices for the Operational System. Since all proposed devices for data input and processing are available in Malaysia, tenders were called from local suppliers in due consideration of easy system maintenance and upgrade. Accordingly, the local supplier selected furnished, installed and adjusted the specified devices.

    (1)   Procurement

        The detailed function and quantity of the devices procured are as specified in Table IV-6. The procurement cost was about RM 820,000 (30,300,000 yen), as shown in Table IV-7.

    (2)   Delivery of Devices

        The devices specified in Table IV-8 were delivered and installed in the following two (2) locations.

Location	Address
Federal Information Center	River Engineering Division, Department of Irrigation and Drainage, Ministry of Agriculture, Jalan Sultan Salahuddin, 50626, Kuala Lumpur
State Information Center	Department of Irrigation and Drainage, Perak, Jalan Pablima Bukit Gantang Wahab, 3000 Ipoh, Perak.

    (3)   Installation and Adjustment

        The local supplier undertook the necessary installation and adjustment of hardware and software as specified in Table IV-9. The JICA Study Team provided all

necessary information such as user's environment for the workstation and personal computer and IP address for the installation and adjustment.

4.4.2 Undertaking of JICA and JICA Study Team

As described above, JICA (Malaysia Office) had procured the necessary devices through local tendering in Malaysia. After procurement of the devices, the JICA Study Team undertook the following items:

(a) Acceptance of the items delivered by the local supplier;

(b) Supervision of the initial installation/adjustment of the devices made by the local supplier;

(c) Setup of the hardware including necessary connection works;

(d) Installation of the necessary software;

(e) Setup of database and data input;

(f) Program design and programming; and

(g) Transfer of knowledge on system operation and maintenance to the Malaysian counterparts.

4.4.3 Undertaking of the Government of Malaysia

In relation with the aforesaid undertaking of JICA/Study Team, the Government of Malaysia had undertaken the following items:

(1) Preparation of Space and Related Supporting Items for Installation of Devices

Before delivery of the system devices, the Government of Malaysia prepared the following items at the locations described in Subsection 4.4.1(2):

Item	Preparatory Items	
	Federal DID	State DID in Ipoh
Office Space	More than 5 x 5m	More than 2 x 3m
Power Supply	More than 3000W	More than 2000W
Table for Devices	4 sets of office table (more than 1500 x 900mm)	One office table (more than 1500 x 900mm)
Air Conditioning	Non-stop air conditioning to secure the continuous run of computers	

(2) Preparation of Data Transmission Line

The Government of Malaysia prepared the following data transmission system required for the Operational System:

Item	Preparatory Items	
	Federal DID	State DID in Ipoh
Allocation of IP Address for AGROLINK	3 Global IP Address and 3 Private IP Address together with AGROLINK 10 Base Terminal Connector	2 Private IP Address
Lease of ISDN	Lease of 128Kbps ISDN line connecting Federal and State DID	

(3) Assignment of Staff for Operation and Maintenance of the System

As proposed in Sector III, the Technical Center for the Operational System was set up at DID, so that DID was required to assign the following three (3) personnel at Federal DID and one (1) at the State DID of Perak.

Required Staff	Qualification	Major Work Required	KL	Ipoh
Network Manager	System Engineer	To administrate the WAN for the System	1	-
Database Manager	System Engineer	To manage the GIS data server in KL	1	
Telecommunication Engineer	Technician	To operate and maintain the Telewin and TM data transfer PC	-	1
Digitizing Operator	Technician	To execute the data input works	1	-
Total			3	1

KL = Kuala Lumpur

As stated above, three (3) personnel are required for the system operation and maintenance at Federal DID in Kuala Lumpur. Among them, the Database Manager is to administer all database and dissemination through the two (2) UNIX server machines placed in Kuala Lumpur. Moreover as a staff of the Database Manager, the Digitizing Operator is to undertake the digitizing works for data renewal of the Operational System. The Network Manager on the other hand is to administer the AGROLINK, the system web communication.

As for the necessary personnel at the State DID in Ipoh, one (1) Telecommunication Engineer is required to operate and maintain the telemetry system including the existing telemetry gauging network, the existing Telewin System and the new TM Data Transfer PC.

DID needs to assign a new Database Manager and a new Digitizing Operator. In contrast, the present engineer who takes care of the existing DID communication system could serve

concurrently as the Network Manager for the Operational System. Likewise, the present Telecommunication Engineer for the existing flood forecasting and warning system in the State of Perak could hold also the position of Telecommunication Engineer for the Operational System.

4.4.4 Time Schedule for Development of Operational System

The implementation schedule for establishment of the Operational System is as shown in Table IV-10 including schedule of tendering by JICA, the procurement of hardware and software by the supplier, the preparatory works by DID and the system setup/programming by the JICA Study Team. Delivery and installation/adjustment of the hardware and software took about 2.5 months stating from the tendering by JICA. Before the mid-term of delivery, DID was required to complete all necessary preparatory works, so that the preparatory period was about 1.5months starting from the tendering by JICA. The JICA Study Team started the 3rd field works about one month before the end of delivery so as to give the necessary instruction on installation and adjustment of the hardware and software. The JICA Study Team made all data input and programming works and the Operational System was finally setup by the sixth month starting from tendering.

CHAPTER 5   DEVELOPMENT OF THE OPERATIONAL SYSTEM

Based on the design of the Operational System in Chapter 4, the Government of Malaysia and the JICA study team have jointly set up the system network and hardware. The configuration and functions of the system network and hardware are described in this Chapter. Details of system management and operation are also described in the "System Management and Operation Manual".

5.1   Network Configuration

The Operational System covers the following four (4) sub-nets to collect, process and disseminate both the real-time information and the non-real time information such as geographic information and/or textual database information (refer to Fig. IV-10):

(1)   State DID Sub-Net

The Operational System applies the existing telemetry hydrological gauging network operated by the State DID. The gauging network consists of five (5) rainfall gauging stations and eight (8) water level gauging stations. All real-time hydrological gauging information are collected in the State DID sub-net, and finally transmitted to the Federal DID sub-net mentioned in Item (4) below.

(2)   ISDN Sub-net

The Government of Malaysia leased a dedicated ISDN line of 128Kbps from Telekom Malaysia to transmit the above hydrological gauging information on real-time base from State DID to Federal DID. That is, the State DID in Ipoh transmits the information through the ISDN line to the existing access point of the AGROLINK sub-net [Item (3)] in Kuala Lumpur and finally into Federal DID.

(3)   AGROLINK Sub-net

AGROLINK is the existing Wide Area Network system established by the Ministry of Agriculture (MOA). This network links all departments of DOA located in Kuala Lumpur including the Federal DID. The IP address for the Operational System network is allocated inside AGROLINK. to from the Operational System. The AGROLINK Domain Server also manages the global network to open the information from the Operational System Web Server in the Federal sub-net through the Internet. Thus, AGROLINK facilitates the traffic control of all information into

and from the Federal sub-net. The users can access the Operational System Web Homepage through the Internet by the URL address "gis.moa.my." The IP address assignment for the whole Operational System network is shown in Fig. IV-11.

(4)   Federal DID Sub-net

The information center of the Operational System is placed at Federal DID in Kuala Lumpur. All server machines of the Operational System are placed in this Federal DID sub-net, and both real-time information and non real-time information are finally collected, processed and disseminated from the Federal DID Sub-net.

Both of the real-time and non real-time information systems open their information to Intranet and Internet users through the AGROLINK. In order to protect the information security, the Operational System network is divided into private (opening information to the Intranet) and global (opening information to the Internet) network.

5.2   Development of System Hardware and Software

The Operational System is equipped with the various hardware as described hereinafter, and all of them have been installed at either the Federal DID office in Kuala Lumpur or the State DID office of Perak in Ipoh. The inventory of all hardware in the Operational System is as shown in Table IV-11.

5.2.1   Router

The router is the important device to link the sub-nets under the Operational System. In the Operational System, two routers have been newly installed; one at the State DID (Router "A") in Ipoh and the other at the AGROLINK Control Center in Kuala Lumpur (Router "B"). Both Router "A" and "B" check the IP address and ISDN number of external access and ignore the illegal packets ("packet" is a segment of digital transmission data). The routers also check all packets dispatched from the Operational System to external sub-net, and reject them, unless they are the static routing packets transmitted between Routers "A" and "B". The configuration of these routers is as described below.

(1)   Configuration of Router "A"

Router "A" at the State DID in Ipoh can activate the ISDN line, only when it is used to call Router "B". Router "A" also automatically disconnects the line, should it not send any data for more than 120 seconds. The ISDN switch-type for Router "A" is set

as "basic-net3" which is an available signal to connect with the ISDN connector provided by Telekom IPOH.

(2)   Configuration of Router "B"

Router "B" is installed at the AGROLINK Network Control Center in due consideration of appropriate operation and maintenance. The default ISDN switch type is set for this router because the ISDN connector in Kuala Lumpur allows any type of ISDN signal passage. Moreover, the dial map is not set with this router in order to prevent any call from Federal DID to external sub-nets.

5.2.2   Workstation

The Operational System has two units of workstations placed at the Federal DID sub-net. The first unit is called the "GIS Server" which processes non-real time information such as geological information and texture database information and disseminates them through internet and/or intranet. The other is the "TM Server" to receive real-time information transmitted from State DID and disseminate them to the Internet and/or Intranet. The details of these workstations are as described below.

(1)   Hard Disk

The same type of UNIX workstation (HP-UX) is applied to both the "GIS Server" and the "TM Server". The workstation has a total hard disk capacity of 9GB, which is divided into several partitions and used as Operation System and/or other various applications. Out of the total disk capacity, a largest portion of about 3.6GB is allocated to the RBIS database and its associated use. The hard disk also reserves a vacant space of 1GB for the future system expansion and system swap space.

(2)   Device for Network Communication

The workstation contains two network cards, and could work, through the network cards, both for the Intranet communication and the Internet communication. Thus, one workstation can virtually work as if two servers are working. The workstation also has the following security to protect the workstation from illegal network communication:

(a)   Elimination of "IP Forwarding"

"IP Forwarding" is a default function in a UNIX system to activate communication by the above two network cards between the Internet and the Intranet. However, illegal external users could enter into the Operational System through IP Forwarding, causing difficulties in securing the system. Due to these circumstances, the function of "IP Forwarding" was removed from the workstations.

(b)   Setting of "Router Tables"

The workstation is equipped with a routing table that is also a default function of the UNIX system. The routing table is to control the communication between the workstation and the external network, and thus protect the workstation from any illegal access.

5.2.3   Peripheral Hardware

In addition to the aforesaid routers and workstations, the Operational System contains the following peripheral hardware:

(1)   Personal Computers

Two (2) units of personal computers (Pentium 11/233Mhz) are set as client machines at the State DID and the Federal DID sub-nets, respectively. The client machine at the Federal DID sub-net is to be used also as data input and map output controller. The client machine at the State DID sub-net is to be used also as real-time data transmission controller. "Windows NT4.0" system is used as the OS (operating system) for these client machines, and the network IP protocol was set up in the OS in accordance with the system network design.

(2)   Input and Output Devices

One (1) unit of table digitizer of A0 size and one (1) unit of color Inkjet plotter of A0 size are installed at the Federal DID sub-net. These digitizer and plotter are used as the input device of vector data on geographic information and as the output device of map, respectively. Two (2) units of laser printer are also installed as output device of documents at the Federal DID sub-net and the State DID sub-net, respectively.

All of the above input and output devices are directly connected to LAN and could be accessed from either workstations or personal computers. Thus, use of the devices could be shared by multi-uses.

(3)   Power Regulator and Backup Power Supply

Two (2) units of "Automatic Voltage Regulator" (AVR) and three (3) units of "Un-interruptible Power Supply" (UPS) are installed to protect the server machine and other hardware from any electrical shock. The UPS works for more than one hour as the backup power supply, and the AVR' power rating is more than 600VA.

(4)   Backup Device for Database

The Operational System applies two (2) kinds of backup device; one is a "4-mm Type Driver" which is linked directly to the UNIX server machine at Federal DID sub-net, and the other is a CD-R driver linked to the client machine at Federal DID sub-net.   The database in the Operational System is protected by these backup devices.

5.2.4   System Software

The Operational System applies the following particular system software. The outline of these system software is as given hereinafter, while detailed procedures on management and operation are as described in the "System Management and Operation Manual".

(1)   Internet WEB Server Software

The "Netscape Enterprise Server" is installed as WEB server software to the aforesaid "TM Server" and "GIS Server" at Federal DID sub-net. With this software, users can browsethe Operational System homepages through Internet or Intranet.

(2)   GIS Database Management Software

A series of software on Geographic Information System (GIS) is also installed with the "GIS Server" to manage the Operational System Database. The software is divided into three components: "ArcInfo", "ArcView" and "ArcView Internet Map Sever (IMS)". These components of the GIS software have the following functions:

(a)   "ArcInfo" is the database management software administrating all necessary analysis on Geographic Information System.

(b) "ArcView" is used as a viewer to present the GIS data, and at the same time used as software for data input.

(c) "ArcView IMS" is used to dynamically open the GIS data through Internet.

5.3   Development of Application Software

The following two (2) kinds of application software have been developed to support the management of the Operational System: (1) Telemetry System Application, and (2) "GIS System Application". The outline of development of these application software is given below, while the detailed operation method of these software is described in the "System Management and Operation Manual".

5.3.1   Introduction of Telemetry System Application

This application was developed to support the management of real-time hydrological information gauged by the telemetry gauging stations in the State of Perak. The main functions of this application are as enumerated below:

(a) To collect the gauging data of water stage and rainfall in Perak river basin on real-time base;

(b) To collect the outflow discharge from Chenderoh Dam located in the upper reaches of Perak river basin;

(c) To calculate the discharge data from telemetry water stage data;

(d) To alarm the flooding condition when the water level exceeds three critical levels: warning level, alert level and danger level; and

(e) To send the above hydrological data periodically to the Web server at Federal DID sub-net and update the web page.

The software package includes "Telewin Server", "Telewin Event Logger", "Telewin Application Software", "Telewin FTP Scheduler" and "Telewin Web Application Software". Among these packages, the "Telewin Web Application Software" is installed at the Federal DID sub-net, while the others are in the State DID sub-net. The contents of these software packages are as described below:

(a) "Telewin Server" is a system communication interface for the telemetry management system of State DID sub-net. This software automatically starts, whenever the user operates the personal computer.

(b) "Telewin Event Logger" is to save the telemetry gauging data into the hardware of personal computer;

(c) "Telewin Application Software" is a data viewer with an interactive graphic user interface (GUI);

(d) "Telewin FTP Scheduler" is used to transfer the telemetry gauging data through FTP (fill transfer protocol) to "TM Server" every hour or on demand; and

(e) "Telewin WEB Application" is to open the telemetry gauging data through the Internet.

Among the above software packages, the "Telewin Application Software" and "Telewin WEB Application" are the core to process and display the real-time information. The contents of processing and display by these software packages are further described hereinafter.

5.3.2 Development of "Telewin Application Software"

The State DID has so far operated the telemetry gauging system consisting of ten (10) telemetry gauging stations, one (1) unit of master controller (called "CD6000s"), and one (1) unit of personal computer (called "Telewin PC"). This existing system closes the distribution of telemetry gauging data within the State of Perak. In order to upgrade such function of the existing telemetry system, the Operational System newly introduced one (1) unit of personal computer and ISDN sub-net at the DID Sub-net to transmit the telemetry data to Federal DID. Moreover, the Operational System installed one (1) unit of workstation as "TM Server" at Federal DID sub-net to open the telemetry data through the Internet.

The Telewin Application Software (Version 1) has been used for the operation of the above existing telemetry system of State DID Perak. The Operational System improved this software and made a new version of Telewin Application Software (Version 3) adding new various functions. The major functions by this new version are as enumerated below:

(a) It displays various hydrological information as enumerated below:

 (i) Telemetry data table which contains the latest 24-hour telemetry data on water level and rainfall (refer to Fig. IV-12);

 (ii) Hydrographs of water level (refer to Fig. IV-13);

 (iii) Bar charts of daily rainfall (refer to Fig. IV-14); and

 (iv) Location map which includes various scales from the nationwide scale to the river basin scale and further contains the photographs of gauging station (refer to Fig. IV-15).

(b) It enables setting of the three alarm water levels (warning level, danger level and critical level) at each gauging station (refer to Fig. IV-16). Moreover, it displays the latest water level and rainfall on the real-time base. When the water level at some gauging stations reaches the above alarm levels, the stations are highlighted.

(c) It enables input of "H-Q" rating curves into the system and automatically calculates the river discharge from the water level through the rating curves. The rating curves are provided from the Federal DID Hydrology Division, and the system administrator is required to periodically update the rating curves. It also enables the manual input of dam outflow discharge from Chenderoh Dam which is informed from TNB to the State DID through the telephone line. The discharge information will facilitate both flood management and discharge management. Further, it displays the discharge information together with the water level and rainfall.

5.3.3 Development of "Telewin WEB Application Software"

The telemetry data created by the aforesaid new version of "Telewin Application Software" are sent to the "TM Server" at Federal DID sub-net. The "Telewin WEB Application Software" was developed to open the telemetry data through the Internet. The main homepage of this application displays an image map of the Perak river basin as well as the location of telemetry gauging stations (refer to Fig. IV-17). A list of the stations is also displayed beside the image map.

The image map presents the latest rainfall and water level, updating them whenever new data is transmitted from the State DID sub-net. The normal water level is expressed in light blue

color. However, when the water level exceeds the alarm levels, the color changes to yellow for warning level, orange for danger level and red for critical level.

The "Telewin WEB Application Software" also displays the table and the lone graphs of the latest 7-day data on rainfall, water level and discharge gauged at all telemetry stations (refer to Figs. IV-18 and IV-19). Moreover, the users can download the raw data as ASCII data file and/or GNU zipped file (refer to Fig. IV-20) The ASCII data file is about 100K in size, while GUN zipped file could reduce the size to about 10K.

5.3.4 Introduction of GIS System Application

As described in Chapter 4, the database of the Operational System is supported by a series of GIS software such as "ArcInfo", "ArcView" and "ArcView IMS". Through these software, the user could process various map information as well as attribute data. A distinct feature of GIS operation is such that the Operational System could open all database information through the Internet. The "ArcView IMS (Internet Map Server)" in particular could dynamically open the query GIS information through the Internet. In order to facilitate the operation for "ArcView IMS", particular frames were developed. Moreover, the "GIS WEB Application" was also developed to open the whole web pages to the Internet. The details of these development works are as described below.

The "GIS WEB Application" consists of two web servers, namely the "Private Server" and the "Global Server". The "Global Server" is to open the information to the public, while the "Private Server" is for the Government's exclusive use. In this connection, the objective information of the Operational System needs to be classified into the following two dissemination levels according to system users:

(a)   Level 1: Information for exclusive use of government agencies

(b)   Level 2: Information to be open to the public

All objective information under the Operational System were initially classified as described in the Progress Report (2) submitted in January 1998. Various comments on the classification were, however, given afterwards by the Malaysian Government. Based on the comments, the objective information was reclassified as listed in Table IV-12, and the aforesaid "Private Server" and "Global Server" were developed in accordance with the reclassification. The reclassification is, however, still preliminary and will be finally determined, during the next

field study stage (in October 1998) in accordance with the comments of the Government of Malaysia.

The main points on the reclassification are as enumerated below:

(a) All map information including topographic map and land use map could be open to the public only in the form of raster data due to copyright and/or regulations. However, the government agency could use vector data of map information to facilitate the river basin management.

(b) All hydrological information was initially proposed to be open to the public through Internet so as to promote more active research on the river hydrology. However, a substantial part of hydrological information are originally from the existing database of the DID Hydrology Division, and use of information is currently charged by the Division. Under such circumstances, hydrological information was reclassified under Level 1.

(c) In accordance with the request from the State DID of Perak, some of the information on flood management are classified under Level 1. Information classified under Level 1 are the location map and inventory of the projected flood mitigation scheme, results of river channel survey and the extent of flood inundation area.

(d) Information on annual logging volume and the future land use plans is classified under Level 1 due to confidentiality by the State Government.

5.3.5 Development of Particular Tools for "ArcView IMS"

The GIS Server serves a total of 150 web pages. A substantial part of the web pages are the IMS web pages presented by the above "ArcView IMS".(the homepage image is as shown in Fig. IV-21). In the IMS web page, the following four frames were developed to facilitate the users' operation; namely, "map frame", "title frame", "download frame" and "info frame".

The "map frame" activates the GIS Server Machine upon opening of the IMS web page through a Java program applet. Then, the map frame displays the map image upon request on data generation by users. At the same time, the "title frame" shows the map title. The "info frame" initially displays the map features, upon query by users.

The " download frame" is installed under the above "map frame" and "info frame" showing the download information. Users can download the raw GIS data displayed in the "map frame". In the "map frame", a friendly graphic user interface with 15 map query tools are generated by Java application program. Through this interface, users can pan, zoom-in, or zoom-out the objective map so as to clarify and display the detailed features of the map.

5.3.6   Development of "GIS WEB Application"

The "GIS WEB Application" was developed to open all web homepages including the aforesaid IMS web pages. The contents of development works are as described hereinafter.

(1)   Main Homepage

The main homepage is as shown in Fig. IV-22. As shown in the main homepage, the database is divided into the following seven categories: (1) General, (2) Hydrology, (3) River Structures, (4) Flood Mitigation, (5) Water Supply Management, (6) River Environmental Management, and (7) Watershed Management. The hierarchy of web pages is as shown below. Users can access to any of the above categories through the hierarchy. Moreover, the users can also access to the real-time homepages.
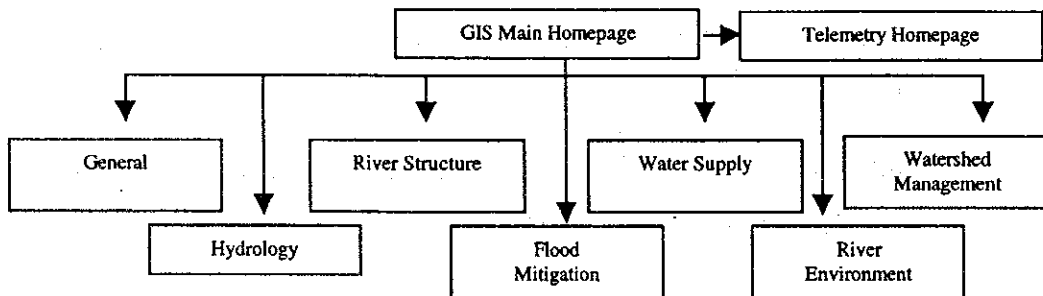
(2)   General Information

The General Information covers the information on basin natural conditions and socio-economic conditions to provide the general features of Perak river basin. The sample homepages of this category are as shown in Figs. IV-23 to IV-28.

The following is the information hierarchy in this category where the items of information for the Government's exclusive use are expressed in boldface.

General

Basin Natural Conditions
- *Base map of   Perak river basin*
- *Contour Map*
- *River Map*
- *Road Map*
- *Town Map*
- *Geological Map*
- *Soil Map*

Basic Social-economic Conditions
- *Administrative Boundary*
- *Population by   Mukim*
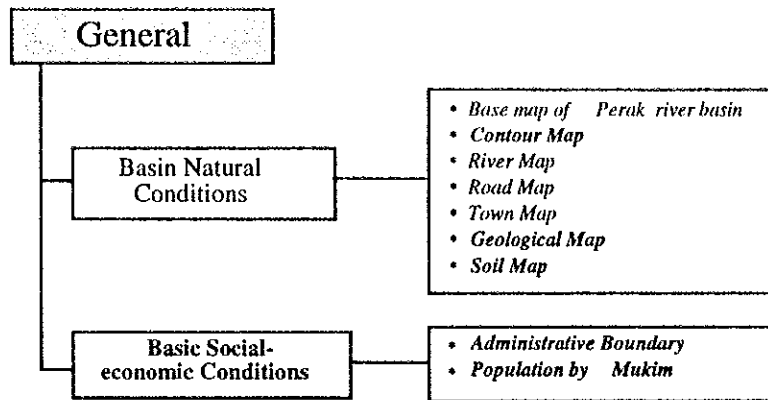
(3)   Hydrological Information

The hydrological information covers the database on all hydrological gauging data (rainfall, river water stage, river suspended discharge which are provided from the "Hydrological Database" controlled by the Federal DID Hydrology Division. The sample home pages are as shown in Figs. IV-29 to IV-30.

The following is the information hierarchy in this category where the items of information for the Government's exclusive use are expressed in boldface.

Hydrology

Gauging Stations
- *Real-time Gauging Stations*
- *Non Real-time Rainfall Gauging Stations*
- *Non Real-time River Stage and Discharge Gauging Stations*
- *Non Real-time River Suspended Discharge Gauging Stations*

Rainfall at principal Stations
- *Hourly Rainfall*
- *Daily Rainfall by Manual*
- *Daily Rainfall by Automatic*
- *Monthly Total Rainfall by Manual*
- *Monthly Total Rainfall by Automatic*
- *Annual Maximum Daily Rainfall*

Rainfall at secondary stations
- *Daily Rainfall*
- *Monthly Total Rainfall*

River Stage Information
- *Hourly River Stage*
- *Daily Mean River Stage*
- *Monthly Mean River Stage*
- *Annual Maximumand MinimumRiver Stage*

River Discharge Information
- *Hourly River Discharge*
- *Daily Mean River Discharge*
- *Monthly Mean River Discharge*
- *Annual Maximumand Minimum River Discharge*
- *River Discharge Rating Curve*

Suspended Discharge Information
- *Monthly Mean Sediment Discharge*
- *Annual Maximumand Minimum Sediment Discharge*
- *Sediment Discharge Rating Curve*

Meteorology
- *Meteorology Gauging Stations*

Tidal Level
- *Tidal Level Gauging Stations*

(4) Information on River Structures

The category covers the major river structures of bridges, river intake facilities and dams. The sample homepages are as shown in Figs. IV-31 to IV-32. The information hierarchy is as shown below.

```
┌─────────────────────┐
│  River Structure    │
└─────────────────────┘
   │
   │   ┌──────────────────────┐     ┌──────────────────────────────────────────┐
   ├───│  Bridge Information   │─────│ • Location Map of Bridges                 │
   │   └──────────────────────┘     │ • Inventory Table of Bridges              │
   │                                 └──────────────────────────────────────────┘
   │   ┌──────────────────────┐     ┌──────────────────────────────────────────┐
   ├───│  Dam Information       │─────│ • Location Map of Dams                    │
   │   └──────────────────────┘     │ • Inventory Table of Dams                 │
   │                                 └──────────────────────────────────────────┘
   │   ┌──────────────────────┐     ┌────────────────────────────────────────────────────┐
   └───│  Intake Point          │─────│ • Location Map of Irrigation Intake                 │
       │  Information           │     │ • Inventory Table of Irrigation Intake Points       │
       └──────────────────────┘     │ • Location Map of Domestic and Industrial Intake Points │
                                      │ • Inventory Table of Domestic and Industrial Intake Points │
                                      └────────────────────────────────────────────────────┘
```

(5) Information on Flood Mitigation

The information contains the flood conditions as well as the existing and projected flood mitigation schemes. The sample homepages of these information are as shown in Figs. IV-33 to IV-36.

The following is the information hierarchy in this category where the items of information for the Government's exclusive use are expressed in boldface.

```
┌─────────────────────┐
│       Flood         │
└─────────────────────┘
   │
   │   ┌──────────────────────┐     ┌──────────────────────────────────────────────────┐
   ├───│  Flood Mitigation      │─────│ • Location Map of Flood Mitigation Scheme          │
   │   │  Scheme                │     │ • Inventory Table of Existing Flood Mitigation Scheme │
   │   └──────────────────────┘     │ • Inventory Table of Projected Flood Mitigation Scheme │
   │                                 └──────────────────────────────────────────────────┘
   │   ┌──────────────────────┐     ┌──────────────────────────────────────────┐
   ├───│  Probable Flood        │─────│ • Probable Peak Flood                     │
   │   └──────────────────────┘     │ • Probable Flood Inundation Area          │
   │                                 └──────────────────────────────────────────┘
   │   ┌──────────────────────┐     ┌──────────────────────────────────────────────────────┐
   ├───│  River Channel         │─────│ • Results of River Channel Survey                      │
   │   │  Survey                │     │ • River Channel Flow Capacity                          │
   │   └──────────────────────┘     │ • Longitudinal Profile of River Channel and Probable Flood Level │
   │                                 └──────────────────────────────────────────────────────┘
   │   ┌──────────────────────┐     ┌──────────────────────────────────────────┐
   └───│  Flood Damage          │─────│ • Extent of Flood Inundation              │
       │  Record                │     │ • Road and Bridge Inundation              │
       └──────────────────────┘     │ • Number of People Affected               │
                                      │ • Monetary Value of Overall Flood Damage  │
                                      │ • Agriculture Damage                      │
                                      │ • Epidemic Caused by Flood                │
                                      └──────────────────────────────────────────┘
```

(6)   Information on Water Supply Management

The information contains the water demand as well as all water supply facilities in the Perak river basin. The sample homepages are as shown in Figs. IV-37 to IV-38.
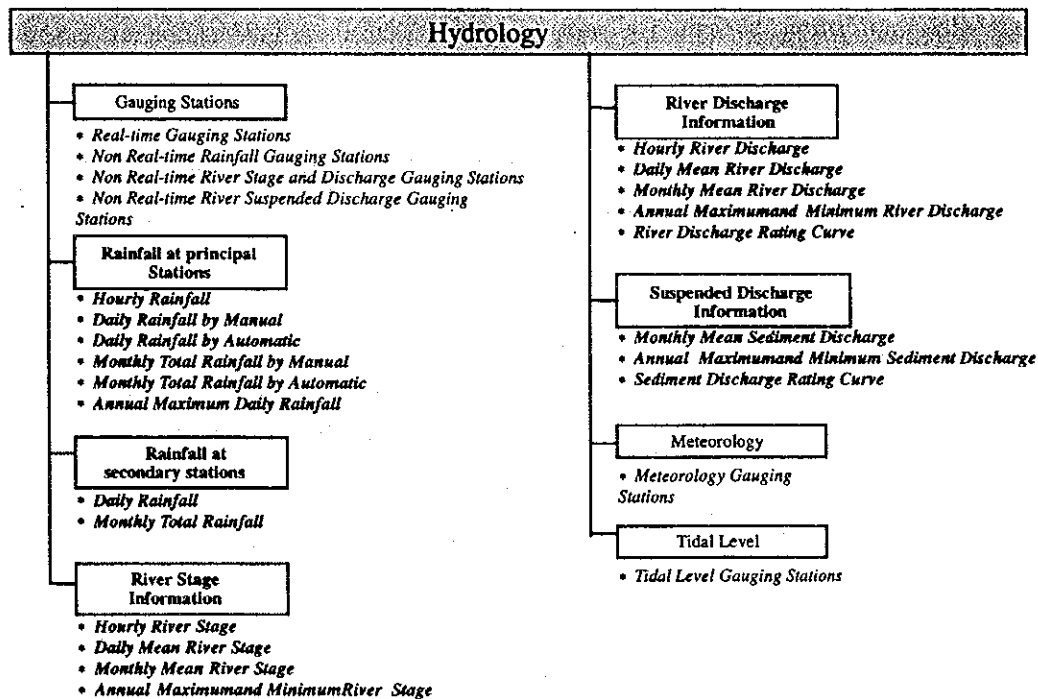
The following is the information hierarchy in this category where the items of information for the Government's exclusive use are expressed in boldface.
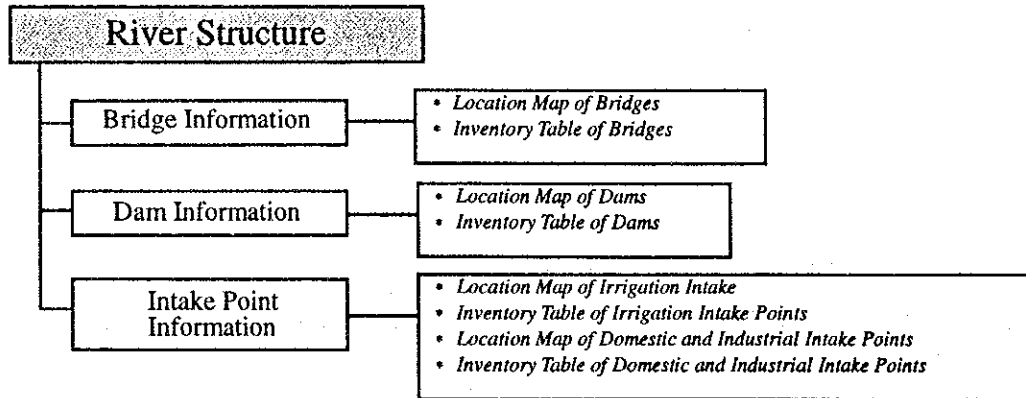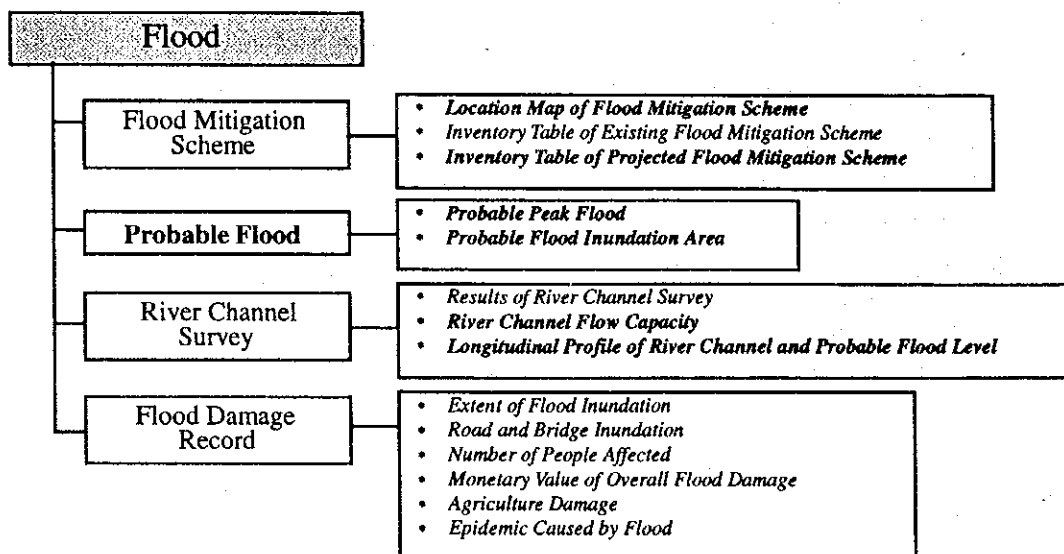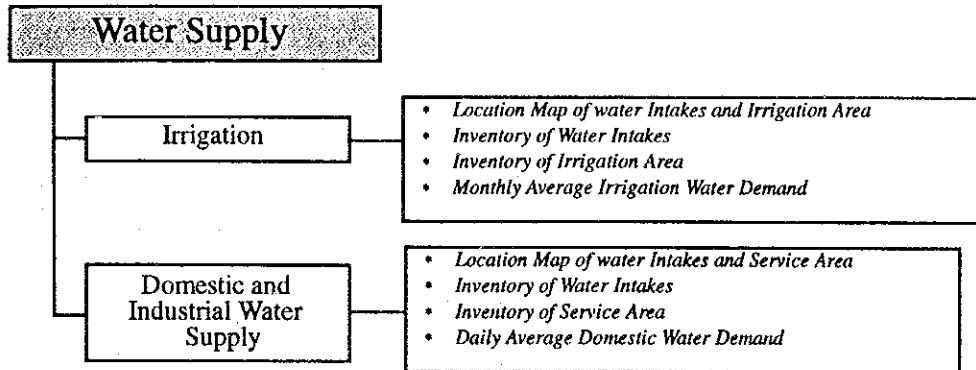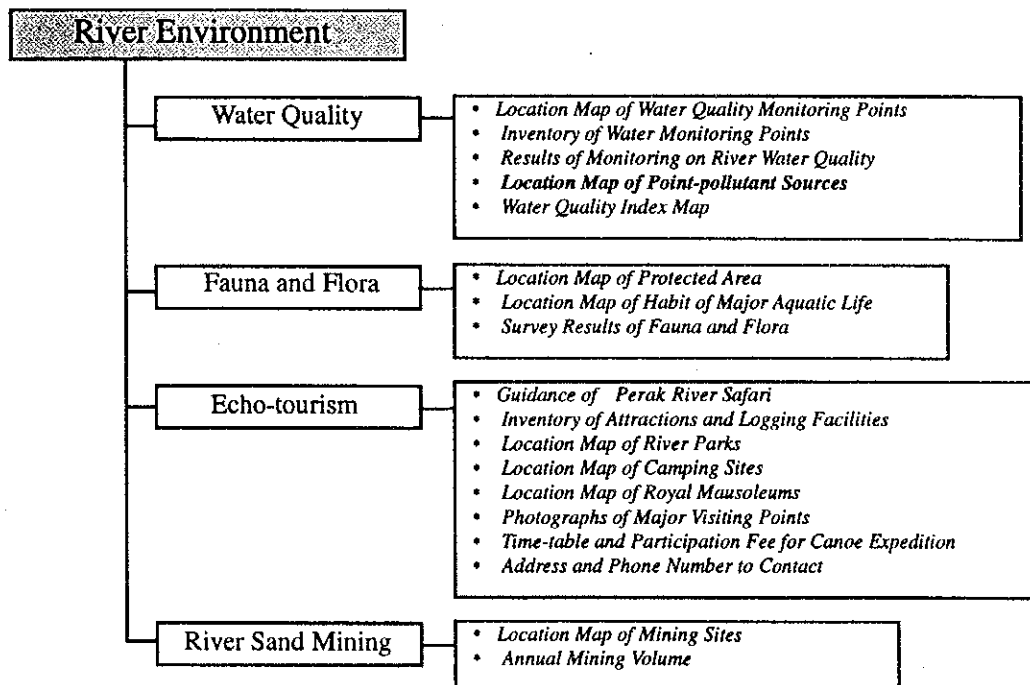
```
┌─────────────────────┐
│    Water Supply     │
└─────────────────────┘
    │
    │   ┌─────────────────┐      ┌──────────────────────────────────────────────┐
    ├───│    Irrigation   │──────│ • Location Map of water Intakes and Irrigation Area │
    │   └─────────────────┘      │ • Inventory of Water Intakes                 │
    │                            │ • Inventory of Irrigation Area               │
    │                            │ • Monthly Average Irrigation Water Demand    │
    │                            └──────────────────────────────────────────────┘
    │
    │   ┌─────────────────┐      ┌──────────────────────────────────────────────┐
    └───│  Domestic and   │──────│ • Location Map of water Intakes and Service Area │
        │ Industrial Water│      │ • Inventory of Water Intakes                 │
        │     Supply      │      │ • Inventory of Service Area                  │
        └─────────────────┘      │ • Daily Average Domestic Water Demand        │
                                 └──────────────────────────────────────────────┘
```
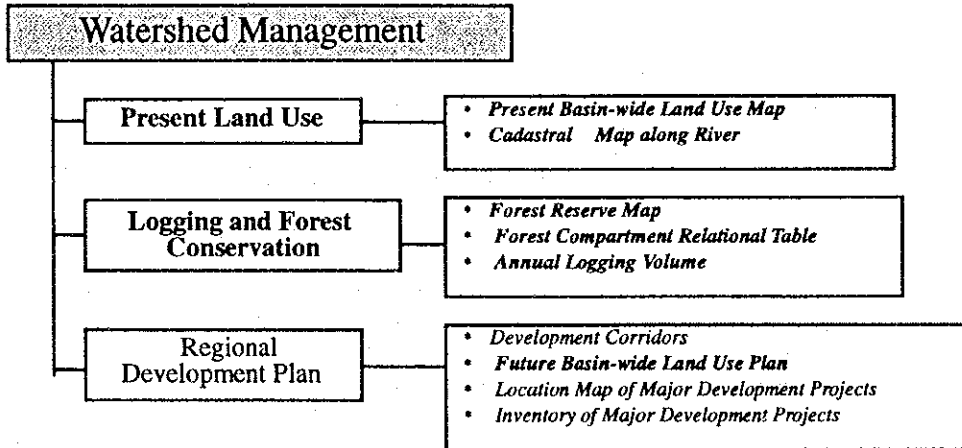
(7)   Information on River Environmental Management

This category covers the information related to river water quality, fauna and flora, ecotourism and river sand mining (refer to Figs. IV-39 to IV-43), and the hierarchy of information is made as below.

```
┌─────────────────────┐
│  River Environment  │
└─────────────────────┘
    │
    │   ┌─────────────────┐      ┌──────────────────────────────────────────────┐
    ├───│  Water Quality  │──────│ • Location Map of Water Quality Monitoring Points │
    │   └─────────────────┘      │ • Inventory of Water Monitoring Points       │
    │                            │ • Results of Monitoring on River Water Quality │
    │                            │ • Location Map of Point-pollutant Sources    │
    │                            │ • Water Quality Index Map                    │
    │                            └──────────────────────────────────────────────┘
    │
    │   ┌─────────────────┐      ┌──────────────────────────────────────────────┐
    ├───│ Fauna and Flora │──────│ • Location Map of Protected Area             │
    │   └─────────────────┘      │ • Location Map of Habit of Major Aquatic Life │
    │                            │ • Survey Results of Fauna and Flora          │
    │                            └──────────────────────────────────────────────┘
    │
    │   ┌─────────────────┐      ┌──────────────────────────────────────────────┐
    ├───│  Echo-tourism   │──────│ • Guidance of  Perak River Safari            │
    │   └─────────────────┘      │ • Inventory of Attractions and Logging Facilities │
    │                            │ • Location Map of River Parks                │
    │                            │ • Location Map of Camping Sites              │
    │                            │ • Location Map of Royal Mausoleums           │
    │                            │ • Photographs of Major Visiting Points       │
    │                            │ • Time-table and Participation Fee for Canoe Expedition │
    │                            │ • Address and Phone Number to Contact        │
    │                            └──────────────────────────────────────────────┘
    │
    │   ┌─────────────────┐      ┌──────────────────────────────────────────────┐
    └───│ River Sand Mining│──────│ • Location Map of Mining Sites              │
        └─────────────────┘      │ • Annual Mining Volume                       │
                                 └──────────────────────────────────────────────┘
```

(8) Information on Watershed Management

The information presents the land use, forest conditions and the regional development plans (refer to Figs. IV-44 to IV-45). The information hierarchy is made as below.

```
┌──────────────────────────────────────┐
│      Watershed Management            │
└──────────────────────────────────────┘
    │
    │   ┌─────────────────────┐    ┌─────────────────────────────────────┐
    ├───│  Present Land Use   │────│ • Present Basin-wide Land Use Map    │
    │   └─────────────────────┘    │ • Cadastral   Map along River        │
    │                              └─────────────────────────────────────┘
    │   ┌─────────────────────┐    ┌─────────────────────────────────────┐
    │   │ Logging and Forest  │    │ • Forest Reserve Map                 │
    ├───│    Conservation     │────│ • Forest Compartment Relational Table│
    │   └─────────────────────┘    │ • Annual Logging Volume              │
    │                              └─────────────────────────────────────┘
    │   ┌─────────────────────┐    ┌─────────────────────────────────────────┐
    │   │     Regional        │    │ • Development Corridors                  │
    └───│ Development Plan     │────│ • Future Basin-wide Land Use Plan        │
        └─────────────────────┘    │ • Location Map of Major Development Projects│
                                   │ • Inventory of Major Development Projects  │
                                   └─────────────────────────────────────────┘
```

CHAPTER 6 SYSTEM TECHNOLOGY TRANSFER

Simultaneously with the progress of development of the Operational System, the Study Team provided On-the-Job Training (OJT) to the Malaysian counterparts to enhance their knowledge on the necessary operation and maintenance of the system.

The OJT contains the lecture and practice/exercise and was carried out from the beginning of June to the middle of August, 1998. The schedule of the OJT is as shown Table IV-13. The lecture was made once a week in principle, and the practice/exercise was for 4 to 8 days after the lecture based on the knowledge given in the lecture. Among the OJT programs, the Supplier's training on Arc/Info was provided by the Environmental System Research Institute (ESRI), while the others are by the JICA Study Team.

All programs of lecture and OJT other than the supplier's training and the training in Ipoh were made from Monday to Thursday at the office of the River Division, DID Headquarters. The supplier's training was at the office of ESRI in Kuala Lumpur, and the training in Ipoh was at the flood forecasting room in the State DID Office of Perak. The trainees had actual practice on system operation and maintenance using the equipment provided by JICA during the OJT. The contents of all the OJT lectures are given below.

Lecture 1 was an introductory lecture. Almost all of the Technical Committee members took part in this lecture. The lecture introduced the concept of system network. It included the system construction, network construction, the WEB server setting, the system security, and the expandability of the network.

Lecture 2 was for system engineers. This lecture introduced the management of system hardware. It included system hardware construction and management; for example, IP address assignment of network machines, router and workstation setting, UNIX system management, digitizer and plotter management, etc.

Lecture 3 was for system technicians. The GIS data creation through ArcView was introduced. It included preparing the paper map, preparing the ArcView for digitizing, preparing digitizer tablet, digitizing the GIS features, using the tools of data editing and adding the attributes to the GIS features.

Lecture 4 was also for the system engineers. Here, the system software construction and management were introduced. It included setting and managing the Netscape Enterprise

Server, setting and managing the GIS software (ArcInfo, ArcView and ArcView Internet Map Server).

Lecture 5 was for the Database Manager of the Operational System. The data type, database structure, detail database description and database definition in the Operational System were introduced. It also included the procedure to convert the data sources into the database.

Lecture 6 was held in Ipoh. All Ipoh system operations were introduced. The purpose of this lecture was to teach the operator in Ipoh how to operate the telemetry application software.

Lecture 7 was another introductory lecture to all the Technical Committee members. Here, the JICA study team introduced all the system images by OHP sheets, then, did the demonstration on the Operational System in the Federal Operation Room.

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TABLE

Table IV-1 (1/2)   PRESENT AND PROPOSED INFROMATION SYSTEM CONFIGURATION

Agency/Department	Purpose	Software			Hardware		Network	No. of Stuff
		OS	GIS/RS	DB/others	Computer	Peripheral		
DID, Coastal Div.	Coastal Information Management	Windows	ArcView ArcCAD		PC	Digitizer Plotter Scanner(A4)	LAN	less than 5
DID, Hydrology Div.	Hydrological Data Management	UNIX (Server)		Infomix	UNIX Server		LAN	less than 5
		UNIX (Client)	Arc/Info ArcView	TIDEDA	Workstation	Digitizer Plotter		
		Windows (Client)	ArcView	TIDEDA	PC	Digitizer		
DOA	Land Use and Soil Database Management	UNIX (Server)		ORACLE	UNIX Server	Disk Storage & Back up Device	LAN	GIS: Officer x 1 Senior Technician x 1 Technician x 2 Operator x 4 RS: Officer x 1 Technician x 4
		UNIX (Client)	Arc/Info		Workstation	Digitizer Plotter		
		UNIX (Client)	ERDAS		Workstation	CCT Drive		
Fishery Dept.	Fisheries Management	UNIX (Server)		ORACLE	UNIX Server	8 mm Tape Back Device	WAN	In HQ x 7
		UNIX (Client)		In-house Application				
MOA	AGROLINK Network Administration, Home Page Production	UNIX		Web Server ftp Server BC Server	UNIX Server	Back Device	Internet Intranet LAN	In HQ System Engineer x 3 (full time) Application Group x 12 (temporally)
		WindowsNT		Video Server Audio Server IPC Server news Server BC Server	WindowsNT Server	Back Device		
DOE	River Environment Management	UNIX	Arc/Info ERDAS		Workstation	Digitizer Plotter	LAN	less than 5
		Windows	ArcView		PC			

Table IV-1 (2/2)   PRESENT AND PROPOSED INFROMATION SYSTEM CONFIGURATION

Agency/Department	Purpose	Software			Hardware		Network	No. of Stuff
		OS	GIS/RS	DB/others	Computer	Peripheral		
Dept. of Wildlife and National Park	Protected Areas Map Production	UNIX	Arc/Info		Workstation	Digitizer Plotter		less than 5
MACRES	Consultant, Training and Contract Research	UNIX	Geovision SPANS		Workstation	Digitizer Plotter	LAN	All of Staff x 90
		Windows	Geovision SPANS		PC	Digitizer Plotter		
Forest Dept.	Forestry Information Management	UNIX (Server)	Arc/Info		UNIX Server	DAT Drive Plotter	LAN	GIS Expert x 2 Digitizing Operator x 6
		UNIX (Client)	Arc/Info		Workstation			
		UNIX (Client)	ERDAS		Workstation			
		MS-DOS	Arc/Info		PC	Digitizer		
		MS-DOS	ERDAS ArcView			CCT Drive Color Printer		
Mines Research Institute	Geological Survey	UNIX	Arc/Info		Workstation	Digitizer Plotter		less than 10
DSMM	Topographic Mapping	OpenVMS	Sysdeco GINIS (Mapping Software, Norway) ER Mapper		Minicomputer Workstation	Digitizer Scanner Plotter Film Writer Cell Plotter	LAN	Officer x 20 Technician x 80
DSMP	Cadastral Survey and Mapping	UNIX	Arc/Info		UNIX Server Workstation	Digitizer Plotter MO Drive	LAN	less than 10
Perak Water Authority	Water Supply Facility Management, Delivery Network Analysis	Windows	AutoCAD		PC	Digitizer Plotter		less than 10
Town and Country Planning Dept., Perak	Urban Development Plan	UNIX PC	GenaMap MapInfo		UNIX Server Workstation	Digitizer Plotter MO Drive	LAN	NA (Proposed)

Table IV-2 PRESENT AND PROPOSED INFORMATION SYSTEM

Agency/Department		Ministry	Purpose of System	GIS
DID, Coastal Div.	Federal	MOA	Shoreline Erosion Monitoring, Coastal Data Inventory(Coastal Information System)	Exist
DID, Hydrology Div.	Federal	MOA	Hydrological Data Bank, Hydrological Information System(HIS)	Exist
DID Perak	State	MOA	Flood Forecasting and Warning System(Telemetry System)	No exist
DOA	Federal	MOA	GIS for Land Use Database and Soil Database	Exist
Fishery Dept.	Federal	MOA	Fisheries Management System(National Integrated Database Management System)	No exist
MOA	Federal	MOA	AGROLINK Network System Administration, Home Page Production	No exist
DOE	Federal	MOSTE	River Environment Database(Klang River Information System)	Exist
MMS	Federal	MOSTE	Meteorological Database	No exist
Dept. of Wildlife and National Park	Federal	MOSTE	GIS for Forest Cover and Protected Areas Map	Exist
MACRES		MOSTE	GIS, Remote Sensing for Consultant, Training and Contract Research	Exist
Forestry Dept.	Federal	MOPI	National Forestry Information System(NFIS)	Exist
Mines Research Institute	Federal	MOPI	GIS for Geological Survey	Exist
DSMM	Federal	MLCD	Mapping System for Topographic Map	No exist
DSMP	State	MLCD	GIS for Cadastral Survey and Mapping	Exist
TNB	Federal	METP	Electric Load Management	No exist
TNB Perak	State	METP	Power Generation Remote Control, Power Station Monitoring	No exist
Health Dept., Perak	State	MOH	Drinking Water Quality Data Management System	No exist
Town and Country Planning Dept., Perak	State	MHLG	GIS for Urban Development Plan (proposed)	Proposed
Perak Water Authority	State	MWORKS	CAD System for Water Supply Facility Management, Delivery Network Analysis	Exist
Public Works Dept.	Federal	MWORKS	Bridge Management System	No exist

Abbreviation:

DID: Dept. of Irrigation and Drainage
DOA: Dept. of Agriculture
DOE: Dept. of Environment
MMS: Malaysian Meteorological Service
MACRES: Malaysian Center of Remote Sensing
DSMM: Dept. of Survey and Mapping Malaysia
DSMP: Dept. of Survey and Mapping Perak
TNB: Tenaga Nasional Berhad

MOA: Ministry of Agriculture
MOSTE: Ministry of Science, Technology and Environment
MOPI: Ministry of Primary Industry
MLCD: Ministry of Land and Cooperative Development
METP: Ministry of Energy, Telecommunications and Posts
MOH: Ministry of Health
MHLG: Ministry of Housing and Local Government
MWORKS: Ministry of Works

Table IV-3 GROWTH IN NUMBER OF TELEPHONE LINE

Services	Operator	1990	1991	1992	1993	1994	1995	1996
Residential Tel.	Telekom Malaysia	1,135,954	1,298,741	1,504,480	1,737,750	2,078,103	2,410,523	2,696,045
Business Tel.	Telekom Malaysia	449,790	518,109	587,098	672,971	785,652	929,240	1,014,749
Public Phone	Telekom Malaysia	6,789	8,658	10,290	14,528	23,892	99,225	137,606
	Uniphone	17,793	19,092	30,627	34,908	40,483	80,216	67,218
	Citifon	NA	NA	NA	NA	NA	2,500	8,784
Total		1,610,326	1,844,600	2,132,495	2,460,157	2,928,130	3,521,704	3,924,402

Source: Statistics Telecomunication Industry Malaysia, Jabatan Telekom Malaysia (1996)

http://www.kttp.gov.my/jtm/

Table IV-4 LAUNCHING SCHEDULE OF SATELLITE MEASAT NETWORKS

Satellite Name	Orbital Slot	Coverage	Type of Frequency	No. of Frequencies	Lanching Schedule
MEASAT-SA1	5.7 E	South Africa, Africa & Middle East	C	39	Not fixed yet
		South Africa, Central to Eastern Africa & Middle East	Ku		
MEASAT-SA2	9.0 E	South Africa, Central to Eastern Africa & Middle East	C	39	Not fixed yet
		South Africa, Central to Eastern Africa & Middle East	Ku		
MEASAT-SA3	37.0 E	Africa & Middle East Africa	C	63	Not fixed yet
		South Africa, Africa, Middle East & India	Ku		
MEASAT-SA4	46.0 E	Africa	C	63	Not fixed yet
		South Africa, Africa, Middle East & India	Ku		
MEASAT-1	91.5 E	East Asia particularly Malaysia	C & Ku	71	13-Jan-96
MEASAT-IK 91.5	91.5 E	India	Ku	39	Not fixed yet
MEASAT-IC 91.5	91.5 E	India	C	39	Not fixed yet
MEASAT-AK 91.5	91.5 E	Vietnam, Australia, Indonesia	Ku	80	Not fixed yet
MEASAT-3	95.0 E	East Asia particularly Malaysia	C & Ku	71	Not fixed yet
MEASAT-IK 95	95.0 E	India	Ku		
MEASAT-4	72.0 E	Asia (Global Beam)	C	24	Not fixed yet
MEASAT-2	148.0 E	East Asia particularly Malaysia	C & Ku	71	14-Nov-96

Table IV-5   COMPARISON OF CLIENT/SERVER SYSTEM WITH MAINFRAME SYSTEM

	The Client/Server System (distributed system)	The Mainframe System (integrated system)
Extendibility	1. Extended use of the existing system is possible 2. Addition of functions to suit the purpose of operations is easy. 3. Increase in the volume of data and the number of users can be met with the extenuation of server.	1. If a model different from the existing system is chosen, all the machines must be replaced. 2. Addition of functions to suit the purpose of operation is possible but limited. 3. The data volume and the number of users are fixed by the capacity of the computer.
Maintenance Management	1. Time and labor increase as the number of models and units increases.	1. Maintenance is easy because there is only one machine. 2. In some cases the system has to be stopped during maintenance.
Reliability	1. Since data is distributed and stored to plural units, the system never stops even if one unit fails.	1. The entire system stops if the computer fails.
Cost Efficiency	1. Construction of the system suited for the purpose of work is possible. 2. The open system allows choice of cost efficient models.	1. Initial investment is large. 2. The cost of application software is expensive because vendors are limited.

Table IV-6 (1/7)   SPECIFICATION OF HARDWARE AND SOFTWARE FOR OPERATIONAL SYSTEM

Item Code	Name	Function	Specification	Units
0100	Workstation1	1. GIS DB Server Running as a GIS Database Server for storing GIS Database. 2. GIS Web Server Running as a Internet Web Server for opening information to public.	1. RISC CPU: 200 MHz 2. Memory: 128 MB 3. Hard Disk: 8 GB 4. Network: IEEE802.3/Ethernet 10/100 Mbits/sec, 2 cards 5. Interface: SCSI-II, Parallel, Serial. 6. Driver: 12 X CD-ROM, Floppy 7. OS: UNIX 8. Monitor: 20 inch color monitor 9. Weight: 20 KG + 30 KG 10. Physical Dimensions: 500x550x700 mm 11. Power Supply: 1000W	1 unit
0200	Workstation2	1. TM Data Server Storing telemetery data realtimely, and starting a web server for opening the data to public 2. TM Web Server Running as a Internet Web Server for opening information to public.	1. RISC CPU: 200 MHz 2. Memory: 128 MB 3. Hard Disk: 8 GB 4. Network: IEEE802.3/Ethernet 10/100 Mbits/sec, 2 cards 5. Interface: SCSI-II, Parallel, Serial. 6. Driver: 12 X CD-ROM, Floppy	1 unit

Table IV-6 (2/7)   SPECIFICATION OF HARDWARE AND SOFTWARE FOR OPERATIONAL SYSTEM

Item Code	Name	Function	Specification	Units
0200	Workstation2		7. OS: UNIX 8. Monitor: 20 inch color monitor 9. Weight: 20 KG + 30 KG 10. Physical Dimensions: 500x550x700 mm 11. Power Supply: 1000W	

0300	Personal Computer 1	1. Web Client
		For browsing the servers homepage and outputting the results.
		
		2. Data Input Controller
		
		3. GIS viewer and Map output Controller
		
		4. CD-ROM Database Backup Controller
			1. CPU: Intel Pentium II/233 MHz
			
			2. Memory: 32 MB
			
			3. Hard Disk: 2.5 GB
			
			4. Network: Ethernet, 10 Mbits/sec
			
			5. Interface: Parallel, Serial.
			
			6. Driver: 24 X CD-ROM, Floppy
			
			7. OS: WindowsNT 4.0 with
			    pre-installed Internet Explore 4.0
			
			8. Monitor: 17 inch 1280x1024
			
			9. Weight: 10 KG + 20 KG
			
			10. Physical Dimensions:
			
			    450x450x550 mm
			
			11. Power Supply: 150W
				1 unit

Table IV-6 (3/7)   SPECIFICATION OF HARDWARE AND SOFTWARE FOR OPERATIONAL SYSTEM

Item Code	Name	Function	Specification	Units
0400	Personal Computer 2	1. Web Client For browsing the servers homepage and outputting the results. 2. Telemetry data transfering from state to federal TM Data Server.	1. CPU: Intel Pentium II/233 MHz 2. Memory: 32 MB 3. Hard Disk: 2.5 GB 4. Network: Ethernet, 10 Mbits/sec 5. Interface: Parallel, Serial. 6. Driver: 24 X CD-ROM, Floppy 7. OS: WindowsNT 4.0 with pre-installed Internet Explore 4.0 8. Monitor: 17 inch 1280x1024 9. Weight: 10 KG + 20 KG 10. Physical Dimensions: 450x450x550 mm 11. Power Supply: 150W	1 unit
0500	Digitizer	GIS Vector Data Input	1. Support OS: WindowsNT 4.0 2. Interface: RS-232C Serial Port 3. Baud Rate: Up to 19200 4. Board Size: Up to A0 5. Cursor: 16 buttons cordless 6. Weight: 50 KG 7. Physical Dimensions: 1500x1300x1500 mm 8. Power Supply: 50W	1 unit

Table IV-6 (4/7)   SPECIFICATION OF HARDWARE AND SOFTWARE FOR OPERATIONAL SYSTEM

Item Code	Name	Function	Specification	Units
0600	Plotter	Map output	1. Colors: 16.7 million 2. Resolutions: 600 DPI 3. Media Size: Up to A0 4. Memory: 8 MB 5. Interface: Ethernet(10BaseT), RS-232-C 6. Weight: 60 KG 7. Physical Dimensions: 1500x700x1200 mm 8. Power Supply: 50W	1 unit
0700	Laser Jet Printer	Document Print: Outputting the client browser results	1. Resolution: 600 DPI 2. Paper Size: Up to A4 3. Memory: 2 MB 4. Interface: Ethernet 5. Weight: 15 KG 6. Physical Dimensions: 1000x400x200 mm 7. Power Supply: 200W	2 units
0800	HUB(10Mb)	Local Area Network Linking	10 BaseT X 8 Ports	2 units
0900	HUB(100Mb)	Local Area Network Linking	100 BaseT X 8 Ports	1 unit

Table IV-6 (5/7)   SPECIFICATION OF HARDWARE AND SOFTWARE FOR OPERATIONAL SYSTEM

Item Code	Name	Function	Specification	Units
1000	Modular Router	Link LAN to WAN	1. Ethernet Interface: 10BaseT 2. Memory: 4 MB DRAM and 8 MB Flash memory 3. Module: 128K Lease Line	2 units
1100	4 mm Type Driver	DB Backup	1. Interface: SCSI 2. Capacity: 4 GB DDS-2	1 unit
1200	CD-R Driver	DB Backup	1. Interface: SCSI (SCSI Adaptec P&P Card for Win95/NT) 2. Speed: 4 X Write and Read	1 unit
1300	AVR	To maintain smooth and save operation under unstable power supply situations for the server computer and its network equipment	1. Power: 600 VA 2. Output Sockets: Three	2 units
1400	UPS	Back up power from frequent power outage problems for the server computer and its network equipment	1. Power: 2.0 KVA 2. Backup Time: 1 hour for full load 3. Output sockets: Four	3 units
1500	Ethernet Cable	To link all computers to Network	Length: 10 Meters 10BaseT Cable	16 lines
1600	Power Supply Cable		Length: 5 Meters and 3 Meters	3 lines each
1700	Ethernet Card	Upgrading exist TeleWin PC to a Network Computer	PCI Ethernet Card	1 unit

Table IV-6 (6/7)   SPECIFICATION OF HARDWARE AND SOFTWARE FOR OPERATIONAL SYSTEM

Item Code	Name	Function	Specification	Units
1800	Consumption	1. Plotter Ink Consumption 2. Plotter Paper Consumption 3. Backup blank CD 4. Laser Printer Toner 5. DAT/DDS type catridge	1. Ink cartridges (Plotter) 2. 36 inch 150 feet roll paper 3. CD-R blank disc 4. Laser Jet toner cartridge 5. 120m type catridge (5 Packs)	5 sets 5 sets 20 pices 2 sets 1 set
1900	ESRI Arc/Info with full options	1. GIS Database Management 2. GIS Analysis tools	1. Arc/Info Base Module 2. TIN Module 3. Network Module 4. GRID Module 5. ArcSTORM Module 6. ArcPRESS Module 7. UNIX Arc/View 3 8. UNIX Spatial Analyst 9. UNIX Network Analyst	1 unit
2000	ESRI Arc/View	GIS Database Viewing Tool	1. PC Arc/View 3 2. PC Spatial Analyst 3. PC Network Analyst	1 unit
2100	Web Server Soft	1. Start a Web Server 2. Distributing Information through the Server	Netscape Navigator Server: 1 Server. License, 50 Client User License	2 units
2200	Printer Server for UNIX	Printer software utilities for setting up and network administration.	Driver software: For driving Plotter and Printer	2 units

Table IV-6 (7/7)   SPECIFICATION OF HARDWARE AND SOFTWARE FOR OPERATIONAL SYSTEM

Item Code	Name	Function	Specification	Units
2300	Installation Charges		To provide installation, testing, commissioning for WAN and LAN, OS, application software and hardware peripherals at KL and IPOH sites.	1 unit

Table IV-7　PRICE OF HARDWARE AND SOFTWARE FOR INSTALLATION

Item Code	Name	Units	Unit Price RM	Price RM
0100	Workstation 1	1	120,000	120,000
0200	Workstation 2	1	120,000	120,000
0300	Personal Computer 1	1	12,000	12,000
0400	Personal Computer 2	1	12,000	12,000
0500	Digitizer	1	17,000	17,000
0600	Plotter	1	28,000	28,000
0700	Laser Jet Printer	2	6,000	12,000
0800	HUB(10Mb)	2	500	1,000
0900	HUB(100Mb)	1	3,000	3,000
1000	Modular Router	2	12,500	25,000
1100	4 mm Type Driver	1	10,000	10,000
1200	CD-R Driver	1	2.300	2,300
1300	AVR	2	250	500
1400	UPS	3	6,000	18,000
1500	Ethernet Cable	16	62.5	1,000
1600	Power Supply Cable	3 meters x 3	50	150
1600	Power Supply Cable	5 meters x 3	70	210
1700	Ethernet Card	1	500	500
1800	Consumption	Plotter Ink x 5 sets	440	2,200
1800	Consumption	Plotter Paper x 5 sets	200	1,000
1800	Consumption	CD-R disc x 20 pices	25	500
1800	Consumption	Printer toner x 2 set	500	1,000
1800	Consumption	DAT/DDS Type x 1 set	300	300
1900	Arc/Info	1	300,000	300,000
2000	Arc/View	1	35,000	35,000
2100	Web Server Soft	2	40,000	80,000
2200	Printer Server Soft	2	500	1,000
2300	Installation	1	15,000	15,000
			Total (RM)	818,660
			Total (JYEN)	30,290,420

Table IV-8   LOCATION FOR INSTALLATION OF HARDWARE AND SOFTWARE

Item Code	Name	Units	Federal	State
0100	Workstation 1	1	●	
0200	Workstation 2	1	●	
0300	Personal Computer 1	1	●	
0400	Personal Computer 2	1		●
0500	Digitizer	1	●	
0600	Plotter	1	●	
0700	Laser Jet Printer	1	●	
0700	Laser Jet Printer	1		●
0800	HUB(10Mb)	1	●	
0800	HUB(10Mb)	1		●
0900	HUB(100Mb)	1	●	
1000	Modular Router	1	●	
1000	Modular Router	1		●
1100	4 mm Type Driver	1	●	
1200	CD-R Driver	1	●	
1300	AVR	2	●	
1400	UPS	2	●	
1400	UPS	1		●
1500	Ethernet Cable	11	●	
1500	Ethernet Cable	5		●
1600	Power Supply Cable	3 meters x 2 5 meters x 2	●	
1600	Power Supply Cable	3 meters x 1 5 meters x 1		●
1700	Ethernet Card	1		●
1800	Consumption	Plotter Ink x 5 sets Plotter Paper x 5 sets CD-R disc x 20 pices Printer toner x 1 set DAT/DDS Type x 1 set	●	
1800	Consumption	Printer toner x 1 set		●
1900	Arc/Info	1	●	
2000	Arc/View	1	●	
2100	Web Server Soft	2	●	
2200	Printer Server Soft	2	●	

Table IV-9 (1/4)   INSTALLATION WORK LIST FOR OPERATIONAL SYSTEM

Item	Name	Units	Installation Contents
0100	Workstation	2	1. To connect the power cord to the UPS and switch on the system.
0200			2. To initialize the harddisk and make partition.
			3. To install the Unix Operating System, and Start up the X window on the Unix OS.
			4. To configure the Network Cards and DAT/DDS Driver.
			5. To create user environment, including groups, names, password and etc.
			6. To link the machine to hubs by the network cable for getting the LAN/WAN environment.
			7. To set up the network environment, including IP address, NFS server and client, NIS security, and administration on TCP/IP network environment.
			8. To install the utility software for network plotter and printer, and configure the plotter and printer.
			9. To install the Web Server/Client software, and set up Web Server environment and start up the Web Server.
			10. To install the Arc/Info and Arc/View software.
			11. To test on final system for above installations of network and peripherals environment.
			12. To tune the final system and create a system recovery type.

Table IV-9 (2/4)   INSTALLATION WORK LIST FOR OPERATIONAL SYSTEM

Item	Name	Units	Installation Contents
0300	Personal Computer	1	1. To connect the power cord to the UPS and switch on the system.
			2. To initialize the harddisk and set up the hardware environment.
			3. To install the Windows NT Operating System.
			4. To configure the Network Cards, CD-R Driver and Digitizer.
			5. To create the user environment for groups, names, password and etc.
			6. To link the network cable to the HUB(10Mb) for getting the LAN/WAN environment.
			7. To set up the network environment, including IP address, NFS server and client, NIS security, and administration on TCP/IP network environment.
			8. To install and configure the network plotter and printer.
			9. To install the Arc/View software and test the digitizer.
			10. To test on final system for above installations of network and peripherals environment.
			11. To tune the final system.
0500	Digitizer	1	1. To connect the power cord to the AVR.
			2. To link to the Personal Computer COM port and test data inputting on Arc/View software.
0600	Plotter	1	1. To connect the power cord to the AVR.
			2. To link to the HUB(10Mb) by the network cable and test printing through the network.
0700	Laser Jet Printer	1	1. To connect the power cord to the AVR.
			2. To link to the HUB(10Mb) by the network cable and test printting through the network.
0800	HUB(10Mb)	1	1. To connect the power cord to the UPS.
			2. To link to the Modular Router by the network cable.

Table IV-9 (3/4)   INSTALLATION WORK LIST FOR OPERATIONAL SYSTEM

Item	Name	Units	Installation Contents
0900	HUB(100Mb)	1	1. To connect the power cord to the UPS. 2. To link to the Agrolink network terminal jack by the network cable.
1000	Modular Router	1	1. To connect the power cord to the UPS. 2. To link to the Lease Line(128Kb) terminal jack.
1100	4 mm Type Driver	1	1. To connect the power cord to the UPS. 2. To link to the SCSI port of the GIS Server Workstation (Item No. 0100).
1200	CD-R Driver	1	1. To connect the power cord to the AVR. 2. To link to the personal computer SCSI port and test the driver.
1300	AVR	2	To link to the 240V power point
1400	UPS	2	To link to the 240V power point

Table IV-9(4/4)   INSTALLATION WORK LIST FOR OPERATIONAL SYSTEM

Item	Name	Units	Installation Contents
0400	Personal Computer	1	1. To connect the power cord to the UPS and switch on the system. 2. To initialize the harddisk and set up the hardware environment. 3. To Install the Windows NT Operating System. 4. To configure the Network Cards. 5. To create the user environment for groups, names, password and etc. 6. To link the network cable to the HUB(10Mb) for getting the LAN/WAN environment. 7. To set up the network environment, including IP address, NFS server and client, NIS security, and administration on TCP/IP network environment. 8. To install and configure the network printer driver. 9. To test on the final system for above installations of network environment. 10. To tune the final system.
0700	Laser Jet Printer	1	1. To connect the power cord to the UPS. 2. To link to the HUB(10Mb) by the network cable and test printing through the network.
0800	HUB(10Mb)	1	1. To connect the power cord to the UPS. 2. To link to the Modular Router by the network cable.
1000	Modular Router	1	1. To connect the power cord to the UPS. 2. To link to the Lease Line(128Kb) terminal jack.
1400	UPS	1	To link to the 240V power point.

Table IV-10   IMPLEMENTATION SCHEDULE FOR SETUP OF OPERATIONAL SYSTEM

Period / Undertaken by	First Month	Second Month	Third Month	Fourth Month	Fifth Month	Sixth Month
JICA	Tendering					
Supplier	Procurement, Delivery and Installation & Adjustment of Hardware and Software					
DID	Preparatory	Training for System Operation and Maintenance				
Study Team		Hardware Setup / Software Installation / Web Server Set up / Database Input Work Adoption / Database Creation / Program Design / Programming				

Table IV-11 (1/2)   INVENTORY OF ALL HARDWARE AND SOFTWARE IN OPERATIONAL SYSTEM

Hardware Name	Function	Specification	Location
HP C200 UNIX WORKSTATION	• GIS Database Server • GIS Private Web Server • GIS Global Web Server • Internet Map Server	• RISC CPU: 200 MHz • Memory: 128 MB • Hard Disk: 9 GB • Two Network Cards	DID HQ in KL
HP C200 UNIX WORKSTATION	• TM Data Server • TM Private Web Server • TM Global Web Server	• RISC CPU: 200 MHz • Memory: 128 MB • Hard Disk: 8 GB • Two Network Cards	DID HQ in KL
HP Kayak XA Pentium II Personal Computer	• GIS Database Creation Machine • CD-R Backup Machine	• Intel Pentium II 233 MHz CPU • 64 MB Memory • 2.5 GB Hard disk	DID HQ in KL
HP Vectra VL 6 Pentium II Personal Computer	• Real-time Data Transmission Machine	• Intel Pentium II 233 MHz CPU • 64 MB Memory • 2.5 GB Hard disk	DID PERAK in IPOH
Calcomp Drawing Board III Digitizer Model34480	• GIS Graphic Data Input	• A0 Size Tablet • 16 Button Cordless Courser	DID HQ in KL
HP DesignJet 750C Plotter	• Map Output Device	• A0 Size Paper • Color Ink Jet	DID HQ in KL
HP LaserJet 6MP Printer	• Document Output Device	• A4 Size Paper • Post Scrip	DID HQ in KL
HP LaserJet 6MP Printer	• Document Output Device	• A4 Size Paper • Post Scrip	DID PERAK in IPOH
3COM Superstack II PS HUB 40 TP	• Private Net Connect HUB in KL	• 12 Ports • 100 MB • Optical Fiber Transceiver	DID HQ in KL
3COM Superstack II PS HUB 40 TP	• Global Net Connect HUB in KL	• 12 Ports • 100 MB	DID HQ in KL
3COM Office Connect HUB	• Private Net Connect HUB in IPOH	• 8 Ports • 10 MB	DID PERAK in IPOH
Cisco 2503 Router	• ISDN Link in KL	• 128 kbps ISDN Line Modem	Agrolink in KL
Cisco 2503 Router	• ISDN Link in IPH	• 128 kbps ISDN Line Modem	DID PERAK in IPOH

Table IV-11 (2/2)   INVENTORY OF ALL HARDWARE AND SOFTWARE IN OPERATIONAL SYSTEM

Hardware Name	Function	Specification	Location
HP SureStore DAT	• Server Backup Driver	• 4mm Tape	DID HQ in KL
Yamaha CDR400trx	• CD Recorder for Distributing Data	• 4X Write / 6X Read	DID HQ in KL
PK 600 AVR	• To save unstable power supply for Digitizer	• 600 VA	DID HQ in KL
PK 600 AVR	• To save unstable power supply for PC and Printer	• 600 VA	DID HQ in KL
PK 1052C/CX UPS	• Back up power for the GIS server computer	• 4 hours full load	DID HQ in KL
PK 1052C/CX UPS	• Back up power for the TM server computer	• 4 hours full load	DID HQ in KL
PK 1052C/CX UPS	• Back up power for the Real-time system in IPOH	• 4 hours full load	DID PERAK in IPOH
3COM Ethernet Card	• Upgrading exist TeleWin PC in IPOH	• 10/100 BaseT	DID PERAK in IPOH
Arc Info	• GIS Database Management • GIS Analysis tools	• Full Option • Version 7.1.2	DID HQ in KL
Arc View PC	• GIS Database Input Tool	• Version 3	DID HQ in KL
Arc View IMS	• GIS Information Distribution Tool	• Version 1	DID HQ in KL
Netscape Suitespot	• Web Server Software for GIS Server	• Version 3.1	DID HQ in KL
Netscape Suitespot	• Web Server Software for TM Server	• Version 3.1	DID HQ in KL
HP JetDirect Printer Server	• Unix Printer Utilities Software	• Full Version	DID HQ in KL

Table IV-12 REVISED CLASSIFICATION OF OBJECTIVE INFORMATION (1/3)

Major Category	Detailed Category	Contents		Class
1. General Information	1.1 Information on Basin Natural Conditions	• Base Map		Level 2
		• Counter Map		Level 1
		• River Map		Level 2
		• Road Map		Level 2
		• Town Map		Level 2
		• Geological Map		Level 1
		• Soil Map		Level 1
	1.2 Information on Basin Socio Information	• Administrative Boundary		Level 2
		• Population by Mukim		Level 2
2. Hydrological Information	2.1 Gauging Station	• Location Map of Real-time Gauging Station		Level 2
		• Location Map of Non-Real Time Gauging Station (Rainfall)		Level 2
		• Location Map of Non-Real Time Gauging Station (Stage/Discharge)		Level 2
		• Inventory of Gauging Station (Real Time)		Level 2
		• Inventory of Gauging Station (Non-real Time, Rainfall)		Level 2
		• Inventory of Gauging Station (Non-real Time, Stage/Discharge)		Level 2
		• Inventory of Gauging Station (Non-real Time, Suspended Sediment)		Level 2
	2.2 Rainfall	• Hourly Value		Level 1
		• Daily and Monthly Value		Level 1
		• Annual Maximum		Level 1
	2.3 River Stage and Discharge	• Hourly Value		Level 1
		• Daily and Monthly Value		Level 1
		• Annual Maximum and Minimum		Level 1
		• Discharge Rating Curve		Level 1
	2.4 Suspended Discharge	• Monthly Value		Level 1
		• Annual Maximum and Minimum		Level 1
		• Sediment Rating Curve		Level 1
	2.5 Meteorology	• Meteorological Table		Level 2
	2.6 Tidal Level	• Tide Table		Level 2
3. Information of River Structures	3.1 River Structures	• Location Map		Level 2
		• Inventory of River Structures		Level 2
		• Structural Features		Level 2

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Table IV-12 REVISED CLASSIFICATION OF OBJECTIVE INFORMATION (2/3)

Major Category	Detailed Category	Contents	Class
4. Information on Flood Mitigation	4.1 Flood Mitigation Scheme	• Location Map of Flood Mitigation Scheme • Inventory of Existing Flood Mitigation Scheme • Inventory of Projected Flood Mitigation Scheme	Level 1 Level 2 Level 1
	4.2 Probable Flood	• Probable Flood Peak Discharge • Probable Flood Inundation Area	Level 1 Level 1
	4.3 River Channel Survey	• Results of River Channel Survey • River Channel Flow Capacity • Longitudinal Profile of River Channel and Probable Flood Level	Level 1 Level 1 Level 1
	4.4 Flood Damage Record	• Extent of Flood Inundation • Road and Bridge Inundated • Number of People Affected • Overall Monetary Flood Damage Value • Agricultural Damage • Epidemic Caused by Flood	Level 2 Level 2 Level 2 Level 2 Level 2 Level 2
5. Information on Water Supply Management	5.1 Irrigation	• Location Map of Intake Point and Irrigation Area • Inventory of Water Intakes • Inventory of Irrigation Area • Monthly Average Irrigation Demand	Level 2 Level 2 Level 2 Level 2
	5.2 Domestic and Industrial Water	• Location Map of Intake Point and Service Area • Inventory of Water Intakes • Daily Average Domestic and Industrial Water	Level 2 Level 2 Level 2

Table IV-12   REVISED CLASSIFICATION OF OBJECTIVE INFORMATION (3/3)

Major Category	Detailed Category	Contents	Class
6. Information on River Environmental Management	6.1 Water Quality	• Location Map of Water Quality Monitoring Point	Level 2
		• Inventory of Water Quality Monitoring Points	Level 2
		• Results of Monitoring on River Water Quality	Level 2
		• Location Map of Point Pollutant Source	Level 1
		• Water Quality Index Map	Level 2
	6.2 Aquatic Life	• Location Map of Protected Area	Level 2
		• Location Map of Habitat of Major Aquatic Life	Level 2
		• Survey Results of Fauna and Flora	Level 2
	6.3 Ecotourism	• Guidance of Perak River Safari	Level 2
		• Inventory of Attractions and Lodging Facilities	Level 2
		• Location Map of River Parks	Level 2
		• Location Map of Camping Sites	Level 2
		• Location Map of Royal Mausoleums	Level 2
		• Pictures of Major Visit Points	Level 2
		• Time-table and Participation Fee for Canoe Expedition	Level 2
		• Address and Phone Number to Contact	Level 2
	6.4 River Sand Mining	• Location Map of Mining Sites	Level 2
		• Annual Mining Volume	Level 2
7. Information on Watershed Management	7.1 Present Land Use	• Present Basin-wide Land Use Map-	Level 1
		• Cadastral Map along River	Level 1
	7.2 Logging and Forest Conservation	• Forest Reserve Map	Level 1
		• Forest Compartment Relational Table	Level 1
		• Annual Logging Volume	Level 1
	7.3 Regional Development Plan	• Development Corridors	Level 2
		• Future Basin-wide Land Use Map-	Level 1
		• Location Map of Major Development Projects	Level 2
		• Inventory of Major Development Projects	Level 2

Table IV-13 THE SCHEDULE OF ON-THE JOB TRAINING (1/2)

Date			Lecture	Practice/Exercise
June	1	Mon		
	2	Tue		
	3	Wed		
	4	Thu		
	5	Fri	Lecture (1st) for Orientation and System Network	
	6	Sat		
	7	Sun		
	8	Mon		
	9	Tue		Supplier's training for Arc/Info
	10	Wed		
	11	Thu		
	12	Fri		
	13	Sat		
	14	Sun		
	15	Mon	Lecture (2nd) for System Hardware	
	16	Tue		Operation of UNIX OS and peripherals. Web Server Setting
	17	Wed		
	18	Thu		
	19	Fri		
	20	Sat		
	21	Sun		
	22	Mon	Lecture (3rd) for Digitizing	
	23	Tue		
	24	Wed		Basic Training for Arc/Info Digitizing Training
	25	Thu		
	26	Fri		
	27	Sat		
	28	Sun		
	29	Mon	Lecture (4th) for System Application to River Management	
	30	Tue		
July	1	Wed		
	2	Thu		
	3	Fri		
	4	Sat		
	5	Sun		
	6	Mon		
	7	Tue	Lecture (5th) for Processing of Database	
	8	Wed		
	9	Thu		Advanced training for Arc/Info Database training
	10	Fri	Lecture (6th) for Ipoh System Operat	
	11	Sat		
	12	Sun		System Operation in Ipoh
	13	Mon		
	14	Tue		
	15	Wed		
	16	Thu		
	17	Fri		
	18	Sat		
	19	Sun		

Table IV-13   THE SCHEDULE OF ON-THE JOB TRAINING (2/2)

Date			Lecture	Practice/Exercise
July	20	Mon	Lecture (7th) for Software Operation	
	21	Tue		
	22	Wed		
	23	Thu		
	24	Fri		
	25	Sat		
	26	Sun		
	27	Mon		
	28	Tue		
	29	Wed		Overall Training
	30	Thu		
	31	Fri		
August	1	Sat		
	2	Sun		
	3	Mon	Lecture (8th) for System Application to	
	4	Tue	River Basin Management and Discussion	
	5	Wed		
	6	Thu		
	7	Fri		
	8	Sat		
	9	Sun		
	10	Mon		
	11	Tue		