VOLUME 4 - SECTOR V

RIVER CHANNEL IMPROVEMENT PLAN

THE STUDY ON INTEGRATED URBAN DRAINAGE IMPROVEMENT FOR MELAKA AND SUNGAI PETANI IN MALAYSIA

FINAL REPORT

VOLUME 4: SUPPORTING REPORT ON FEASIBILITY STUDY

SECTOR V: RIVER CHANNEL IMPROVEMENT PLAN

TABLE OF CONTENTS

LIST OF FIGURES

SECTOR V

RIVER CHANNEL IMPROVEMENT PLAN

1. GENERAL

The Study classifies the watercourse into the river channel and the drainage channel based on the size of catchment area. That is, the watercourse with its catchment area of more than 4km^2 is defined as the river channel, while that with less than 4km^2 is the trunk drain. According to this classification, the followings are enumerated as the interior river channel located within the four (4) priority areas and the exterior downstream river connected to the areas.

Name of the Objective Drainage Basin	Interior River within Drainage Basin		Exterior River Connected to Drainage Basin	
	Name	Flow Capacity (return period)	Name	Flow Capacity (return period)
(1) Sg. Air Mendidih in Sg. Petani	-		Sg. Petani	Less than 2-year
(2) Line G in Sg. Petani	-		Sg. Petani	Less than 2-year
(3) Pokok Mangga in Melaka	-		-	
(4) Sg. Ayer Salak in Melaka	Sg. Air Salak	25-year	Sg. Malim	50-year

As listed above, Sg. Ayer Salak is an interior river channel located within the objective drainage areas and serves as a principal channel to drain the stormwater in its catchment of 17.2km^2. Sg. Petani is also enumerated as an exterior downstream river channel connected to the two (2) drainage areas of both of Sg. Air Mendidih and Line G. Sg. Malim is another exterior river for the drainage area of Sg. Ayer Salak likewise. Only Pokok Mangga drains directly into Strait of Melaka. Thus, the urban drainage improvement for three (3) drainage areas other than Pokok Mangga are greatly influential to the interior and exterior river channel flow. Hence, the necessary channel improvement works for these interior and exterior rivers are clarified.

2. PROPOSED CHANNEL IMPROVEMENT WORKS

2.1 Channel Improvement Plan for Downstream River from Drainage Basin

As described above, Sg. Petani and Sg. Malim are enumerated as the exterior rivers located downstream from the objective drainage basins. Among the rivers, Sg. Malim has increased its channel flow capacity through the Melaka Floodway Project completed in early of 1990s, and currently accommodates the probable peak food of 50-year return period. This river channel capacity is roomier than the target design of 5-year return period for drainage improvement plan, and the drainage improvement in the upstream drainage basins will influence practically nothing to the downstream river, Sg. Malim. Accordingly, the channel

improvement for Sg. Malim is not required as far as the drainage improvement for in the upstream drainage basin is concerned.

In contrast with Sg. Malim, Sg. Petani is left behind without any major river channel improvement, and its entire stretch has an extremely small channel flow capacity that could not cope with the probable flood runoff discharge of even 2-year return period. Accordingly, the drainage improvement with the target design discharge for two (2) drainage basins of Sg. Air Mendidih and Line G will seriously influence the overflow of Sg. Petani. From this view point, the necessary river channel improvement for Sg. Petani are proposed as below:

(1) Design Discharge for Channel Improvement of Sg. Petani

The design discharge of Sg. Petani was estimated, as shown in Fig. V-1 on the premises of the following four (4) planning concepts:

(a) Design Flood Level of 100-year Return Period

The river channel improvement adopts its design flood discharge higher than that for the urban drainage improvement. This is attributed to that the river overflow causes far more extensive and disastrous flood damage than that by stagnant of storm rainfall. According to the interview survey to DID, all of the future river channel improvement for regional centers in Malaysia will apply the design flood level of 100-year return period, unless particular difficulties arise. In line with this development policy in Malaysia, the design flood level for Sg. Petani was set as 100-year return period flood.

(b) Basin-wide Extent of Flood Runoff Discharge

Sg. Petani river basin covers 37 drainage basins in its catchment area of 20.3km^2. Flood runoff discharges from all of the drainage basins are influential to the river channel improvement. Moreover, the flood runoff discharge is subject to regulation effect by the flood detention ponds in the drainage basins. The optimum drainage plan for Sg. Petani was proposed in the Drainage Structure Plan including the flood detention ponds (refer to Sectors IV and VI of Vol. 3):

Description	Total catchment Area	Total Storage Volume
Existing Pond	376ha	536,000 m^3
Newly Constructed Pond	1,330ha	1,700,000 m^3
Total	1,706ha	2,236,000 m^3

The design discharge for Sg. Petani is determined on the basis of the flood runoff discharge from all of the drainage basins with incorporating effected by the flood detention in the basin.

(d) Flood Runoff Discharge Effected by Change of Land Use in 2020

The design flood discharge is decided in due consideration of the future flood runoff conditions influenced by change of basin land use in the year of 2020. That is, as the urban area expands in the basin, the peak flood discharge tends to gradually increase. On the other hand, it is virtually difficult to upgrade the river channel improvement work incessantly according to the gradual increment of peak discharge. Instead, the river channel improvement needs to be made in line with a certain long-term prospects for change of flood runoff condition effected by the future land use.

(2) Proposed Alignment, Longitudinal Profile and Cross-sections for Channel Improvement of Sg. Petani

In parallel with the drainage improvement for the priority drainage basins of Air Mendidih and Line G, It is ideal that the channel improvement for Sg. Petani is carried out so as to realize the well-balanced flood mitigation against both of the river channel over flow and the internal flood inundation by storm rainfall. From this viewpoint, the channel improvement plan was prepared starting about 4,000m upstream from the river mouth until the confluence point of Line G located about 7,200m upstream from the river mouth. The downstream of the channel improvement section is in the natural mangrove area. This mangrove area is preserved even in the future functioning as the natural flood retarding area, and therefore, any protection work against river overflow is not required for this mangrove area. Described below are the proposed alignment, longitudinal profile and cross-section for the channel improvement.

(a) Alignment

The existing river channel of Sg. Petani is meandering particularly along a section between the confluence with Air Mendidih (5,800m upstream from the river mouth) and the confluence with Line G (7,200m upstream from the river mouth). The meandering tends to rise the flood water level, and it is re-aligned to be strait channel. The proposed alignment is as shown in Fig. V-2.

(b) Longitudinal Profile and Cross-section

The longitudinal profile and the typical cross-sections for the proposed channel are set as shown Fig. V-3 and V-4, respectively taking the following items into account..

(i) The objective improvement section runs along the pre-built up area, and therefore, difficulties arise in widening the river channel. Under the conditions, the width of the channel was set to be almost same as the present channel width, and the single section shape was adopted to maximize the channel flow area and minimize the design high water level.

(ii) The existing channel bed is rather stable not causing any extreme channel erosion nor sedimentation. From this viewpoint, the existing average channel slope of 1 to 1500 was adopted as the proposed channel slope in order to keep the existing stable channel bed.

(iii) The design high water level was determined through non-uniform calculation with assuming the Manning's Roughness Coefficient of 0.035 and the Mean Spring Tide of 1.28m above LSD at Tanjung Dawai as the boundary water level at the downstream end of the channel. The river bank level was set as the freeboard height of 80cm above the design high water level.

(c) Work Volume

The work volume for the above proposed river channel improvement was preliminarily estimated as listed below:

Work Item	Unit	Quantity	Unit Price (RM)	Amount (RM)
1. Earth Work	m^3			
(1) Common Excavation	m^3	258,800	3.0	776,400
(2) Foundation Excavation	m^3	64,700	8.0	516,600
2. Embankment	m^3	40,600	21.0	852,600
3. Land Acquisition	m^3			
(1) Residential Land	m^2	55,300	100.0	5,530,000
(2) Vacant Land	m^2	35,900	6.2	222,580
4. Relocation of Bridge* (6m in width x 58n in length)	m^2	348	1,700.0	591,600
Total				8,519,780

*: In addition, one road bridge and one rail bridge are across the improvement section, but their abut levels are higher than the proposed high water level and therefore, its relocation is not required.

2.2 Channel Improvement Plan for Interior River of Drainage Basin

As described above, Sg. Ayer Salak is an interior river in a drainage area and functions as a principal drainage channel. The river channel improvement for Sg. Ayer Salak is now in progress. Upon completion of the improvement works, the river flow capacity could cope with the probable flood discharge of 25-year return period, while the objective drainage improvement plan is formulated on the premises of the target design level of 5-year return period. Thus, Sg. Ayer Salak appears to have a sufficient flow capacity as the drainage channel.

The river flow capacity is, however, subject to the flood runoff condition under present land use states, while the design discharge for drainage improvement plan has to corresponds to the value under the future land use in the year 2020. The present peak discharge will increase in the year 2020 due to the intensive land development. If an alternative drainage improvement plan contributes to less basin flood detention effect, the channel flow capacity of Sg. Ayer Salak may fall short of the future runoff discharge of 5-year return period in the year 2020.

In due consideration of the above conditions, the detailed hydrological simulation was made on the peak channel discharge of Sg. Ayer Salak for each of alternative drainage improvement plan, and the optimum plan was selected incorporating the necessary cost of channel improvement of Sg. Ayer Salak. As the results, it is concluded that the on-going channel improvement section will not require further channel improvement works due to effect of the proposed flood detention facilities (refer to Sector IV of Vol. 4). However, the upstream section which is out of the on-going channel improvement will require the channel improvement to increase tits channel flow capacity and cope with the flood runoff discharge increased by the projected land development by 2020. . The proposed longitudinal profiles, cross-sections and alignment for the improvement are as presented Sector IV of Vol. 4