

## CHAPTER 6 OBJECTIVE INFORMATION FOR THE MASTER PLAN

### 6.1 Objective Information to be Collected

In due consideration of the major issues on present and future river basin management in the Perak river basin, the necessary hydrological information to be collected by the system are preliminarily proposed as follows.

Objective Information	Real-time Information	Non real-time Information	Digitization of Non real-time Information	Present Competent Agency for the Information
Hydrological Information (rainfall, river stage/ discharge, river suspended sediment load and tidal level)	yes	yes	Completed	DID
Dam reservoir Information (inflow/outflow discharge and reservoir level)	yes	yes	-	TNB
Meteorological Information (monthly statistical values)	-	yes	-	MMS

As shown above, hydrological information is classified into real-time and non real-time information. The real-time information is in principle used for disaster management such as flood forecasting and warning. On the other hand, the non-real-time information could be used, for instance, for the clarification of the long-term relationship between the hydrological conditions of the river and the impacts of basin land development (the logging activities in the upper reaches, the urban and industrial development in the basin).

The recent technology on hydrological gauging and telecommunication devices would improve the gauging function as well as the data transmission speed. The radar gauge, as an example, would cope with the inadequate coverage of point rainfall gauging stations and uselessness for urgent activities due to the delay of data transmission. In view of these developed technologies, a radar rainfall gauge is proposed as a part of the objective hydrological information system.

### 6.2 Objective Information to be Disseminated

The objective hydrological information to be disseminated to users is proposed, as shown in Table I-9. In principle, all hydrological information should be open to public users. The

dissemination of real-time hydrological information will especially facilitate the evacuation and disaster prevention activities of the public.

### **6.3 Objective Hydrological Gauging Stations/Devices**

The objective hydrological gauging stations/devices are proposed in due consideration of the potential technological development so as to set up the futuristic river basin information system.

#### **6.3.1 Rainfall and Meteorological Gauging**

As described in Section 5.3, the average density of the existing DID point rainfall stations in the Perak river basin is 237 km<sup>2</sup>/station, which may satisfy the standard of 100-250 km<sup>2</sup>/station recommended by the WMO. The rainfall stations are, however, biased to the lower and middle reaches and scarcely distributed in the upper reaches.

There exist no rainfall gauging station in the upper reaches of the Temengor Dam. Thus, fourteen (14) point rainfall gauging stations need to be constructed in accordance with the standard (refer to Table I-10).

Likewise, the point rainfall gauging stations in the upper reaches of Chenderoh Dam need to be increased from the existing eight (8) stations to twenty-six (26) stations. Such drastic increment is judged to be not technically feasible due to the extremely difficult accessibility to the gauging sites located in the deep jungles.

The recent technology would enable wide rainfall gauging coverage by the radar rainfall gauge. When the electric waves radiated from the radar sites impinges raindrops on the way, a part of the electric waves is reflected back to the radar site.

The rainfall depth could be estimated by the strength of reflected wave which has a definitive relationship with the rainfall intensity. The data on the strength of the reflected waves are transmitted by micro radio wave from a radar site to an office and converted to rainfall intensity.

The rainfall area also can be easily displayed on radar terminal equipment. The effective range of radar wave is about 120 km in radius and, therefore, one radar site can cover the entire watershed of the Perak river basin (refer to Fig. I-8). On this concept, about thirteen (13) radar sites can cover the whole of Malaysia; i.e., five (5) radar sites for Peninsular Malaysia, and eight (8) for Sabah and Sarawak (refer to Fig. I-9).

The disadvantage of the radar rainfall gauge is the high investment and operation and maintenance (O/M) cost. The cost for one site of radar is estimated at about RM 12 million at present, while the annual operation and maintenance cost is about RM 1.8 million. However, a dynamic reduction of cost of the radar gauge is expected in the future in view of the present intensive development of technology on the radar itself, the data transmission, and the computer processing.

The radar rainfall gauge is available for both real-time and non real-time rainfall gauge, and will enable the estimation of not only rainfall intensity but also other various factors of rainfall such as extent, movement direction and speed of rainfall area. Such information is quite useful for flood forecasting and warning (FFW) and other disaster management.

From the above viewpoints, a new radar gauge and the existing five (5) DID telemetry point gauging stations for FFW are proposed as the objective stations for the Master Plan, as shown in Table I-11 and Fig. I-8. The proposed stations are divided into two (2) classes.

The radar gauge is proposed as the principal measure for rainfall gauging. The radar site needs to be located on a high ground elevation and, therefore, the proposed site in the Perak river basin is preliminarily placed at the top of Mt. Soh that has an elevation of 1,324 m.

The radar gauge also requires several telemetry point rainfall gauge stations in order to calibrate the rainfall observed by radar based on the actual gauged point rainfall. In this connection, the existing five (5) DID telemetry stations are proposed for the calibration.

The two (2) principal meteorological stations at Ipoh Airport and Lubok Merbau are also proposed as the objective stations for the Master Plan, as shown in Table I-11. These stations could serve to comprehend general meteorological conditions.

No evaporation data is available in the basin except for the meteorological stations. However, it is deemed necessary to gauge basin-wide evaporation for the study on water balance of the basin. Consequently, the installation of new evaporation gauges is also proposed at the existing five (5) DID telemetry rainfall stations.

### **6.3.2 Stream Gauging**

Twenty-one (21) stream gauging stations (river stage and discharge, sediment discharge, dam reservoir information) are proposed as the objective stations for the Master Plan, as shown in Table I-11 and Fig. I-10. The proposed stations are divided into six (6) classes.

The existing gauging stations of the Perak river basin are controlled by DID and rather well distributed in the basin. In due consideration of continuity of gauging data, all of the existing gauging stations of DID are applied as the gauging stations for the river basin information system. Moreover, in due consideration of the existing conditions described in Section 5.4, additional and/or modified gauging points are preliminarily proposed for the river basin information system, as follows:

- (a) The water quality sampling points should be placed at the existing three (3) principal gauging stations of DID to monitor both flow discharge and water quality;
- (b) The existing two (2) DID telemetry river stage gauging stations for FFW at Parit and Kg. Gajah, located in the middle and lower reaches of the Perak River, should be upgraded to principal gauging stations to gauge the actual water intake volume from the river and the water quality for water intake; and
- (c) A new tidal gauging station should be installed at Bagan Datoh near the estuary to gauge the tidal level as a hydrological boundary condition for the hydraulic calculation such as non-uniform and unsteady flows.

Of the sixteen (16) proposed river stage stations, eight (8) stations are not equipped with a telemetry system at present. The major reason for the non-telemetry gauging method adopted is attributed to two (2) reasons; namely:

- (a) the telemetry gauging station requires a higher investment cost; and
- (b) the telemetry gauging data could be used for the flood forecasting and warning but not as basic data for the study and planning due to low data accuracy.

The river basin management will require a dynamic improvement on data transmission and processing to realize a more effective and quick response in the future, and the telemetry system could meet such future requirement. Also, the reliability of data gauged by the telemetry system will certainly be improved and could even be used as the basic data for the study and planning works. Moreover, as the technology of the telemetry system is progressively improved, the investment cost of the telemetry system will become lower and could be competitive with the operation and maintenance cost of the off-line gauging system. In due consideration of such possible future trend of technology, all stream gauging stations are proposed to be equipped with the telemetry gauging system.

## CHAPTER 7 OBJECTIVE INFORMATION FOR OPERATIONAL SYSTEM

### 7.1 Objective Information to be Collected

Hydrological information is the essential information for the various aspects of river management work such as flood control, water supply, water resources development and watershed management. All hydrological information in the Operational System has to be collected carefully in line with the river management purposes.

The objective hydrological information is classified into the real-time and non real-time information. The detailed contents of both real-time and non real-time gauging items to be collected for the Operational System are summarized in Table I-12, taking into account the considerations mentioned hereinafter.

#### 7.1.1 Real-time Information

##### (1) Gauging Items

The Operational System will collect the following objective real-time hydrological information to support flood and drought management:

- (a) Hourly rainfall, river stage and outflow discharge from the Chenderoh Dam during a flood for the sake of flood forecasting and warning (FFW); and
- (b) Daily river discharge at the Iskandar Bridge (Sta. No. 4809443) and outflow discharge from the Chenderoh Dam during a drought to support the drought management.

The State DID currently monitors the hourly rainfall and river stage on real-time base through the existing five (5) rainfall and eight (8) river stage telemetry gauging stations. The State DID also monitors the outflow discharge from the Chenderoh Dam through the telephone line from TNB. This existing real-time gauging network covers all key gauging stations, and is applied as the objective gauging source for the Operational System (refer to Table I-13 and Fig. I-11).

All telemetry stations should be applied as objective stations, even though two river stage stations are located very closely like Teluk Sena and Kg. Gajah. The reason is

that all the stations are necessary components of the existing FFW system in terms of the three (3) flood warning levels at the stations.

In the existing real-time monitoring system, particular attention is given to the present off-line (telephone) communication system between DID and TNB. So far, TNB estimates the outflow discharge from the Chenderoh Dam by manual calculation and has no available data server to automatically monitor and transmit the information to DID. Due to lack of available data server at the dam, the Operational System has to follow the current off-line communication system.

The existing gauging network monitors the rainfall and river stage only during a flood period (October to January) for the sake of flood forecasting and warning. However, the Operational System will expand the gauging period not only for a flood period but also for a drought period (June to August) in order to facilitate both flood forecasting and drought management. The Operational System will have a function to convert the river stage to flow discharge during a drought period so as to clarify whether the river discharge could be sufficient as compared with the water intake capacity.

The real-time gauging data is now monitored only by the State DID in Ipoh, while the dam outflow discharge is determined in principle by the National Load Dispatch Center (NLDC) of TNB in Kuala Lumpur. Such a situation causes difficulties in coordinating the control of dam outflow both for flood and drought management between TNB and DID. To retrieve the issues, the Operational System will expand the data transmission system from Ipoh to Kuala Lumpur so that both the Federal DID and NLDC can monitor the real-time gauging information and coordinate the control of dam outflow during the critical periods.

(2) Data Source and Data Renewal Interval

The data source of the real-time hydrological gauging information is the telemetry data server installed at the Ipoh FFW Terminal Station, State DID. The data can be monitored and displayed at the Terminal Station through the existing software TeleWin32.

The real-time information will be introduced and displayed in the Operational System by online connection, and the existing interface of TeleWin32 will be applied in principle. In the Operational System, gauging for the flood forecasting and warning

will be made at one-hour interval, while gauging for the low flow discharge will be made once a day during a drought period.

### 7.1.2 Non Real-time Information

#### (1) Rainfall Gauging

In the Master Plan, a new radar rainfall gauge and the existing five (5) DID telemetry rainfall stations for calibration are proposed. However, the radar gauge will be installed as a part of the nationwide radar gauging plan after the year 2011 in line with the 9th Malaysia Plan.

The upper reaches from the Chenderoh Dam are regarded as the hydrological blind areas for rainfall gauging. In order to satisfy the standard, the rainfall gauging stations need to be increased to twenty-six (26) stations.

Such drastic increment is not technically feasible considering the extremely difficult accessibility to the gauging sites in the deep jungle. Moreover, the runoff discharge from the upper reaches from the Chenderoh Dam is regulated by the existing four (4) hydropower dams, and the rainfall in the upper reaches has less significance for the river flow regime in the downstream stretch.

In due consideration of the above circumstances, the Operational System will apply the existing DID gauging network as the hydrological data source without installation of any new gauging station. The inventory and classification of the objective stations are shown in Tables I-14 and I-15 and the locations of the proposed stations are shown in Fig. I-12.

In the Operational System, the gauging stations are classified into Class 1 and Class 2 stations. Class 1 stations include fourteen (14) automatic gauging stations [twelve (12) principal and two (2) secondary stations], while Class 2 stations include the remaining forty-eight (48) manual gauging stations.

The Operational System will collect hourly, daily and monthly rainfall depth in line with the dissemination plan for river management (refer to Table I-12 in details). The information of Class 1 have a relatively long gauging period and high reliability of gauging data, and the stations will be utilized as the key stations to estimate the basin mean rainfall by Thiessen polygon method for the design flood and low flow calculation.

On the other hand, the information of Class 2 stations will be utilized in principle to supplement the missing data of Class 1 stations. In addition to the raw gauging data, processed information such as typical isohyetal maps and typical monthly rainfall pattern will also be collected to comprehend general hydrological conditions in the Perak river basin.

(2) Stream Gauging

(a) River Stage and Discharge / Sediment Discharge

In contrast to the rainfall gauge, the existing stream gauging stations are well distributed in the river basin, monitoring all important gauging points on the major tributaries as well as the mainstream. The major gauging stations are: (1) Iskandar Bridge on the Perak River (Sta. No. 4809443); (2) Weir G. Tg. Tualang on the Kinta River (Sta. No. 4310401); and (3) Kg. Lintang on the Pelus River (Sta. No. 4911445). River basin management can be substantially carried out through the stream conditions monitored by such existing gauging network.

The Operational System will apply the existing DID gauging network (river stage and discharge, sediment discharge) as its hydrological data source. The inventory and classification of the proposed stations are shown in Tables I-14, I-16 and I-17. The locations of the proposed stations are shown in Fig. I-13.

As to the above rainfall gauging stations, the gauging stations are likewise classified into Class 1, Class 2 and Class 3 stations. The following three (3) Class 1 stations (present DID principal stations) are regarded as the key gauging stations to comprehend the hydrological conditions for the river management works:

- (i) Iskandar Bridge on the Perak River (Stn. No. 4809443) is regarded as the most important basic control point for the basin. The reasons are: (1) the station is the only DID Principal gauging station on the mainstream; (2) the location is the most suitable for FFW because of no major tributaries joining until the confluence with the Kinta River; (3) the station is also important for drought control because most of the water intakes are located downstream of the bridge; and (4) the recorded period is the longest in the basin.



- (ii) Weir G. Tg. Tualang on the Kinta River (Stn. No. 4310401) is regarded as the basic control point for the biggest tributary. The reasons are:
  - (1) the station is the only DID principal gauging on the Kinta River; and
  - (2) the location is suitable to determine the design flood for the whole Kinta river basin. Moreover, the reliability of the gauging record has already been proved relatively high by the "Kinta River Flood Mitigation and Catchment Area Rehabilitation Project (DID, 1994)".
- (iii) Kg. Lintang on the Pelus River (Stn. No. 4911445) is regarded as the indispensable station to clarify the relationship between sediment discharge and logging activity in the Pelus river basin, where intensive logging has been done, for the watershed management.

Class 2 gauging stations are also placed at seven (7) points on the secondary tributaries such as the Bidor, Cenderiang, and Pari. The gauging items of both Class 1 and Class 2 stations will cover the river stage, river discharge and suspended sediment loads. In addition, two (2) Class 3 stations are proposed for the Operational System to supplement the river discharge data for Class 1 and Class 2 stations.

The storage function method was employed for the upstream basin of Nordin Bridge on the Perak mainstream in the "Lower Perak Flood Mitigation Study (JICA, 1980)". Likewise, the design floods of the Kinta river basin were established through statistical analysis using historical floods in the "Kinta River Flood Mitigation and Catchment Area Rehabilitation Project (DID, 1994)". Further, the integrated flood runoff model for the whole Perak river basin should be developed in the future. The information of the Class 2 and Class 3 stations can be used for the calibration of the runoff model in this study.

The Operational System will collect the hourly, daily and monthly average value at twelve (12) gauging stations. The detailed attributes to be collected are shown in Table I-12 in line with the dissemination plan for river management.

The Master Plan proposes to upgrade the existing two (2) river stage gauging stations to river discharge gauging stations. On the other hand, a new stream gauging device/station is not proposed for the Operational System.

Regarding the new stations proposed in the Master Plan, the minimum guaranteed discharge at Iskandar Bridge is much more than the total water intake capacity at present. Accordingly, as far as the guaranteed discharge is maintained at Iskandar Bridge, the water intake downstream will not suffer from the water shortage. From this viewpoint, the newly proposed stations are not included in the Operational System.

(b) Chenderoh Dam Reservoir Gauging

The Operational System will compile the long term record of outflow discharge from the Chenderoh Dam in order to clarify the contribution of dam regulation on both flood mitigation and river maintenance flow.

(c) Tidal Level

A new tidal gauging station is also proposed in the Master Plan. The tidal data is to be used as a hydrological boundary condition to estimate the river channel flow capacity by non-uniform flow calculation. The tide table is also to be used as a hydrological boundary condition to estimate the effectiveness of riverbank erosion control measures at Teluk Intan by unsteady flow calculation.

However, the estimation cannot be made without the results of a full-scale river channel survey. Since the river channel survey is not presently available, the tidal gauging data itself has little use for the river management works.

From this viewpoint, a tidal gauging station is not included in the Operational System. Instead, the Operational System will store the following tide levels observed in 1984 at Bagan Datoh near the estuary. The tide table will be used as a boundary condition for various hydraulic simulations.

Items at Bagan Datoh	Tidal Level (m)	Tidal Level converted by Land Survey Datum (m)
Lowest Astronomical Tide	0.0	-1.7
Mean Low Water Springs	0.4	-1.3
Mean Low Water Neaps	1.2	-0.5
Mean Sea Level	1.7	0.0
Mean High Water Neaps	2.1	0.4
Mean High Water Springs	2.9	1.2
Highest Astronomical Tide	3.4	1.7

Source: Directorate of Hydrology, Royal Malaysian Navy (1991); "Tide Tables 1992, Volume 1"

### (3) Meteorological Gauging

The Operational System will collect and store the long-term monthly mean meteorological data at the two (2) MMS principal meteorological stations at Ipoh Airport and Lubok Merbau (refer to Table I-14). The meteorological information will be utilized not only to study the water balance using evaporation data but also to comprehend the general meteorological condition in the basin.

The attributes of station data to be collected are several monthly meteorological records in line with the dissemination plan for river management. The detailed attributes to be collected are presented in Table I-12.

New evaporation gauges are proposed to be installed at the existing five (5) DID telemetry rainfall stations in the Master Plan stage. However, the evaporation data at two (2) meteorological stations are judged to be practically useful for the moment, since temperature does not vary widely in the basin.

### (4) Data Source, Data Format and Input Method

The data source of the objective hydrological items to be collected is summarized in Table I-14. All hydrological gauging data are currently stored by the existing "Hydrological Data Bank System" (the Data Bank) installed at the DID Hydrology Division of Federal DID in Kuala Lumpur. Moreover, the DID Hydrology Division is now developing the "Hydrological Information System" (HIS) to operate the Data Bank.

Upon the completion of HIS, the hydrological data could be transmitted through on-line system from the Data Bank to the Operational System. The completion schedule of HIS is, however, still indefinite and, therefore, the ASCII data stored in the Data Bank have to be supplied to the Operational System in the form of diskette.

On the information other than mentioned above, the data sources are various publications and study reports. Most of the data are compiled in this report. Input method of those data into the Operational System is manual input by typing and/or digitizing.

(5) Data Renewal Interval

The proposed data renewal interval for the Operational System is shown in Table I-12. The data renewal of the "Hydrological Data Bank System" is conducted monthly at present.

It is desirable that the data renewal in the Operational System would coincide with maintenance work on the Data Bank. However, judging from the actual work volume of manual input through the diskette, the interval in the Operational System is proposed once a year in principle until the online renewal is established.

So far, it is necessary to submit the designated application form to the DID Hydrology Division to access and use any hydrological data in the Data Bank. The necessary application form is shown in Table I-18.

**7.2 Objective Information to be Disseminated**

**7.2.1 Real-time Information**

(1) Objective Information

On the flood forecasting and warning, the Operational System will disseminate the following flood hydrological information, on a real-time base, during floods from October to January:

- (a) Hourly rainfall and stream water level collected from the existing DID telemetry gauging stations;
- (b) Hourly outflow discharge from the Chenderoh Dam informed from TNB; and
- (c) Three (3) levels of warning described in "Inventori Sistem Amaran Banjir (DID, 1997)".

The information, in particular, will be also useful to TNB among the government users. The existing four (4) hydropower dams are used by TNB principally for peak load generation, while in the event of a major flood, the dam reservoir operation is changed to supply the base load generation in order to minimize the dam outflow discharge. Through these reservoir operations, the existing hydropower dams have a substantial flood control effect to the downstream areas.

However, such reservoir operation is not always effectively made due to lack of timely flood information to TNB. The Operational System will retrieve such unfavorable conditions through online dissemination of the real-time flood information to TNB in Kuala Lumpur as well as the Dam Control Center in Perak State.

On the drought control, the Operational System will monitor the river discharge at the Iskandar Bridge and the outflow discharge from the Chenderoh Dam once a day. The monitoring will be made during the dry season from June to August. The real-time information will clarify whether the river flow discharge could be sufficient as compared with the intake volume in the downstream areas.

(2) Data Dissemination to Users

All the real-time hydrological information including dam outflow information in the Operational System will be open in principle through the Internet and/or Intranet to the public users as well as the related government agencies. Dissemination of real-time information through the Internet will facilitate emergency activities against floods by public users, and also to inform the drought condition and coordinate with the drought management. As to drought control, the monitored information will be disseminated to various water users such as PWB, DID and TNB to facilitate drought management.

(3) Display Image

With respect to real-time hydrological information, the user interface of the existing TeleWin32 installed in the FFW Terminal Station of the State DID will be applied in principle to the Operational System for dissemination. The TeleWin32 can display the required real-time hydrological information for FFW in the form of: (1) location map of telemetry gauging stations; (2) rainfall hyetograph; (3) river stage hydrograph; and (4) hourly rainfall and river stage tables, as shown in Fig. I-14.

The interface of TeleWin32 is advisable since unfavorable confusion on the actual FFW activity should be avoided by unifying the interface and information source. The information will be disseminated to users in the form of Internet Homepage so that the user can browse the information easily by using widely spread Web browsers on the market such as Microsoft Internet Explorer and/or Netscape Communicator.

However, for opening the information to the Internet, the new TeleWin Transfer software and the Telewin Internet Server Software are required to be developed.

### 7.2.2 Non Real-time Information

#### (1) Objective Information

The Operational System will furnish the following hydrological and meteorological features (for details, refer to Table I-12) of the Perak river basin:

- (a) Inventory and location map of hydrological and meteorological gauging stations;
- (b) Hourly, daily and monthly hydrological data (rainfall, river stage/discharge and suspended sediment);
- (c) Annual minimum and maximum hydrological data (rainfall, river stage/discharge and suspended sediment);
- (d) Discharge and sediment rating tables at river stage stations;
- (e) Monthly average of air temperature, relative humidity, sunshine hours, rainfall and evaporation;
- (f) Isohyetal maps of annual average rainfall, typical monsoon seasons rainfall and monthly average rainfall; and
- (g) Tidal levels at Bagan Datoh.

The above hydrological data in the Operational System will be useful as basic data for the hydrological and hydraulic calculation/simulation models. The essential information on river management works such as probable flood run-off discharge and channel flow capacity can be estimated through such models.

#### (2) Data Dissemination to Users

All non real-time hydrological information in the Operational System will be open in principle to public users as well as the related government agencies. The information will be disseminated to the users through various media such as the Intranet and/or Internet, CD-ROM, diskette and printed paper. However, some of the information analyzed by using the raw hydrological data, for instance, probable flood inundation

area (PFIA), will not be open to the public to avoid confusion and unfavorable land speculation.

As a reference to the user charge which will be set up, the current prices of hydrological data of DID are tabulated below.

	For 3 months and below	3 months to 1 year or any part thereof	For any additional year up to 10 years or any part thereof	For any additional year in excess of 10 years or any part thereof
1. Rainfall Data	RM 50	RM 100	RM 50 per year or part thereof	RM 25 per year or part thereof
2. Water Level Data	RM 155	RM 310	RM 155	RM 72.5
3. Discharge Data (Stage-Discharge Curve of Derived Maps)	RM 35	RM 70	RM 35	RM 17.5
4. Discharge Data (Discharge Readings)	RM 165	RM 330	RM 165	RM 82.5
5. Evaporation Data	RM 35	RM 70	RM 35	RM 17.5

### (3) Display Image

On the "Hydrological Data Bank System", the hydrological information is retrieved in various forms of table as shown Fig. I-15. These original tables will be adopted in principle to the display image in the Operational System.

Regarding the location and inventory of the objective hydrological stations, the tables and figures compiled in Chapter 7 will be adopted to the Operational System. The processed hydrological data such as rainfall intensity curve, isohyetal maps and monthly rainfall graph will be displayed, and those original images are shown in Fig. I-17.

The monthly meteorological information will be input and displayed on the format prepared in Fig. I-17.

### (4) Operation and Maintenance

The raw hydrological gauging data are presently collected by the State DID and forwarded to the DID Hydrology Division in Kuala Lumpur at monthly intervals for centralized processing. On receipt of the data, they are checked, processed and merged into the "Hydrological Data Bank System". In view of the aforesaid present

data flow, the source of the statistical hydrological data should always be fixed in the Data Bank to maintain the unification of data. Accordingly, a staff of the DID Hydrology Division will be temporarily assigned to the O/M works when data renewal and compilation are required.



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## **TABLE**

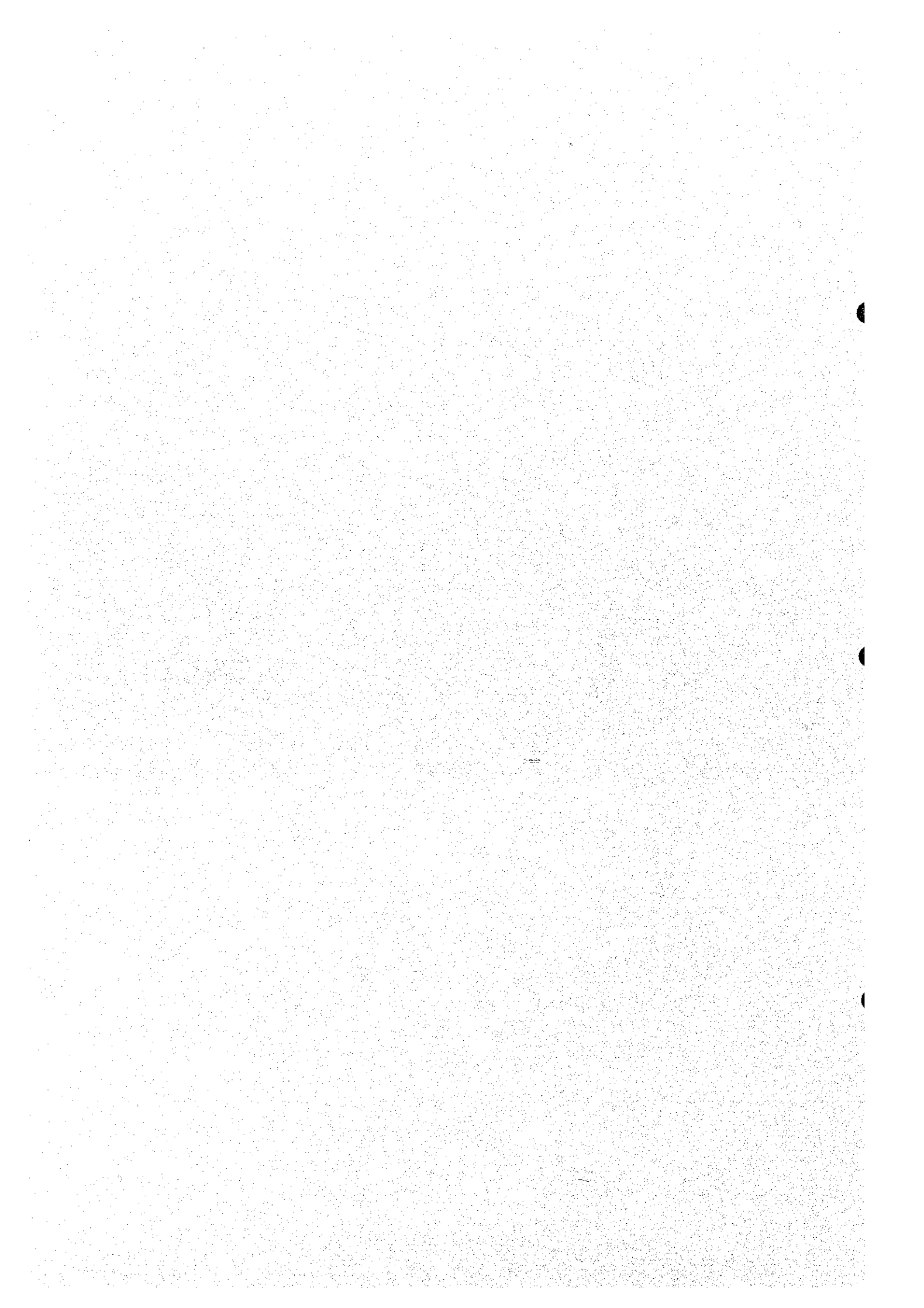


Table I-1 INVENTORY OF DID HYDROLOGICAL STATIONS FOR MAJOR RIVER BASINS

River Basin	Catchment Area (km <sup>2</sup> )	Rainfall Station				River Stage and Discharge Station				Evaporation Station (nos.)	Suspended Sediment Station (nos.)
		Non-recording (nos.)	Recording (nos.)	Total (nos.)	Density (km <sup>2</sup> /stations)	Non-recording (nos.)	Recording (nos.)	Total (nos.)	Density (km <sup>2</sup> /stations)		
<b>Peninsular Malaysia</b>											
<b>(West Coast Area)</b>											
Perlis	790	10	3	13	61	2	3	5	158	1	2
Kedah	3,695	23	4	27	137	0	0	0	0	0	0
Muda	4,210	16	4	20	211	0	3	3	1,403	1	1
Perak	15,180	49	13	62	245	0	12	12	1,265	0	10
Bernam	3,335	18	2	20	167	2	3	5	667	1	3
Klang	1,288	14	9	23	56	0	3	3	429	2	3
Linggi	1,420	14	2	16	89	1	2	3	473	1	1
Melaka	1,010	10	1	11	92	0	2	2	505	0	1
Muar	6,595	37	7	44	150	3	4	7	942	2	3
Subtotal	37,523	191	45	236	159	8	32	40	938	8	24
<b>(East Coast Area)</b>											
Pahang	29,300	69	16	85	345	2	9	11	2,664	2	9
Terengganu	4,650	11	6	17	274	0	2	2	2,325	0	1
Kelantan	13,100	26	10	36	364	0	3	3	4,367	3	3
Subtotal	47,050	106	32	138	341	2	14	16	2,941	5	13
Total	84,573	297	77	374	226	10	46	56	1,510	13	37
<b>Sabah and Sarawak</b>											
Kinabatangan	16,800	0	8	8	2,100	0	3	3	5,600	1	0
Rejang	51,315	12	10	22	2,333	1	2	3	17,105	4	0
Sarawak	3,398	5	1	6	566	2	1	3	1,133	4	0
Total	71,513	17	19	36	1,666	3	6	9	7,946	9	0

Source :

- 1 DID (1991) "Hydrological Data - Rainfall and Evaporation Records for Malaysia, 1986-1990"
- 2 DID (1995) "Hydrological Data - Streamflow and River Suspended Sediment Records, 1986-1990"

Table I-2 INVENTORY OF EXISTING DID FLOOD FORECASTING AND WARNING SYSTEM  
(DID Gauging Stations and Relating Facilities for FFW)

Number	Station Name	River	Gauging Item		Discharge Rating Curve	Location		Year Installed	Radio Frequency (MHz)		Water Level for FFW (EL, m)		Remarks
			Rainfall	River stage		Latitude	Longitude		TX	RX	Alert	Warning Danger	
<b>Telemetry Station</b>													
1	Kg. Lalang	Perak	X	-	-	05 36 15	101 04 50	1974	75.475	71.900	-	-	Stn. No. 5610063
2	Kuala Kenderong	Perak	X	-	-	05 25 00	101 09 15	1974	75.475	71.900	-	-	Stn. No. 5411066
3	K.g. Lintang	Perak	-	X	X	04 56 15	100 06 10	1974	72.125	75.625	53.64	54.25	Stn. No. 4911445
4	Jam. Iskandar	Perak	-	X	X	04 49 10	100 57 55	1974	72.125	75.625	34.8	35.4	Stn. No. 4809443
5	Parit	Perak	-	X	-	-	-	1997	Telephone circuit		19.8	21.3	22.3
6	Telok Sena	Perak	-	X	-	-	-	1997	Telephone circuit		11.0	11.6	12.8
7	Kg. Gajah	Perak	-	X	-	-	-	1997	Telephone circuit		6.4	6.4	7.0
8	Tg. Tuilang	Kinta	X	X	X	04 19 20	101 04 30	1974	72.125	75.625	-	-	Stn. No. 4310401, #
9	Tg. Rambutan	Kinta	X	X	X	04 40 10	101 09 30	1974	72.125	75.625	-	-	Stn. No. 4611463, #
10	Kuala Pari	Kinta	X	X	-	-	-	1974	75.625	72.125	-	-	#
<b>Non-telemetry Station (Flood Monitoring Station)</b>													
1	Boti Kanan	Perak	-	X	-	-	-	1974	-	-	15.5	17.1	18.3
2	Telok Inan	Perak	-	X	-	-	-	1974	-	-	2.4	2.6	2.7

Legend X : available, - : not available

# : Data logger

**FFW FACILITIES**

Number	Name	Nos.
1	Terminal Station	1
2	Repeater Station	2
3	Flood Warning Board	0
4	Flood Warning Siren	4
5	VHF (permanent)	0
6	VHF (mobile)	0
7	Boat (engine)	11
8	Boat/small boat (no engine)	4

Table I-3 (1/3) INVENTORY OF DID RAINFALL STATIONS

Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities
				latitude	longitude	manual	auto	from	to	manual	auto	
4010001	PA	JPS. Telok Intan	VD380445	04 01 00	100 02 10	01/50	01/60			M8	HW, #	JPS
4012143	PA	Ldg. Birkam	VD674480	04 02 55	101 18 00	01/12	03/64			M8	HL, #	JPS
4311001	PA	Pejabat Daerah Kampar	VD515765	04 18 20	101 09 20	07/74	07/74			M8	HW, #	JPS
4409091	PA	Rumah Pam Kubang Haji	VD233937	04 27 40	100 54 05	11/54	04/65			M8	HW, #	JPS
4511111	PA	Pojiteknik Ungku Omar, Ipoh	QY482079	04 35 20	101 07 30	04/72	04/72			M8	OTAW, #	JPS
4611001	PA	Ldg. Kuda Keb. Ulu Kinta	QY530180	04 40 50	101 10 10	07/74	07/74			M8	HW, #	JPS
4708084	PA	Ibu Bekalan Talang, Kuala Kangsar	QY225284	04 46 30	100 53 40	10/59	10/59			M8	HW	JPS
4811075	PA	Ranc. Belia Perlop Sg. Siput	QY538414	04 53 34	101 10 30	08/69	07/74			M8	HL	JPS
5210069	PA	Stn. Pemeriksa Hutan Lawin	QY411863	05 17 55	101 03 30	07/60	08/71			M8	HW, #	JPS
5710061	PA	Dispensari Kroh	QT348315	05 42 30	101 00 00	08/71	08/71			M8	HL	JPS
5411066	PAT	Kuala Kenderong	QY517994	05 25 00	101 09 15	06/72	06/72			M8	HL	JPS
5610063	PAT	Kg. Lalang	QT435200	05 36 15	101 04 50	01/72	08/71			M8	HL	JPS
4111137	SA	Ibu Bekalan Sg. Manik	VD490557	04 07 05	101 08 05	12/85	06/62	02/77	02/77	M8	KW	JPS
4209093	SA	JPS. Telok Sena	VD231712	04 15 20	100 54 00	12/61	06/77	01/73	03/75	M8	OTAW, #	JPS

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

P: Principal station

S: Secondary station

Manual or Automatic Recording

M: Manual

A: Automatic (It is assumed that manual observation are also taken)

Other Details

T: Telemetric

Equipment

Daily Read Manual Raingauges

M5: 5 inch (127 mm) orifice

M8: 8 inch (203 mm) orifice

Type of Automatic Graphical Recorders

HD: Hattori daily

HW: Hattori weekly

HL: Hattori long-term

KW: Kent weekly

OTAW: Ota weekly

#: Data logger

Table I-3 (2/3) INVENTORY OF DID RAINFALL STATIONS

Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities
				latitude	longitude	manual	auto	from	to	manual	auto	
3907103	SM	JPS. Bagan Datoh	VD108408	03 58	100 47	09/32				M8		JPS
3908101	SM	Lpg. New Coconut, Bagan Datoh	VD194363	03 56	100 52	01/26				M8		LDG
3909100	SM	Bt. 5 Ldg. Nova Scotia	VD324385	03 57	100 59	01/13				M8		LDG
3939104	SM	Ldg. Jendarata Telok Intan	VD301330	03 54	100 57	01/07				M8		LDG
3911149	SM	Ldg. Susex	VD482422	03 59	101 07	01/14				M8		LDG
3913146	SM	Ldg. Sg. Klah	VD698385	03 57	101 19	01/13				M8		LDG
4008102	SM	Ldg. Sg. Sungkai	VD673394	03 58	101 18	01/18				M8		LDG
4009096	SM	Ldg. Arcadia	VD119488	04 03	101 15	04/11				M8		JPS
4010097	SM	JPS. Sg. Dedap	VD260510	04 04	100 35	02/64				M8		LDG
4010098	SM	Ldg. Sabrang	VD348437	04 00	101 00	01/14				M5		RS
4010098	SM	Hospital Telok Intan	VD364460	04 01	101 01	1888				M8		JPS
4010138	SM	Peringkat 1 Sg. Manik	VD428492	04 03	101 04	02/35				M8		JPS
4011139	SM	Rumah JPS. Sg. Megkuang	VD493434	04 00	101 08	07/19				M8		JPS
4011144	SM	Rumah Kerajaan JPS. Chui Chak	VD533478	04 02	101 10	11/54				M8		LDG
4012142	SM	Ldg. Bidor Bahru, Bidor	VD600523	04 05	101 17	01/09				M8		JPS
4109094	SM	K.g. Gajah	VD276632	04 11	100 56	01/60				M8		JPS
4109095	SM	K.g. Pulau Besar	VD329584	04 08	100 59	01/60				M8		JPS
4110129	SM	Peringkat IV Sg. Manik	VD370548	04 06	101 01	01/53				M8		JPS
4110136	SM	Rumah JPS. Labu Kubong	VD451576	04 08	101 05	12/63				M8		LDG
4111135	SM	Ldg. Tai Seng	VD506594	04 09	101 08	11/63				M8		JPS
4112141	SM	Ldg. Gedong, Bidor	VD670557	04 07	101 17	04/35				M8		JKR
4209001	SM	Rumah Pam Telok Sarek	VD245712	04 15	100 54	09/36				M8		JKR
4212128	SM	SRK Sri Kinjang Chendriang	VD607721	04 16	100 10	10/25				M5		RS
4212133	SM	Hospital Tapah	VD630648	04 12	101 15	1889				M5		RS

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

- P: Principal
- S: Secondary

Manual or Automatic Recording

- M: Manual
- A: Automatic (It is assumed that manual observation are also taken)

Other Details

- T: Telemetric

Equipment

Daily Read Manual Raingauges

- M5: 5 inch (127 mm) orifice
- M8: 8 inch (203 mm) orifice

Type of Automatic Graphical Recorders

- HD: Hattori daily
- HW: Hattori weekly
- HL: Hattori long-term
- KW: Kent weekly
- OTAW: Ota weekly
- #: Data logger



Table I-3 (3/3) INVENTORY OF DID RAINFALL STATIONS

Station Number	Station Index	Station Name	Grid Reference	Location			Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities
				latitude	longitude	altitude	manual	auto	from	to	manual	auto	
4309092	SM	Rumah Pam Bota	VD234847	04 22 40	100 54 10	3/53					M8	JPS	
4311127	SM	Hospital Kampar	VD515773	04 18 50	101 09 20	1897					M8	RS	
4409090	SM	Ldg. Glenealy	VD265936	04 27 30	100 55 50	11/11					M8	LDG	
4409121	SM	Ldg. Nalla, Tronoh	VD294886	04 24 50	100 57 25	01/26					M8	LDG	
4410120	SM	Hospital Batu Gajah	VD381948	04 28 10	101 02 00	1888					M8	RS	
4410122	SM	Ldg. Hill Rise, Batu Gajah	VD383900	04 25 40	101 02 10	01/27					M8	LDG	
4508087	SM	Ldg. Sadang	QY199006	04 31 20	100 52 15	06/47					M8	LDG	
4509088	SM	Ldg. Parit	QY241010	04 31 35	100 54 30	05/13					M8	LDG	
4510117	SM	Ldg. Pinji	QY423014	04 31 50	101 04 20	10/12					M8	LDG	
4610112	SM	Ldg. Strathisla, Jelapang	QY432179	04 40 50	101 04 50	06/14					M8	LDG	
4610116	SM	Hospital Ipoh	QY442094	04 36 10	101 05 20	1891					M5	RS	
4611115	SM	Taman Bahagia, Tg. Rambutan	QY515173	04 40 30	101 09 15	01/16					M5	RS	
4708082	SM	Ldg. Bukit Berapit	QY150289	04 45 45	100 49 30	01/12					M8	LDG	
4710081	SM	Kolam Air JKR, Sg. Siput	QY420308	04 47 50	101 04 10	01/19					M8	JKR	
4711113	SM	Ldg. Chemor	QY488242	04 44 10	101 07 50	01/26					M8	JKR	
4810079	SM	Ldg. Changkat Salak	QY350373	04 51 20	101 00 15	15/47					M8	LDG	
4810080	SM	Ldg. Kemuning, Sg. Siput	QY411343	04 49 40	101 03 45	02/10					M8	LDG	
4811078	SM	Ldg. Elphill	QY460409	04 53 20	101 06 00	01/13					M8	LDG	
4909072	SM	Kolam Takungan Air Chendroh	QY321490	04 57 40	100 58 45	01/48					M8	JPS	
4909073	SM	Ldg. Kati, Kuala Kangsar	QY254446	04 55 15	100 55 10	01/26					M8	LDG	
4910077	SM	Ldg. Sg. Krudda, Sg. Siput	QY447434	04 54 40	101 05 30	03/63					M8	LDG	
4911076	SM	Balai Polis Kg. Lintang	QY459464	04 56 15	101 06 10	06/68					M8	POLIS	
5009071	SM	Ldg. Kota Lima	QY315601	05 03 40	100 58 25	01/14					M8	LDG	
5109070	SM	Pekan Lenggong	QY326665	05 07 10	100 59 00	12/62					M8	JPS	

Source: DID (1997). 'Inventory of Hydrological Stations in Malaysia - 25th. Edition'

Type of Station

P: Principal

S: Secondary

Manual or Automatic Recording

M: Manual

A: Automatic (It is assumed that manual observation are also taken)

Other Details

T: Telemetric

Equipment

Daily Read Manual Raingauges

M5: 5 inch (127 mm) orifice

M8: 8 inch (203 mm) orifice

Type of Automatic Graphical Recorders

HD: Hattori daily

HW: Hattori weekly

HL: Hattori long-term

KW: Kent weekly

OTAW: Ota weekly

#: Data logger

Table I-4 INVENTORY OF DID RIVER STAGE AND DISCHARGE STATIONS

Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities	Catchment Area (km <sup>2</sup> )
				latitude	longitude	manual	auto	from	to	manual	auto		
4310401	PAHDSQ	Sg. Kinta at Weir C. Tg. Tualang	VD423785	04 19 20	101 04 30	09/73	09/73			S	OTFL	JPS	1,700
4809443	PAHDSQT	Sg. Perak at Jam. Iskandar	QY304333	04 49 10	100 57 55	1915	09/67			S	SEFL	JPS	7,770
4911445	PAHDSQT	Sg. Plus at Kg. Lintang	QY458463	04 56 15	101 06 10	1936	12/64	07/65	12/73	S	SEFL	JPS	1,090
3913458	SAHDSQ	Sg. Sungkai at Sungkai	VD688414	03 59 15	101 18 50	1930	11/67			S	OTFL	JPS	289
4012401	SAHDSQ	Sg. Bidor at Malayan Bidor Bhd.	VD615510	04 04 30	101 14 40	02/80	02/80			S	OTFL	JPS	210
4111455	SAHDSQ	Sg. Btg. Padang at Tg. Keramat	VD504576	04 08 05	101 08 50	1930	12/62			S	OTFL	JPS	445
4212467	SAHDSQ	Sg. Cenderiang at Bt. 32 Jalan Tapah	VD586683	04 13 55	101 13 10	1964	05/67	10/91	06/93	S	OTFW, #	JPS	119
4511468	SAHDSQ	Sg. RAIK at Keramat Pulai	QY497018	04 32 00	101 08 20	02/72	02/72			S	OTFL	JPS	192
4610466	SAHDSQ	Sg. Pari at Jln. Siliabin, Ipoh	QY418097	04 36 20	101 04 00	1915	06/64	04/70	11/72	S	OTFW	JPS	245
5610401	SAHDSQ	Sg. Rui at Jam. Jalan Raya	QY419200	05 36 10	101 03 45	02/87	02/87			S	SEFL, #	JPS	352
4311464	SAHDQ	Sg. Kampar at Kg. Lamjut	VD456798	04 20 10	101 06 05	1930	07/69			S	OTFL	JPS	432
4611463	SAHDQ	Sg. Kinta at Tg. Rambutan	QY518166	04 40 10	101 09 30	1930	07/60			S	OTFW, #	JPS	246

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

P: Principal

S: Secondary

Manual or Automatic Recording

A: Automatic

Other Details

H: If stages are taken

D: If discharge observation are taken

S: If suspended sediment observation is taken

Q: Water quality other than suspended sediment is taken

T: Telemetric

Equipment

S: Stick type manual gauge

Type of Automatic Graphical Recorder

OTFW: Ott float-type weekly

OTFL: Ott float-type long-term

SEFL: SEBA float-type long-term

#: Data logger

Table I-5 INVENTORY OF DID RIVER SUSPENDED SEDIMENT STATIONS

Station Number	Station Index	Station Name	Grid Reference	Location		Date Sample Started	No Operation		Operation Authorities	Catchment Area (km <sup>2</sup> )
				latitude	longitude		from	to		
4310501	P	Sg. Kinta at Weir G. Tg. Tualang	VD423785	04 19 20	101 04 30	08/77			JPS	1,700
4809543	P	Sg. Perak at Jam. Iskandar	QY304333	04 49 10	100 57 55	10/77			JPS	7,770
4911545	P	Sg. Plus at Kg. Lintang	QY458463	04 56 15	101 06 10	08/77	01/65	12/73	JPS	1,090
3913558	S	Sg. Sungkai at Sungkai	VD688414	03 59 15	101 18 50	02/79			JPS	289
4012501	S	Sg. Bidor at Malayan Bidor Bhd	VD615510	04 04 30	101 14 40	02/80			JPS	210
4111555	S	Sg. Batang Padang at Tg. Keramat	VD504576	04 03 05	101 08 50	02/79			JPS	445
4212567	S	Sg. Cenderiang at Bt. 32 Jln Tapah	VD586683	04 13 55	101 13 10	10/77			JPS	119
4511568	S	Sg. Rata at Keramat Putai	QY497018	04 32 00	101 08 20	02/79			JPS	192
4610566	S	Sg. Pari at Jln. Silibin Ipoh	QY418097	04 36 20	101 04 00	11/79	04/70	11/72	JPS	245
5610501	S	Sg. Rui at Jam. Jalan Raya	QT419200	05 36 10	101 06 45	01/80			JPS	352

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

P: Principal

S: Secondary

\*Regular suspended sediment measurements are carried out at river stage and discharge stations in conjunction with discharge measurement at least once a month by using US DH48, DH59 or D49 suspended sediment samplers.

Table I-6 INVENTORY OF TNB HYDROLOGICAL GAUGING STATIONS

Station Number	Station Name	Location		Date Equipment Installed		Date Closed		Current Equipment		Operation Authorities
		latitude	longitude	manual	auto	manual	auto	manual	auto	
	<b>Rainfall Station &lt;Daily Measurement&gt;</b>									
	Temengor Dam	05 25	101 19	1978				M		TNB
	Bersia Dam	05 29	101 14	1983				M		TNB
	Kenering Dam	05 13	101 05	1984				M		TNB
	<b>River Flow (River Stage and Discharge) Station &lt;Hourly Measurement&gt;</b>									
6059	Sg. Rui below Highway Bridge	05 27 52	101 10 27	05/91					AUS	TNB
6029	Sg. Piah @ Kuala Chenderoh	05 05 23	101 05 20	05/81					ST	TNB
	<b>River Stage Station &lt;Hourly Measurement&gt;</b>									
6066	Sg. Perak at Kg. Perah	05 27 40	101 09 50	07/86	05/94	09/94		S	AUS	TNB
6067	Sg. Perak at Kg. Bandariang	05 27 00	101 10 40	07/86	07/94	09/95		S	AUS	TNB
6069	Sg. Perak at Kg. Air Kala	05 11 30	101 03 40		05/94				AUS	TNB
6070	Sg. Perak at Kg. Bukit Sapi	05 08 20	101 01 40		05/94				ST	TNB

Equipment

Rainfall

M: Daily read manual gauge

River Flow and River Stage

S: Stick type manual gauge

Type of Automatic Graphical Recorder

AUS: AUS recorder - Depth pressure sensor

ST: Steven recorder - Float

Table I-7 INVENTORY OF MMS METEOROLOGICAL STATIONS

Station Number	Station Name	Location				Height (m, MSL)	Date of Commencement
		latitude	longitude	latitude	longitude		
<b>Principal Meteorological Station</b>							
48623	Lubok Merbau	04	48	100	54	77.2	03/1993
48625	Ipoh Airport	04	35	101	06	39.0	1930
<b>Climatological Station</b>							
43505	Hospital Lenggong	05	06	100	58	61.0	1930
43445	Bukit Larut	04	52	100	48	1037.0	1941
43447	Hospital Kuala Kangsar	04	46	100	56	39.0	1939
43448	MARDI Kuala Kangsar	04	46	100	55	66.0	09/1979
43419	Hospital Ulu Kinta	04	40	101	10	70.1	1930
43418	Bukit Kledang	04	35	101	01	240.0	08/1979
43416	MARDI Parit	04	26	100	54	4.6	07/1969
43417	Hospital Batu Gajah	04	28	101	02	33.5	1930
43353	Pusat Pertanian Titi Gantong	04	22	100	51	-	09/1974
43414	Hospital Kampar	04	18	101	09	37.5	1930
43413	Hospital Tapah	04	12	101	16	35.1	1930
43402	Hospital Teluk Intan	04	02	101	01	3.1	1930
43403	Rusa Sungkai	04	01	101	21	61.0	05/1986
<b>Rainfall Station</b>							
43514	Pos Kemar	05	12	101	23	250.0	02/1974
43507	Pos Poi	05	06	100	13	1524.0	12/1974
43506	Pos Sulleh	05	04	100	17	153.0	12/1974
43456	FELDA Lasah	04	56	101	04	-	03/1974
43437	Pos Legap	04	51	101	17	107.0	09/1972
43436	Pos Landap (Kuah)	04	47	101	16	411.0	10/1972
43411	Chenderiang Intake	04	16	101	14	-	07/1974
43412	Sungai Who Intake	04	13	101	22	-	07/1974
43401	Sabrang Estate	04	01	101	00	-	08/1979
43395	Rubana Estate	03	59	100	58	-	01/1976
43356	Nova Scotia Estate	03	56	100	58	-	01/1970

Source: The Malaysian Meteorological Service Homepage  
 (<http://www.kjc.gov.my/people/agromet/station/43/perak.htm>)

Meteorological Elements Observed

<Principal Meteorological Station>

Daily and Hourly Rainfall  
 Hourly Air Temperature  
 Hourly Relative Humidity  
 Maximum Temperature  
 Minimum Temperature  
 Hourly Wind  
 Sunshine Hour  
 Solar Radiation  
 Evaporation  
 Atmospheric Pressure

<Climatological Station>

Daily Rainfall  
 Air Temperature  
 Relative Humidity  
 Maximum Temperature  
 Minimum Temperature

<Rainfall Station>

Daily Rainfall

Table I-8 (1/2) DATA AVAILABILITY OF DID PRINCIPAL STATIONS

Station Number	Station Name	Year																																					
		30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59								
<b>Rainfall Stations</b>																																							
4010001	JPS. Telok Intan																																						
4012143	Ldg. Bikam																																						
4311001	Pejabat Daerah Kampar																																						
4409091	Rumah Pam Kubang Haji																																						
4511111	Politeknik Ungku Omar, Ipoh																																						
4611001	Ldg. Kuda Keb. Ulu Kinta.																																						
4708084	Ibu Bekalan Talang, Kuala Kangsar																																						
4811075	Ranc. Belia Perlop Sg. Siput																																						
5210069	Stn. Pemereksaan Hutan Lawin																																						
5710061	Dispensari Kroh																																						
5411066	Kuala Kenderong																																						
5610063	Kg. Lalang																																						
<b>River Stage and Discharge Stations</b>																																							
4310401	Sg. Kinta at Weir G, Tg. Tualang																																						
4809443	Sg. Perak at Jam. Iskandar																																						
4911445	Sg. Plus at Kg. Lintang																																						

note: This table was prepared based on the digitized data in "Hydrological Data Bank System"  
 Figures in brackets, e.g.(1915-) denotes commencement of observation

<availability>

@: perfect

#: 6 ~ 11 months

+: 1 ~ 5 months

-: data missing



Table I-9 OBJECTIVE HYDROLOGICAL INFORMATION TO BE DISSEMINATED

Category of Management	Information to be Disseminated
General	<p>1. Hydrological Information</p> <ul style="list-style-type: none"> <li>(1) Inventory of gauging stations</li> <li>(2) Location of gauging stations</li> <li>(3) Rainfall data (hourly, daily and monthly, annual max.)</li> <li>(4) River stage data (hourly, mean daily and monthly, annual max. and min.)</li> <li>(5) River discharge data (rating curve, hourly, mean daily and monthly, annual max. and min.)</li> <li>(6) River suspended sediment (rating curve, mean daily and monthly, annual max. and min.)</li> <li>(7) Processed hydrological information (isohyetal map, typical monthly rainfall pattern, rainfall intensity curve)</li> <li>(8) Tidal level.</li> </ul> <p>2. Meteorological Information</p> <ul style="list-style-type: none"> <li>(1) Inventory and location of meteorological stations</li> <li>(2) Monthly statistical values</li> </ul>
Flood Management	<p>1. Real-time Flood Gauging Information</p> <ul style="list-style-type: none"> <li>(1) Inventory of gauging stations</li> <li>(2) Location of gauging stations</li> <li>(3) Flood hydrological gauging information</li> <li>(4) Dam reservoir gauging information</li> </ul>
Water Supply and Water Resources Management	<p>1. Real-time Low Flow Gauging Information</p> <ul style="list-style-type: none"> <li>(1) Inventory of gauging stations</li> <li>(2) Location of gauging stations</li> <li>(3) Low flow discharge gauging information</li> <li>(4) Dam reservoir gauging information during a drought period</li> </ul>



Table I-10 NUMBER OF EXISTING AND REQUIRED MINIMUM RAINFALL GAUGING STATIONS

River	Reference Point	Catchment Area (km <sup>2</sup> )	Distance from River Mouth (km)	Number of Rainfall Gauging Stations	
				Existing	Minimum Requirement *
Perak	Temengor	3,420	327	0	14
	Chenderoh	6,553	208	8	26
	Iskandar	8,188	184	15	33
	Bagan Datoh	14,743	4	62	59
Pelus	Kg. Lintang	1,090		1	4
Kinta	Weir G. Tg. Tualang	1,700		12	7

Note: \*; The minimum requirement for number of gauging stations is based on the gauging density recommended by WMO (250 km<sup>2</sup>/station).

Table I-11 INVENTORY OF HYDROLOGICAL GAUGING STATIONS FOR MASTER PLAN

Station Classification	Items to be Gauged in Master Plan Stage	Station		No. by DID	Location			Competent Authority	Remarks	
		No.	Name		River System	Latitude	Longitude			
RAINFALL STATION Class 1	Area rainfall by radar	1-1	(Mt. Soh, 1,324 m)	-					Newly proposed radar site	
		2-1	Kg. Lalang	5610063	05 36 15	101 04 50				
		2-2	Kuala Kenderong	5411066	05 25 00	101 09 15				
		2-3	Tg. Tualang (Weir G)	4310401	04 19 20	101 04 30		DID	Existing DID rainfall stations for FFW	
		2-4	Tg. Rambutan	4611463	04 40 10	101 09 30				
		2-5	Kuala Pari	-	*					
METEOROLOGICAL STATION Class 1	General meteorological information	1-1	Ipoh Airport			04 34	101 06		Existing MMS Principal meteorological stations	
		1-2	Lubok Merbau			04 48	100 54			
STREAM GAUGING STATION Class 1	1) River stage by telemetry 2) Discharge 3) Suspended sediment 4) Water quality	1-1	Tg. Tualang (Weir G)	4310401	04 19 20	101 04 30			Existing DID Principal stations as well as river stage stations for FFW	
		1-2	Jam. Iskandar	4809443	04 49 10	100 57 55				
		1-3	Kg. Lintang	4911445	04 56 15	101 06 10				
		1-4	Parit	-	*					Existing DID FFW river stage stations to be upgraded
		1-5	Kg. Gajah	-	*					
Class 2	1) River stage by telemetry 2) Discharge 3) Suspended sediment	2-1	Sungkai	3913458	03 59 15	101 18 50				
		2-2	Malayan Bidor Bhd.	4012401	04 04 30	101 14 40				
		2-3	Tg. Keramat	4111455	04 08 05	101 08 50				
		2-4	Bt. 32 Jalan Tapah	4212467	04 13 55	101 13 10				
		2-5	Keramat Pulau	4511468	04 32 00	101 08 20				
		2-6	Jln. Silibin, Ipoh	4610466	04 36 20	101 04 00				
		2-7	Jam. Jalan Raya	5610401	05 36 10	101 03 45				
Class 3	1) River stage by telemetry 2) Discharge	3-1	Kg. Lamjut	4311464	04 20 10	101 06 05				
		3-2	Tg. Rambutan	4611463	04 40 10	101 09 30		DID	Existing DID river stage stations for FFW	
Class 4	River stage by telemetry	4-1	Telok Sena	-	*					
		4-2	Kuala Pari	-	*					
Class 5	Tidal level by telemetry	5-1	Bagan Datoh			03 59 35	100 47 10		Newly proposed station	
		6-1	Chenderoh Dam			04 57	100 59			
		6-2	Kenering Dam			05 13	101 05			
		6-3	Bersia Dam			05 29	101 14			
Class 6	Dam reservoir hydrological gauging information	6-4	Temengor Dam			05 25	101 19			

\* : According to interview survey, the coordinates of newly installed stations in 1997 are not measured yet by DID.

Table 1-12 HYDROLOGICAL INFORMATION TO BE COLLECTED FOR OPERATIONAL SYSTEM

Agency	Type of Information		Objective Items					Output Image			Data Source									
	Real-time /Non Real-time	Name	No.	Station	No.	Attribute to be collected	Range of Information	Tabulation	Graphic	Data Renewal Intervals	Input Method	Name	Location	Format						
1 DID	Non Real-time	Statistical hydrological information of all the operating DID Principal and Secondary stations	62 Rainfall stations - 12 Principal stations - 50 Secondary stations	Ipoh	1-1-1	Inventories of 62 stations*	Numerical value - max.=9999.0 - min.=0.0 - 1st decimal place	Inventory table	Location map	Annually	Manual input through diskette	Hydrological Data Bank System	DID Hydrology Division	Digitized ASCII data in diskette						
					1-1-2	Hourly values of 14 automatic recording gauges in northeast monsoon period (Oct. - Jan.)		Monthly table												
					1-1-3	Daily, monthly and annual values of 62 stations		Annual table												
					1-1-4	Annual maximum daily values of 14 automatic gauges														
					1-1-5	Rainfall intensity curve at Ipoh*		Printed Graph												
	Real-time	General hydrological information	12 River stage and discharge stations - 3 Principal stations - 9 Secondary stations	Ipoh	1-2-1	Inventories of 12 stations*	Numerical value - max.= 999.00 - min.= -9.00 - 2nd decimal place	Inventory table	Location map	Annually	Manual input through diskette	Hydrological Data Bank System	DID Hydrology Division	Digitized ASCII data in diskette						
					1-2-2	Hourly values of 12 automatic recording gauges in northeast monsoon period (Oct. - Jan.)		Monthly table												
					1-2-3	Daily, monthly and annual mean values of 12 stations		Annual table												
					1-2-4	Annual maximum and minimum values of 12 stations		Rating table												
					1-2-5	Discharge rating curves of 12 stations		Inventory table	Location map											
					1-3-1	Inventories of 10 stations*		Numerical value - max.= 999999.9 - min.= 0.0 - 1st decimal place	Inventory table						Location map	Annually	Manual input through diskette	Hydrological Data Bank System	DID Hydrology Division	Digitized ASCII data in diskette
					1-3-2	Monthly and annual total values of 10 stations			Annual table											
					1-3-3	Annual maximum and minimum values of 10 stations			Rating table											
					1-3-4	Sediment-discharge rating curves of 10 stations														
					Real-time & Non Real-time	General hydrological information		10 Suspended sediment stations - 3 Principal stations - 7 Secondary stations	Ipoh						1-4-1	Isohyetal maps*	Numerical value - max.= 999.0 - min.= 0.0 - 1st decimal place		Contour map	-
1-4-2	Mean monthly rainfalls at sub-regions*		Stick graph																	
1-5-1	Inventories of 10 stations*	Inventory table	Location map**																	
1-5-2	Hourly rainfall and river stage information	Hourly table**	Plots time series**																	
2-1-1	Coordinates of the dam		Location map																	
Real-time & Non Real-time	General meteorological information	2 Principal meteorological stations (Ipoh Airport and Lubok Merbau)	Chenderoh dam	2-1-2	Hourly dam outflow in flooding period and daily outflow in drought period	Numerical value - max.= 999.0 - min.= 0.0	Monthly table		-	Manual typing	Station control devices of Chenderoh dam	Chenderoh dam	Telephone call or Fax							
				3-1-1	Coordinates of 2 stations*															
				3-1-2	Monthly meteorological values (temperature, relative humidity, sunshine, rainfall and evaporation)		Annual table													
				4-1-1	Coordinates of Bagan Datoh* (lowest, highest, mean, etc.)															
Non Real-time	Tidal level information	1 Bagan Datoh (tidal observation in 1984)	Chenderoh dam	4-1-2	Tidal levels*	Numerical value (1st decimal place)	Table	Location map	-	Manual typing	Tide Tables	DID library	Publication							

\*\* : The interface of existing "TeleWin" in FFW Terminal Station, DID Perak will be basically applied.

Table I-13 INVENTORY OF REAL-TIME HYDROLOGICAL GAUGING STATIONS FOR OPERATIONAL SYSTEM  
(DID Gauging Stations and Relating Facilities for FFW)

Number	Station Name	River	Gauging Item		Discharge Rating Curve	Location		Year Installed	Radio Frequency (MHz)		Water Level for FFW (EL, m)		Remarks
			Rainfall	River stage		Latitude	Longitude		TX	RX	Alert	Warning	
<b>Telemetry Station</b>													
1	Kg. Lalang	Perak	X	-	-	05 36 15	101 04 50		75.475	71.900	-	-	Stn. No. 5610063
2	Kuala Kenderong	Perak	X	-	-	05 25 00	101 09 15	1974	75.475	71.900	-	-	Stn. No. 5411066
3	Kg. Limang	Pelus	-	X	X	04 56 15	100 06 10		72.125	75.625	53.64	54.25	Stn. No. 4911445
4	Jam. Iskandar	Perak	-	X	X	04 49 10	100 57 55		72.125	75.625	34.8	35.4	Stn. No. 4809443
5	Parit	Perak	-	X	-				Telephone circuit		19.8	21.3	22.3
6	Telok Sena	Perak	-	X	-						11.0	11.6	12.8
7	Kg. Gajah	Perak	-	X	-						6.4	6.4	7.0
8	Tg. Tualang	Kinta	X	X	X	04 19 20	101 04 30	1997	72.125	75.625	-	-	Stn. No. 4310401, #
9	Tg. Rambutan	Kinta	X	X	X	04 40 10	101 09 30		72.125	75.625	-	-	Stn. No. 4611463, #
10	Kuala Pari	Kinta	X	X	-				75.625	72.125	-	-	#
<b>Non-telemetry Station (Flood Monitoring Station)</b>													
1	Bota Kanan	Perak	-	X	-			1974	-	-	15.5	17.1	18.3
2	Telok Intan	Perak	-	X	-				-	-	2.4	2.6	2.7

Legend X : available, - : not available

# : Data logger

**FFW FACILITIES**

Number	Name	Nos.
1	Terminal Station	1
2	Repeater Station	2
3	Flood Warning Board	0
4	Flood Warning Siren	4
5	VHF (permanent)	0
6	VHF (mobile)	0
7	Boat (engine)	11
8	Boat/small boat (no engine)	4

Table I-14 INVENTORY OF NON REAL-TIME HYDROLOGICAL GAUGING STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Present Gauging Items	Station		No. by DID	River System	Location		Present Competent Authority	Remarks
		No.	Name			Latitude	Longitude		
<b>RAINFALL STATION</b>									
Class 1	Point rainfall (Automatic)	Refer to Table 7-4							
Class 2	Point rainfall (Manual)	Operating DID 12 Principal and 2 Secondary stations							
<b>METEOROLOGICAL STATION</b>									
Class 1	General meteorological information	1-1	Ipoh Airport		Perak	04 34	101 06		Existing DID Principal and Secondary stations
		1-2	Lubok Merbau		Perak	04 48	100 54		Existing MMS Principal meteorological stations
<b>STREAM GAUGING STATION</b>									
Class 1	1) River stage (Automatic)	1-1	Tg. Tualang (Weir G)	4310401	Kinta	04 19 20	101 04 30	DID	Existing DID Principal stations
	2) Discharge	1-2	Jam. Iskandar	4809443	Perak	04 49 10	100 57 55		
	3) Suspended sediment	1-3	Kg. Lintang	4911445	Pelus	04 56 15	101 06 10		
Class 2	1) River stage (Automatic) 2) Discharge 3) Suspended sediment	2-1	Sungkai	3913458	Sungkai	03 59 15	101 18 50	DID	Existing DID Secondary stations
		2-2	Malayan Bidor Bhd.	4012401	Bidor	04 04 30	101 14 40		
		2-3	Tg. Keramat	4111455	Btg. Padang	04 08 05	101 08 50		
		2-4	Bt. 32 Jalan Tapah	4212467	Cenderiang	04 13 55	101 13 10		
		2-5	Keramat Pulai	4511468	Raia	04 32 00	101 08 20		
		2-6	Jln. Silibin, Ipoh	4610466	Pari	04 36 20	101 04 00		
		2-7	Jam. Jalan Raya	5610401	Rui	05 36 10	101 03 45		
Class 3	1) River stage (Automatic) 2) Discharge	3-1	Kg. Lamjut	4311464	Kampar	04 20 10	101 06 05	DID	
		3-2	Tg. Rambutan	4611463	Kinta	04 40 10	101 09 30		
Class 4	Dam outflow information	4-1	Chenderoh Dam	-	Perak	04 57	100 59	TNB	

\* : According to interview survey, the coordinates of newly installed stations in 1997 are not measured yet by DID, and to be measured in 3rd field survey by the Study Team.

Table I-15 (1/3) INVENTORY OF NON REAL-TIME DID RAINFALL STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities
					latitude	longitude	manual	auto	from	to	manual	auto	
Class 1	4010001	PA	JPS. Telok Intan	VD380445	04 01 00	100 02 10	01/50	01/60			M8	HW, #	JPS
	4012143	PA	Ldg. Bikam	VD674480	04 02 55	101 18 00	01/12	03/64			M8	HL, #	JPS
	4311001	PA	Pejabat Daerah Kampar	VD515765	04 18 20	101 09 20	07/74	07/74			M8	HW, #	JPS
	4409091	PA	Rumah Pam Kubang Haji	VD233937	04 27 40	100 54 05	11/54	04/65			M8	HW, #	JPS
	4511111	PA	Politeknik Ungku Omar, Ipoh	QY482079	04 35 20	101 07 30	04/72	04/72			M8	OTAW, #	JPS
	4611001	PA	Ldg. Kuda Keb. Ulu Kinta	QY530180	04 40 50	101 10 10	07/74	07/74			M8	HW, #	JPS
	4708084	PA	Ibu Bekalan Talang, Kuala Kangsar	QY225284	04 46 30	100 53 40	10/59	10/59			M8	HW	JPS
	4811075	PA	Ranc. Belia Perlop Sg. Siput	QY538414	04 53 34	101 10 30	08/69	07/74			M8	HL	JPS
	5210069	PA	Stn. Pemereksaan Hutan Lawin	QY411863	05 17 55	101 03 30	07/60	08/71			M8	HW, #	JPS
	5710061	PA	Dispensari Kroh	QT348315	05 42 30	101 00 00	08/71	08/71			M8	HL	JPS
	5411066	PAT	Kuala Kenderong	QY517994	05 25 00	101 09 15	06/72	06/72			M8	HL	JPS
	5610063	PAT	Kg. Lalang	QT435200	05 36 15	101 04 50	01/72	08/71			M8	HL	JPS
	4111137	SA	Ibu Bekalan Sg. Manik	VD490557	04 07 05	101 08 05	12/35	06/62	02/77	02/77	M8	KW	JPS
	4209093	SA	JPS. Telok Sena	VD231712	04 15 20	100 54 00	12/61	06/77	01/73	03/75	M8	OTAW, #	JPS

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

P: Principal station

S: Secondary station

Manual or Automatic Recording

M: Manual

A: Automatic (It is assumed that manual observation are also taken)

Other Details

T: Telemetric

Equipment

Daily Read Manual Raingauges

M5: 5 inch (127 mm) orifice

M8: 8 inch (203 mm) orifice

Type of Automatic Graphical Recorders

HD: Hattori daily

HW: Hattori weekly

HL: Hattori long-term

KW: Kent weekly

OTAW: Ota weekly

#: Data logger

Table I-15 (2/3) INVENTORY OF NON REAL-TIME DID RAINFALL STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities
					latitude	longitude	manual	auto	from	to	manual	auto	
	3907103	SM	JPS, Bagan Datoh	VD108408	03 58	100 47	30	09/32			M8		JPS
	3908101	SM	Lpg. New Coconut, Bagan Datoh	VD194363	03 56	100 52	05	01/26			M8		LDG
	3909100	SM	Bt. 5 Ldg. Nova Scotia	VD324385	03 57	100 59	10	01/13			M8		LDG
	3939104	SM	Ldg. Jendarata Telok Intan	VD301330	03 54	100 57	50	01/07			M8		LDG
	3911149	SM	Ldg. Susex	VD482422	03 59	101 07	40	01/14			M8		LDG
	3913146	SM	Ldg. Sg. Kiah	VD698385	03 57	101 19	20	01/13			M8		LDG
	3913147	SM	Ldg. Sg. Sungkai	VD673394	03 58	101 18	00	01/18			M8		LDG
	4008102	SM	Ldg. Arcadia	VD119488	04 03	100 48	00	04/11			M8		LDG
	4009096	SM	JPS, Sg. Dedap	VD260510	04 04	100 55	40	02/64			M8		JPS
	4010097	SM	Ldg. Sabrang	VD348437	04 00	101 00	25	01/14			M8		LDG
	4010098	SM	Hospital Telok Intan	VD364460	04 01	101 01	15	1888			M5		RS
	4010138	SM	Peringkat I Sg. Manik	VD428492	04 03	101 04	40	02/35			M8		JPS
	4011139	SM	Rumah JPS, Sg. Megkuang	VD493434	04 00	101 08	10	07/19			M8		JPS
	4011144	SM	Rumah Kerajaan JPS, Chui Chak	VD533478	04 02	101 10	20	11/54			M8		JPS
	4012142	SM	Ldg. Bidor Bahru, Bidor	VD600523	04 05	101 17	10	01/09			M8		LDG
	4109094	SM	Kg. Gajah	VD276632	04 11	100 56	30	01/60			M8		JPS
	4109095	SM	Kg. Pulau Besar	VD329584	04 08	100 59	20	01/60			M8		JPS
	4110129	SM	Peringkat IV Sg. Manik	VD370548	04 06	101 01	35	01/53			M8		JPS
	4110136	SM	Rumah JPS, Labu Kubong	VD451576	04 08	101 05	05	12/63			M8		JPS
	4111135	SM	Ldg. Tai Seng	VD506594	04 09	101 08	55	11/63			M8		LDG
	4112141	SM	Ldg. Gedong, Bidor	VD670557	04 07	101 17	45	04/35			M8		JPS
	4209001	SM	Rumah Pam Telok Sarek	VD245712	04 15	100 54	45	09/36			M8		JKR
	4212128	SM	SRK Sri Kinjang Chendriang	VD607721	04 16	101 14	20	10/25			M5		JKR
	4212133	SM	Hospital Tapah	VD630648	04 12	101 15	35	1889			M5		RS

Class 2

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

- P: Principal
- S: Secondary

Manual or Automatic Recording

- M: Manual
- A: Automatic (It is assumed that manual observation are also taken)

Other Details

- T: Telemetric

Equipment

- Daily Read Manual Raingauges
- M5: 5 inch (127 mm) orifice
- M8: 8 inch (203 mm) orifice
- Type of Automatic Graphical Recorders
- HD: Hattori daily
- HW: Hattori weekly
- HL: Hattori long-term
- KW: Kent weekly
- OTAW: Ota weekly
- #: Data logger

Table I-15 (3/3) INVENTORY OF NON REAL-TIME DID RAINFALL STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities
					latitude	longitude	manual	auto	from	to	manual	auto	
Class 2	4309092	SM	Rumah Pam Bota	VD234847	04 22 40	100 54 10	3/53				M8		JPS
	4311127	SM	Hospital Kampar	VD515773	04 18 50	101 09 20	1897				M8		RS
	4409090	SM	Ldg. Glenealy	VD265936	04 27 30	100 55 50	11/11				M8		LDG
	4409121	SM	Ldg. Nalla, Tronoh	VD294886	04 24 50	100 57 25	01/26				M8		LDG
	4410120	SM	Hospital Batu Gajah	VD381948	04 28 10	101 02 00	1888				M8		RS
	4410122	SM	Ldg. Hill Rise, Batu Gajah	VD383900	04 25 40	101 02 10	01/27				M8		LDG
	4508087	SM	Ldg. Sadang	QY199006	04 31 20	100 52 15	06/47				M8		LDG
	4509088	SM	Ldg. Parit	QY241010	04 31 35	100 54 30	05/13				M8		LDG
	4510117	SM	Ldg. Pini	QY423014	04 31 50	101 04 20	10/12				M8		LDG
	4610112	SM	Ldg. Strathisla, Jelapang	QY432179	04 40 50	101 04 50	06/14				M5		RS
	4610116	SM	Hospital Ipoh	QY442094	04 36 10	101 05 20	1891				M5		RS
	4611115	SM	Taman Bahagia, Tg. Rambutan	QY515173	04 40 30	101 09 15	01/16				M8		LDG
	4708082	SM	Ldg. Bukit Berapi	QY150289	04 45 45	100 49 30	01/12				M8		LDG
	4710081	SM	Kolam Air JKR, Sg. Siput	QY420308	04 47 50	101 04 10	01/19				M8		JKR
	4711113	SM	Ldg. Chemor	QY488242	04 44 10	101 07 50	01/26				M8		JKR
	4810079	SM	Ldg. Changkat Salak	QY350373	04 51 20	101 00 15	15/47				M8		LDG
	4810080	SM	Ldg. Kemuning, Sg. Siput	QY411343	04 49 40	101 03 45	02/10				M8		LDG
	4811078	SM	Ldg. Elphill	QY460409	04 53 20	101 06 00	01/13				M8		LDG
	4909072	SM	Kolam Takungan Air Chendroh	QY321490	04 57 40	100 58 45	01/48				M8		JPS
	4909073	SM	Ldg. Kati, Kuala Kangsar	QY254446	04 55 15	100 55 10	01/26				M8		LDG
4910077	SM	Ldg. Sg. Krudda, Sg. Siput	QY447434	04 54 40	101 05 30	03/63				M8		LDG	
4911076	SM	Balai Polis Kg. Limang	QY459464	04 56 15	101 06 10	06/68				M8		POLIS	
5009071	SM	Ldg. Kota Lima	QY315601	05 03 40	100 58 25	01/14				M8		LDG	
5109070	SM	Pekan Lenggong	QY326665	05 07 10	100 59 00	12/62				M8		JPS	

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Equipment  
 Daily Read Manual Raingauges  
 M5: 5 inch (127 mm) orifice  
 M8: 8 inch (203 mm) orifice  
 Type of Automatic Graphical Recorders  
 HD: Hattori daily  
 HW: Hattori weekly  
 HL: Hattori long-term  
 KW: Kent weekly  
 OTAW: Ota weekly  
 #: Data logger

Type of Station  
 P: Principal  
 S: Secondary  
 Manual or Automatic Recording  
 M: Manual  
 A: Automatic (It is assumed that manual observation are also taken)  
 Other Details  
 T: Telemetric



Table I-16 INVENTORY OF NON REAL-TIME DID RIVER STAGE AND DISCHARGE STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities	Catchment Area (km <sup>2</sup> )
					latitude	longitude	manual	auto	from	to	manual	auto		
Class 1	4310401	PAHDSQ	Sg. Kinta at Weir G. Tg. Tualang	VD423785	04 19 20	101 04 30	09/73	09/73			S	OTFL	JPS	1,700
	4809443	PAHDSQT	Sg. Perak at Jam. Iskandar	QY304333	04 49 10	100 57 55	09/67	09/67			S	SEFL	JPS	7,770
	4911445	PAHDSQT	Sg. Pius at Kg. Limang	QY458463	04 56 15	101 06 10	1936	12/64	07/65	12/73	S	SEFL	JPS	1,090
Class 2	3913458	SAHDSQ	Sg. Sungkai at Sungkai	VD688414	03 59 15	101 18 50	1930	11/67			S	OTFL	JPS	289
	4012401	SAHDSQ	Sg. Bidor at Malayan Bidor Bhd	VD615510	04 04 30	101 14 40	02/80	02/80			S	OTFW	JPS	210
	4111455	SAHDSQ	Sg. Big. Padang at Tg. Keramat	VD504576	04 08 05	101 08 50	1930	12/62			S	OTFL	JPS	445
	4212467	SAHDSQ	Sg. Cenderiang at Bt. 32 Jalan Tapah	VD586683	04 13 55	101 13 10	1964	05/67	10/91	06/93	S	OTFW, #	JPS	119
	4511468	SAHDSQ	Sg. RAJA at Keramat Pulai	QY497018	04 32 00	101 08 20	02/72	02/72			S	OTFL	JPS	192
	4610466	SAHDSQ	Sg. Pari at Jln. Siliabin, Ipoh	QY418097	04 36 20	101 04 00	1915	06/64	04/70	11/72	S	OTFW	JPS	245
Class 3	5610401	SAHDSQ	Sg. Rui at Jam. Jalan Raya	QY419200	05 36 10	101 03 45	02/87	02/87			S	SEFL, #	JPS	352
	4311464	SAHDQ	Sg. Kampar at Kg. Lamjut	VD456798	04 20 10	101 06 05	1930	07/69			S	OTFL	JPS	432
	4611463	SAHDQ	Sg. Kinta at Tg. Rambutan	QY518166	04 40 10	101 09 30	1930	07/60			S	OTFW, #	JPS	246

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

- P: Principal
- S: Secondary

Manual or Automatic Recording

- A: Automatic

Other Details

- H: If stages are taken
- D: If discharge observation are taken
- S: If suspended sediment observation is taken
- Q: Water quality other than suspended sediment is taken
- T: Telemetric

Equipment

- S: Stick type manual gauge
- Type of Automatic Graphical Recorder
  - OTFW: Ott float-type weekly
  - OTFL: Ott float-type long-term
  - SEFL: SEBA float-type long-term
- #: Data logger

Table I-17 INVENTORY OF NON REAL-TIME DID SUSPENDED SEDIMENT STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Station Number	Station Index	Station Name	Grid Reference	Location		Date Sample Started	No Operation		Operation Authorities	Catchment Area (km <sup>2</sup> )
					latitude	longitude		from	to		
Class 1	4310501	P	Sg. Kinta at Weir G. Tg. Tuaiang	VD423785	04 19 20	101 04 30	08/77		JPS	1,700	
	4809543	P	Sg. Perak at Jam. Iskandar	QY304333	04 49 10	100 57 55	10/77		JPS	7,770	
	4911545	P	Sg. Plus at Kg. Limang	QY458463	04 56 15	101 06 10	08/77	01/65	12/73	JPS	1,090
Class 2	3913558	S	Sg. Sungkai at Sungkai	VD688414	03 59 15	101 18 50	02/79		JPS	289	
	4012501	S	Sg. Bidor at Malayan Bidor Bhd	VD615510	04 04 30	101 14 40	02/80		JPS	210	
	4111555	S	Sg. Batang Padang at Tg. Keramat	VD504576	04 03 05	101 08 50	02/79		JPS	445	
	4212567	S	Sg. Cenderiang at Bt. 32 Jin Tapah	VD586683	04 13 55	101 13 10	10/77		JPS	119	
	4511568	S	Sg. Raia at Keramat Pulau	QY497018	04 32 00	101 08 20	02/79		JPS	192	
	4610566	S	Sg. Pari at Jin. Silibin Jpoh	QY418097	04 36 20	101 04 00	11/79	04/70	11/72	JPS	245
	5610501	S	Sg. Rui at Jam. Jalan Raya	QT419200	05 36 10	101 06 45	01/80		JPS	352	

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

P: Principal  
S: Secondary

\*Regular suspended sediment measurements are carried out at river stage and discharge stations in conjunction with discharge measurement at least once a month by using US DH48, DH59 or D49 suspended sediment samplers.

Table I-18 (1/4) APPLICATION FORM FOR HYDROLOGICAL DATA RENEWAL

Details of Data Required (1/4)

RAINFALL DATA (1)

Type and units of data required	Station Number	Station Name	Check			Period of data required		Proposed use of data
			1			from	to	
1 Hourly rainfall (mm) from October to January (4 months)	4010001	JPS. Telok Intan						Data Renewal for the River Basin Information System
	4012143	Ldg. Bikam						
	4311001	Pejabat Daerah Kampar						
	4409091	Rumah Pam Kubang Haji						
	4511111	Politeknik Ungku Omar, Ipoh						
	4611001	Ldg. Kuda Keb. Ulu Kinta						
	4708084	Ibu Bekalan Talang, Kuala Kangsar						
	4811075	Ranc. Belia Perlop Sg. Siput						
	5210069	Stn. Pemereksaan Hutan Lawin						
	5710061	Dispensari Kroh						
	5411066	Kuala Kenderong						
	5610063	Kg. Lalang						
	4111137	Ibu Bekalan Sg. Manik						
4209093	JPS. Telok Sena							

Type and units of data required	Station Number	Station Name	Check			Period of data required		Proposed use of data
			1	2	3	from	to	
<Manual and/or Automatic gauges> 1 Daily rainfall (mm) 2 Monthly total rainfall (mm) 3 Annual maximum daily rainfall (mm)	4010001	JPS. Telok Intan						Data Renewal for the River Basin Information System
	4012143	Ldg. Bikam						
	4311001	Pejabat Daerah Kampar						
	4409091	Rumah Pam Kubang Haji						
	4511111	Politeknik Ungku Omar, Ipoh						
	4611001	Ldg. Kuda Keb. Ulu Kinta						
	4708084	Ibu Bekalan Talang, Kuala Kangsar						
	4811075	Ranc. Belia Perlop Sg. Siput						
	5210069	Stn. Pemereksaan Hutan Lawin						
	5710061	Dispensari Kroh						
	5411066	Kuala Kenderong						
	5610063	Kg. Lalang						
	4111137	Ibu Bekalan Sg. Manik						
4209093	JPS. Telok Sena							

Table I-18 (2/4) APPLICATION FORM FOR HYDROLOGICAL DATA RENEWAL

Details of Data Required (2/4)

RAINFALL DATA (2)

Type and units of data required	Station No.	Station Name	Check			Period of data required		Proposed use of data
			1	2		from	to	
1 Daily rainfall (mm)	3907103	JPS. Bagan Datoh						Data Renewal for the River Basin Information System
	3908101	Lpg. New Coconut, Bagan Datoh						
2 Monthly total rainfall (mm)	3909100	Bt. 5 Ldg. Nova Scotia						
	3939104	Ldg. Jendarata Telok Intan						
	3911149	Ldg. Sussex						
	3913146	Ldg. Sg. Klah						
	3913147	Ldg. Sg. Sungkai						
	4008102	Ldg. Arcadia						
	4009096	JPS. Sg. Dedap						
	4010097	Ldg. Sabrang						
	4010098	Hospital Telok Intan						
	4010138	Peringkat 1 Sg. Manik						
	4011139	Rumah JPS. Sg. Megkuang						
	4011144	Rumah Kerajaan JPS. Chui Chak						
	4012142	Ldg. Bidor Bahru, Bidor						
	4109094	Kg. Gajah						
	4109095	Kg. Pulau Besar						
	4110129	Peringkat IV Sg. Manik						
	4110136	Rumah JPS. Labu Kubong						
	4111135	Ldg. Tai Seng						
	4112141	Ldg. Gedong, Bidor						
	4209001	Rumah Pam Telok Sarek						
	4212128	SRK Sri Kinjang Chendriang						
	4212133	Hospital Tapah						
	4309092	Rumah Pam Bota						
	4311127	Hospital Kampar						
	4409090	Ldg. Glenealy						
	4409121	Ldg. Nalla, Tronoh						
	4410120	Hospital Batu Gajah						
	4410122	Ldg. Hill Rise, Batu Gajah						
	4508087	Ldg. Sadang						
	4509088	Ldg. Parit						
	4510117	Ldg. Pinji						
	4610112	Ldg. Strathisla, Jelapang						
	4610116	Hospital Ipoh						
	4611115	Taman Bahagia, Tg. Rambutan						
	4708082	Ldg. Bukit Berapit						
	4710081	Kolam Air JKR, Sg. Siput						
	4711113	Ldg. Chemor						
	4810079	Ldg. Changkat Salak						
	4810080	Ldg. Kemuning, Sg. Siput						
	4811078	Ldg. Elphill						
	4909072	Kolam Takongan Air Chendroh						
	4909073	Ldg. Kati, Kuala Kangsar						
	4910077	Ldg. Sg. Krudda, Sg. Siput						
	4911076	Balai Polis Kg. Lintang						
	5009071	Ldg. Kota Lima						
	5109070	Pekan Lenggong						

Table I-18 (3/4) APPLICATION FORM FOR HYDROLOGICAL DATA RENEWAL

Details of Data Required (3/4)

RIVER STAGE AND DISCAHRGE DATA

Type and units of data required	Station Number	Station Name	Check				Period of data required		Proposed use of data
			1	2			from	to	
1 Hourly river stage (m) from October to January (4 months) 2 Hourly discharge (m <sup>3</sup> /s) from October to January (4 months)	4310401	Sg. Kinta at Weir G. Tg. Tualang							
	4809443	Sg. Perak at Jam. Iskandar							
	4911445	Sg. Plus at Kg. Lintang							
	3913458	Sg. Sungkai at Sungkai							
	4012401	Sg. Bidor at Malayan Bidor Bhd.							
	4111455	Sg. Btg. Padang at Tg. Keramat							
	4212467	Sg. Cenderiang at Bt. 32 Jalan Tapah							
	4511468	Sg. RAIA at Keramat Pulau							
	4610466	Sg. Pari at Jln. Silibin, Ipoh							
	5610401	Sg. Rui at Jam. Jalan Raya							
4311464	Sg. Kampar at Kg. Lamjut								
4611463	Sg. Kinta at Tg. Rambutan								

Type and units of data required	Station Number	Station Name	Check			Period of data required		Proposed use of data
			1	2	3	from	to	
1 Daily mean river stage (m) 2 Monthly mean river stage (m) 3 Annual maximum and minimum river stage (m)	4310401	Sg. Kinta at Weir G. Tg. Tualang						Data Renewal for the River Basin Information System
	4809443	Sg. Perak at Jam. Iskandar						
	4911445	Sg. Plus at Kg. Lintang						
	3913458	Sg. Sungkai at Sungkai						
	4012401	Sg. Bidor at Malayan Bidor Bhd.						
	4111455	Sg. Btg. Padang at Tg. Keramat						
	4212467	Sg. Cenderiang at Bt. 32 Jalan Tapah						
	4511468	Sg. RAIA at Keramat Pulau						
	4610466	Sg. Pari at Jln. Silibin, Ipoh						
	5610401	Sg. Rui at Jam. Jalan Raya						
4311464	Sg. Kampar at Kg. Lamjut							
4611463	Sg. Kinta at Tg. Rambutan							

Type and units of data required	Station Number	Station Name	Check				Period of data required		Proposed use of data
			1	2	3	4	from	to	
1 Daily mean discharge (m <sup>3</sup> /s) 2 Monthly mean discharge (m <sup>3</sup> /s) 3 Annual maximum and minimum discharge (m <sup>3</sup> /s) 4 Dischrge rating curve of each station	4310401	Sg. Kinta at Weir G. Tg. Tualang						Data Renewal for the River Basin Information System	
	4809443	Sg. Perak at Jam. Iskandar							
	4911445	Sg. Plus at Kg. Lintang							
	3913458	Sg. Sungkai at Sungkai							
	4012401	Sg. Bidor at Malayan Bidor Bhd.							
	4111455	Sg. Btg. Padang at Tg. Keramat							
	4212467	Sg. Cenderiang at Bt. 32 Jalan Tapah							
	4511468	Sg. RAIA at Keramat Pulau							
	4610466	Sg. Pari at Jln. Silibin, Ipoh							
	5610401	Sg. Rui at Jam. Jalan Raya							
4311464	Sg. Kampar at Kg. Lamjut								
4611463	Sg. Kinta at Tg. Rambutan								

Table I-18 (4/4) APPLICATION FORM FOR HYDROLOGICAL DATA RENEWAL

Details of Data Required (4/4)

SUSPENDED SEDIMENT DISCHARGE DATA

Type and units of data required	Station Number	Station Name	Check			Period of data required		Proposed use of data
			1	2	3	from	to	
1 Monthly mean sediment discharge (tonnes)	4310501	Sg. Kinta at Weir G. Tg. Tualang						Data Renewal for the River Basin Information System
	4809543	Sg. Perak at Jam. Iskandar						
	4911545	Sg. Plus at Kg. Lintang						
2 Annual maximum and minimum sediment discharge (tonnes)	3913558	Sg. Sungkai at Sungkai						
	4012501	Sg. Bidor at Malayan Bidor Bhd						
	4111555	Sg. Batang Padang at Tg. Keramat						
3 Sediment-discharge rating curve	4212567	Sg. Cenderiang at Bt. 32 Jln Tapah						
	4511568	Sg. Raia at Keramat Pulau						
	4610566	Sg. Pari at Jln. Silibin Ipoh						
	5610501	Sg. Rui at Jam. Jalan Raya						