

RRP:MAL 26009

# ASIAN DEVELOPMENT BANK

REPORT AND RECOMMENDATION  
OF THE  
PRESIDENT  
TO THE  
BOARD OF DIRECTORS  
ON A  
PROPOSED LOAN  
TO  
MALAYSIA  
FOR THE  
KLANG RIVER BASIN ENVIRONMENTAL IMPROVEMENT  
AND FLOOD MITIGATION PROJECT

November 1996

## CURRENCY EQUIVALENTS

(as of 6 November 1996)

Currency Unit	-	Malaysian Ringgit (RM)
RM1.00	=	\$0.3962
\$1.00	=	RM2.524

In this Report, a rate of \$1.0 = RM2.495 is used. This rate reflects the average rate prevailing at the time of the Appraisal Mission.

## ABBREVIATIONS

ARI	-	Average Recurrence Interval
BME	-	Benefit Monitoring and Evaluation
DBKL	-	Kuala Lumpur City Hall
DID	-	Department of Irrigation and Drainage
DOE	-	Department of Environment
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EIRR	-	Economic Internal Rate of Return
FTKVDD	-	Federal Territory and Klang Valley Development Division
IRBM	-	Integrated River Basin Management
MOA	-	Ministry of Agriculture
MWSS	-	Malaysia Wetland Sanctuary, Selangor
O&M	-	Operation and Maintenance
PMU	-	Program Management Unit
PPTA	-	Project Preparatory Technical Assistance
PSC	-	Program Steering Committee
TOR	-	Terms of Reference
UNDP	-	United Nations Development Programme
7MP	-	Seventh Malaysia Plan
6MP	-	Sixth Malaysia Plan

## NOTES

- (i) The fiscal year (FY) of the Government ends on 31 December.
- (ii) In this Report, "\$" refers to US dollars.

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## LOAN AND PROJECT SUMMARY

<b>Borrower</b>	:	Malaysia
<b>Project Description</b>	:	<p>The Project adopts an integrated approach to provide an improved level of environmental management and coordination, and flood protection in the Klang River Basin (which includes Malaysia's capital, Kuala Lumpur, and other major urban centers) to (i) sustain long-term environmental quality and economic development, (ii) prevent environmental degradation caused by rapid urbanization and industrialization, and (iii) remove one of its economic development constraints, perennial flooding. The Project will improve integrated river basin management (IRBM) in the Klang River Basin, solid waste management, sediment trapping, tributary river corridor improvement, and flood forecasting and warning.</p>
<b>Classification</b>	:	Primary - Environment
<b>Environmental Assessment</b>	:	<p>A</p> <p>An environmental impact assessment (EIA) was undertaken and the summary EIA was circulated to the Board on 17 March 1995.</p>
<b>Rationale</b>	:	<p>Serious environmental degradation problems, which worsen flood control problems, are experienced in the catchment areas and floodplains of the Klang River Basin. These problems, including soil erosion and river sedimentation, proliferation of solid waste in rivers, and water pollution in conjunction with flooding and a lack of coordinated and integrated river basin management inhibit quality of life improvements in the area and pose constraints to sustainable economic development. Environmental degradation is worsening with the rapid changes in land use to meet the needs of population growth, urbanization, and industrialization in the area. In the Seventh Malaysia Plan (1996 to 2000), the Government has accorded high priority to the provision of adequate social and physical infrastructure to support private sector-led expansion of the economy. The proposed Project is part of the Government's overall program for environmental improvement and flood mitigation in the Klang River Basin, which includes significant private-sector participation in flood mitigation in conjunction with commercial development schemes. There is a need to coordinate the overall Klang River Basin environmental improvement and flood mitigation program, with emphasis on IRBM, enhancement of the environment, and flood mitigation. The proposed Project will play a key role in integrating ongoing private and public sector programs for environmental improvement and flood mitigation in the Klang River Basin to achieve a comprehensive and coordinated approach to the problems of soil erosion, solid waste disposal, sedimentation, water pollution, and flooding.</p>

**Objectives and Scope :** The objectives of the Project are to (i) improve environmental conditions, including those that worsen flooding, through an integrated river basin approach that addresses environmental and economic development needs; and (ii) minimize the adverse economic, social, and environmental impacts of flooding in the Klang River Basin. The Project scope consists of three components that directly address environmental improvement needs: (i) IRBM, (ii) solid waste management, (iii) sediment trapping; and two flood mitigation components with environmental aspects: (i) tributary river corridor improvement, and (ii) a flood forecasting and warning system.

**Cost Estimates :** The total Project cost is estimated at \$101.8 million equivalent, comprising a foreign exchange component of \$40.2 million (40 percent of the total cost) and a local cost of \$61.6 million equivalent.

Source	(\$ million equivalent)			
	Foreign Exchange	Local Currency	Total Cost	Percent
Bank	26.3	0.0	26.3	26
Government	13.9	61.6	75.5	74
<b>Total</b>	<b>40.2</b>	<b>61.6</b>	<b>101.8</b>	<b>100</b>

**Loan Amount and Terms :** Bank financing will be provided through a loan of \$26.3 million from the Bank's ordinary capital resources, repayable in 15 years, including a grace period of 6 years, with the interest rate to be determined in accordance with the Bank's pool-based variable lending rate system for US dollar loans; and a commitment charge of 0.75 percent per annum.

**Period of Utilization :** Until 30 September 2003

**Implementation Arrangements :** A Program Management Unit will be established within the Department of Irrigation and Drainage (DID) of the Ministry of Agriculture (MOA) to carry out day-to-day Project implementation activities, benefit monitoring and evaluation, and environmental impact monitoring. A Program Steering Committee will be established within MOA to provide guidance and direction in implementing and coordinating the Project. DID will be responsible for the operation and maintenance of the Project facilities during the Project.

**Executing Agency :** Ministry of Agriculture

- Procurement** : All procurement for the Project financed under the Bank loan will be carried out by DID in accordance with the Bank's *Guidelines for Procurement*. Contracts for civil works costing \$5.0 million or more, or equipment estimated to cost \$500,000 or more, will be awarded on the basis of international competitive bidding. Civil works contracts of less than \$5.0 million will be carried out by contractors selected through local competitive bidding (LCB) in accordance with standard Government procedures acceptable to the Bank. For LCB contracts exceeding \$2 million equivalent, selection and engagement of contractors will be subject to prior approval of the Bank. Supply contracts for equipment costing less than \$500,000 equivalent will be carried out under international shopping procedures. Supply contracts for vehicles costing less than \$500,000 will be carried out under standard procurement procedures of the Government, provided that the Bank is satisfied that (i) the contract is awarded on a competitive basis, and (ii) the vehicle concerned is produced and supplied from a Bank member country.
- Consulting Services** : The Project will provide for a total of 1,159 person-months of domestic consultants (including 777 of subengineers) to be financed from Government funds, to assist in implementing all Project components. Provision is also made for 61 person-months of international consultants to assist in Project implementation. The consultants will be selected and engaged in accordance with the Bank's *Guidelines on the Use of Consultants*.
- Estimated Project Completion Date** : 31 March 2003
- Project Benefits and Beneficiaries** : The Project is expected to reduce total soil erosion in the catchment area from 2.3 million tons (t) annually to 1.5 million t, and to reduce uncollected solid waste levels by 30 percent to 105,000 t by 2003. About 130,000 cubic meters of sediments will be trapped annually. Watershed conditions will be improved, and 1,800 hectare to be designated as the Malaysia Wetland Sanctuary, Selangor (MWSS), one of the last remaining lowland swamp areas on the west coast of peninsular Malaysia, will be preserved. Preservation of the MWSS will result in carbon sequestration, tourism, and biodiversity benefits valued at \$0.4 million in 2003. River water quality and fish life in the Klang River and its tributaries will be improved through Project initiatives, and the recreational and aesthetic value of the river corridors increased. About \$17 million worth of expected annual losses due to floods will be avoided from the year 2003 onward from the overall Klang River environmental improvement and flood mitigation program, and expected losses of \$6.2 million will be directly avoided by the Project. Flood warnings will be issued

no less than three hours before any flood event. The higher level of flood protection will also improve the health and well-being of residents in the currently flood-prone areas, and improve the aesthetic and recreational values of the Klang River and its tributaries. The direct and indirect benefits of the Project include savings from reductions in disruption of traffic, increased land values, reduced cost of removing sediment from the reaches of the Klang River, and reduced cost of removing rubbish from the trash booms and screens on the rivers and from riverbanks. The Project is economically viable, with an economic internal rate of return of 14.9 percent, with significant indirect and nonuse benefits not included in the analysis.





## I. THE PROPOSAL

1. I submit for your approval the following Report and Recommendation on a proposed loan to Malaysia for the Klang River Basin Environmental Improvement and Flood Mitigation Project.

## II. INTRODUCTION

2. At the request of the Government, a project preparatory technical assistance (PPTA)<sup>1</sup> grant was approved by the Bank on 28 April 1993 to assist in the preparation of a feasibility study as the basis for processing a loan project. The PPTA study commenced in November 1993 and was completed in October 1994. A loan Fact-finding Mission visited Malaysia from 28 November to 16 December 1994. Discussion of the Government's Resettlement Plan, and preparation by the Government of the revised Resettlement Plan continued until May 1996. A loan Consultation Mission was fielded from 17 to 21 June 1996 to discuss the revised Resettlement Plan, and revisions to the Project scope. An Appraisal Mission<sup>2</sup> was fielded from 11 to 23 September 1996, and an Aide Memoire was signed by the Government on 23 September 1996. Discussions with Government officials and Project stakeholders regarding the Project were held during the Mission. The Mission also undertook policy dialogue with the Government on an integrated approach to environmental improvement and flood mitigation, the resettlement plan, cost recovery, strengthening of integrated river basin management (IRBM), and privatization of solid waste management. The various Missions visited international agencies and nongovernment organizations to seek their views on environmental issues, solid waste management, and squatter resettlement. This report is based on the findings of the PPTA and subsequent Bank Missions. Loan negotiations were held in Manila on 7 November 1996 with the authorized representative of the Borrower.

## III. BACKGROUND

### A. Sector Description

#### 1. The Klang River Basin

3. Malaysia, one of the most rapidly urbanizing countries in Asia, faces major environmental challenges. Rapid industrialization, although relatively well-planned and regulated, has generated increased pressure on urban areas especially in the Klang River Basin, the most densely populated area of the country. The Basin encompasses the Federal Territory of Kuala Lumpur (Federal Territory), parts of Gombak, Hulu Langat, Klang, and Petaling districts in Selangor State (see Map), and the municipal areas of Ampang Jaya, Petaling Jaya, and Shah Alam.<sup>3</sup> With an estimated population of over 3.6 million, (about 21 percent of the national population), and growing at almost 5 percent per year, the Basin has experienced the highest economic growth in the country.

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<sup>1</sup> TA No. 1867-MAL: *Klang River Basin Integrated Flood Mitigation Project*, for \$800,000, approved on 28 April 1993.

<sup>2</sup> Comprising B. Fawcett (Mission Leader), W. Staub (Senior Social Development Specialist), G. Atay (Counsel), R. Dobias (Environment Specialist), B. Hitchcock (Programs Officer), and A. Malik (Project Engineer).

<sup>3</sup> The seven jurisdictions in Selangor State of Gombak District Council, Hulu Langat District Council, Klang District Council, Petaling District Council, Ampang Jaya Municipal Council, Petaling Jaya Municipal Council, and Shah Alam Municipal Council are collectively referred to in this Report as local authorities.

4. The Klang River originates in a mountainous area about 25 kilometers (km) northeast of Kuala Lumpur. It is joined by 11 major tributaries while passing through the Federal Territory and the area downstream of Kuala Lumpur, before joining the Strait of Malacca at Port Klang. The Klang River has a total length of about 120 km. The Basin is 1,290 square kilometers, about 35 percent of which has been developed for residential, commercial, industrial, and institutional use. The upper catchments of the Klang River and its tributaries — the Gombak and Batu Rivers — are covered with well-maintained forests. However, the lower reaches of the Basin, with extensive urban land development activities, are major contributors of sediment load and flood peaks. Since 1985, urban area development has increased by about 4 percent per annum. Rapid economic growth has attracted a strong inflow of settlers from other parts of the country and overseas, which has resulted in squatter settlements, mainly along the river reserve areas.

5. Three ongoing projects address the environmental issues in the Basin: the Klang River Cleanup Program, implemented through a multiagency task force chaired by the Director General of the Federal Department of Irrigation and Drainage (DID); the Klang River Basin Flood Mitigation Project, being implemented by the Federal DID; and the Federal Territory Drainage Project, implemented by the Federal DID and Selangor State DID. The Government has also involved the private sector in planned environmental improvement and flood mitigation activities. The private sector is expected to undertake a major project to develop a 12-km-long "linear city" along the Klang River in the Federal Territory. There is a need to integrate the various ongoing projects and to strengthen coordination among the various concerned agencies, including the private sector, to achieve the objectives of environmental improvement and flood mitigation in the Basin more efficiently.

## 2. Environmental Degradation

### a. Soil Erosion and Sedimentation

6. The fundamental problem of river basin management in the Klang River Basin is soil erosion and sedimentation. Soil erosion in the catchment is high by both Malaysian and international standards, and is estimated at 18 metric tons per hectare (t/ha) per year which is equivalent to approximately 2.3 million t of annual soil loss from the entire Basin. The major contribution to the overall erosion level is from urbanizing areas (about 660,000 t per year), primarily from land under construction, or recently completed sites where large areas of earth are exposed, particularly steep lands with over a 10 percent grade, where soil losses are potentially in excess of 400 t per ha per year.

7. Another source of significant sediment levels in the main watercourses is riverbank erosion. For the larger streams that are unlined, erosion losses can be significant; for an approximate 3-km length of the Klang River, it is estimated that over 50,000 t of soil was added into the river in 1995. The total volume of soil lost through riverbank erosion in the Basin is estimated at about 200,000 t annually. Concerns raised by excessive erosion and sedimentation levels in the Basin include (i) damage to earthworks, drainage structures, and water storage areas; (ii) sedimentation of drainage structures, ponds, watercourses, and harbors; (iii) increased riverbank erosion; (iv) changes in flood conveyance capacities of rivers, resulting in increased flooding; and (v) reduction in stream water quality, with consequent adverse effects on biological, aesthetic, and recreational values.

8. Sediment (primarily sand) removal from the Klang River system is a major ongoing activity of DID and Kuala Lumpur City Hall (DBKL). DBKL has assumed responsibility

for all sediment removal from the river system within the Federal Territory. DBKL carries out a major sediment removal program in the central city area where sediment has built up in the channeled sections of the Gombak and Klang rivers. Major work to remove sediment is also under way on the Klang River further downstream. It is estimated that the Batu, Gombak, and Klang Rivers carry sand loads of about 510,000 cubic meters ( $\text{m}^3$ ) per year into the city of Kuala Lumpur, exceeding the capacity of the Klang River by about 330,000  $\text{m}^3$  and requiring costly removal of the deposited sand from the river channels. Downstream, the deposition of an additional 300,000  $\text{m}^3$  is estimated to occur from the sediment contribution of the Kerayong, Keroh, Bohol, and Penchala river systems, as well as the bed material load leaving the city area. The total annual deposition of about 630,000  $\text{m}^3$  from the Klang River's tributaries represents a major problem for river maintenance, contributes to flooding, and is costly to remove. While the overall aim should be to limit the sediment entering the rivers by more effective management of the catchment, a system of sediment traps or sedimentation ponds is the best measure to reduce the current widespread and expensive sediment removal programs that also cause traffic congestion along stretches of the rivers in Kuala Lumpur. Sediment trapping facilities can be constructed at sites such as old tin mining ponds that are amenable to trapping, and where the distribution of the sand removed from the traps will cause minimal traffic disruption. The trapped sand material can also be sold to contribute to cost recovery of the investment.

9. Although much of the soil erosion evident in the Klang River Basin is considered to be caused by land uses inappropriate for the terrain, a major contributing factor is the inadequate, or lack of implementation of, erosion control measures, particularly for urban land development. It is evident that while many of the various methods applicable to erosion control are known, particularly on lands for urban development, the application of such measures is generally poor and effectiveness is low. One fundamental reason for this is that the measures employed are inappropriate for the scale and intensity of the development, especially on sloping land. The gross disturbance and earthworks programs that are common to most developments in the Klang River Basin are conducive to a continuation of excessive sedimentation levels in the Basin. A range of laws could be enforced to ensure that effective erosion control measures are applied, particularly for urban developments. However, such measures cannot be enforced largely because of a lack of trained local enforcement officers.

10. Planning for the Klang River Basin is carried out within a framework of an overall regional plan for the Basin prepared and administered by the Federal Territory and Klang Valley Development Division (FTKVDD) of the Prime Minister's Department. District and local plans are prepared by either Selangor State, or the Federal Territory, and implemented by the seven respective local authorities. Regarding prevention of land degradation and soil erosion for urban development proposals within freehold lands, the Department of Environment (DOE), or the local authority, has prime responsibility. In total, nine different agencies have some form of regulatory or advisory role in relation to erosion or sedimentation control. The agency that experiences the greatest problems in regard to effects of erosion and sedimentation is clearly DID, as it is required to maintain drainage channels and watercourses in a condition that will not aggravate flooding and riverbank erosion.

11. There is an overall regional planning framework for the Klang River Basin, but it is used as a very broad and general guide only. The existing plan, prepared in 1984 and updated in 1988, is also outmoded in many respects. Urban land expansion since the plan's preparation has been heavily oriented to the steeper (and more erosion-prone) lands near Kuala Lumpur, at the expense of the lower lying (and less erosion-prone) land to the west. Planning for the overall Basin appears to be inhibited by lack of a clearly defined strategy for

river management, particularly regarding control on urban expansion into the steeper areas. A Landscape Master Plan prepared under the Klang River Cleanup Program has also been prepared, but requires further implementation.

12. There is an obvious need for an IRBM strategy, for planning to alleviate the soil erosion problem at its source, and for implementing a process whereby any future planning, land development activity, and ongoing management decisions are consistent with the overall strategy framework. Since a significant amount of damage has already been done, any management strategy will need to incorporate remediation into the overall management plan.

13. Adjacent to the Rasau Swamp in the Klang River Basin is a wetland area of about 1,800 ha, that, along with the associated forest reserve, is of significant ecological value, since they represent one of the last remnants of lowland swamp forest in the region. The open grasslands provide a valuable adjunct and buffer for the maintenance of the wetland ecosystem. The long-term survival of the vegetation of the area depends on the maintenance of the existing hydrological balance. The ongoing Klang River channel improvement measures are designed to essentially maintain the current inundation balance of the area. It is essential that these measures be implemented appropriately.

14. In broader terms, it is also considered vital that the wetland area be protected from land development activities to preserve the ecological integrity of the area. In this regard, Selangor State authorities, with assistance from a nongovernment organization, Wetlands International, are in the process of designating the 1,800 ha wetland area as a Ramsar Site.<sup>1</sup> The designation is expected to be accepted by the United Nations Environment Programme before the end of 1998. During the interim period, DID is consulting with Selangor State authorities to prohibit further development in this area, referred to as the Malaysia Wetland Sanctuary, Selangor (MWSS). The preservation of the MWSS is an important issue that needs to be addressed and monitored as part of an IRBM strategy.

#### **b. Solid Waste Management**

15. The management of solid waste in the Basin is another major environmental issue. In urban areas in particular, solid waste in rivers may impede river flows, thereby becoming not only a serious environmental problem, but also a cause of flooding. The urban population in Kuala Lumpur generated about 5.2 million t of solid waste in 1993, or between 0.34 and 0.85 kilogram (kg) per capita per day. More recent studies indicate that the generation of solid waste now approaches 0.7 to 1.0 kg per capita per day. Despite the rapid increase in solid waste in recent years, local authorities were able to maintain a reasonable level of service in waste collection and disposal. However, unsafe solid waste landfills and illegal dumping of waste remain a problem, as enforcement is hampered by the lack of capacity and legal power of local authorities. About 150,000 t of solid waste was not collected in 1995. It is estimated that about 507,000 people, primarily squatters whose numbers are expected to grow despite resettlement programs, were not served by solid waste collection in 1995. In addition, because such areas are poorly served, the settlers generally dispose of their

<sup>1</sup> Officially the sites are called Wetlands of International Importance. The sites are nominated to the United Nations Environment Programme by countries that have ratified the Convention on Wetlands of International Importance Especially as Waterfowl Habitat. Once a site has been designated as a Wetland of International Importance, the country is bound under the Convention to maintain the site's conservation values. Malaysia ratified the Convention in 1994.

solid waste into the rivers, which not only reduces river conveyance capacities, but also leads to deterioration in water quality.

16. Solid waste management in the Klang River Basin is an integral part of the Klang River Cleanup Program. The program pays a contribution to local authorities for clearing rubbish from trash screens, or rubbish booms on the rivers. It has also funded the purchase of bins and other collection devices, and equipment, and the construction of bin platforms. However, it does not provide any incentive to prevent rubbish from being discarded into the drainage system. Rubbish booms and fixed screens should be regarded as interim measures. The most effective approach to reduce the solid waste in rivers is to provide better rubbish collection facilities, educate the public to stop disposing of rubbish in the river, relocate squatters, and impose penalties for illegal rubbish disposal. These preventive measures are generally the responsibility of local authorities, but few of them have been successfully implemented. Manually collecting rubbish at the sites where rivers are blocked is the prevailing practice. This approach does not address the root causes of generation of solid wastes. A solid waste management strategy is required to progressively reduce the rubbish input in the rivers, at which time the booms and screens can be gradually removed. Such a strategy will require providing incentives to local authorities to keep rubbish from entering the rivers, and improving collection facilities, particularly to the squatter communities along the Klang River and its tributaries. Monitoring and enforcement of penalties against illegal rubbish dumping are also required. These initiatives need to be incorporated into an integrated program for environmental improvement and flood mitigation in the Klang River Basin.

### c. Water Quality

17. Another important dimension of IRBM is water quality control. DOE assessed 119 major rivers being monitored in Malaysia in 1995 and found that 14, including the Klang River, were highly polluted. The disposal of untreated sewage discharged from squatter settlements, and incompletely treated sewage from treatment plants and pig farms contributes to the further deterioration of the Klang River's water quality, adding to its solid waste and suspended sediments load, especially in reaches passing through the Federal Territory and below. The very low quality of river water in turn contributes to poor hygiene along the river corridors, degradation of vegetation, and loss of biodiversity in the river itself.

18. To accelerate the provision of sewerage services and arrest the problems of domestic and animal waste pollution, the sewerage system in Malaysia was privatized in 1993. By the end of 1995, a single company was managing sewerage systems in 82 of the 143 local authorities in the country, including major urban centers. In the Klang River Basin, agricultural (piggery waste), and industrial wastewater are treated on-site, in some cases via existing treatment ponds and facilities, which then discharge into open drains. These in turn finally drain into the Klang River and its tributaries. In many cases, the existing treatment facilities are insufficient or not maintained, and the effluent discharged does not meet standard A or B of the Environmental Quality (Sewage and Industrial Effluents) Regulations of 1979. The Klang River Cleanup Program has a subprogram for water pollution control that is executed by DOE, and currently focuses on enforcement of pollution control through implementation of existing regulations. DOE considers that measures being implemented to control biological wastes such as effluents from factories and farms will prove effective, and that the reduced generation of sediment from soil erosion is required to improve water quality. Accordingly, the water quality subprogram requires continuing support to adequately monitor and enforce regulations, and needs to be included in an overall IRBM program.

### 3. Flood Impacts and Mitigation

19. Improved mitigative measures are needed to minimize the impacts of annual flooding in the Federal Territory, and other urban and industrial areas of the Klang River Basin. The annual flooding causes extensive damage, and extreme flood events, such as those that occurred most recently in 1988 and 1993, as well as the highest flood on record in 1971, have a much higher economic cost, in the absence of adequate (100-year return period)<sup>1</sup> flood protection. The Klang River Basin receives high rainfall, estimated at 2,500 millimeters per annum. The high-intensity rains, combined with a short time to peak flow development, create sharp flood peaks that cause significant damage and disruption of activities in the urban and industrial areas of Kuala Lumpur, and the lower reaches of the Basin. The flood problem is further aggravated by clogging of the river channels caused by deposition of sediment and solid waste.

20. The flood damage potential of the Klang River is high because of its limited channel capacity — corresponding only to a 10-year-period flood — and its route through the center of the Federal Territory and other urban and industrialized areas. About 17,000 ha (13 percent) of the Klang River Basin is flood prone, with an average of three flood events per year. The flood-prone area is inhabited by about 500,000 people, of which 190,000 (38 percent) are squatters. The most flood-prone area consists of about 5,000 ha, with about 17,700 dwellings and 100,000 residents, as well as 1,410 farms, 42 km of roads, 1,260 commercial and industrial establishments, four schools, and five sewage treatment plants. About 5,000 people residing in low-lying areas are typically evacuated three times a year. The average annual flood damage in this area is estimated at about \$1.5 million.

21. The existing infrastructure and settlements along the rivers constrain attempts to increase river capacities. Obstruction of the river corridors by squatter settlements and the garbage that they dispose of in the river also pose serious challenges to the design of the flood protection and mitigative measures. The flood protection plan that the Government launched after the 1971 flood was designed considering these constraints. The plan included (i) raising of the Klang Gates Dam to increase its storage capacity; (ii) construction of a storage reservoir on the Batu River; (iii) construction of sedimentation and flood detention ponds at various locations in the Basin; (iv) increasing the capacity of the rivers by cleaning, straightening, deepening, and widening them; extending levees and removing gaps and deficiencies in the existing levees; and replacing bridges and other structures that constrain the capacity of the rivers; (v) measures to improve solid waste collection, and removal of floating debris from the rivers with trash booms; and (vi) establishment of a flood forecasting and telemetry system.

22. The raising of the Klang Gates Dam was completed in 1980 while the construction of the Batu Dam was completed in 1987. Channelization of 33 km of the Klang River's reach has been completed, is ongoing for 14 km, and is in the planning stage for the remaining 28 km. Construction of one sedimentation and flood detention pond has been completed, and construction of two is ongoing. The remaining seven ponds are still to be surveyed and designed.

23. The Government attaches high priority to the completion of the flood mitigation works along the Klang River and its tributaries to provide improved flood

<sup>1</sup> A 100-year return period flood is a statistically developed flood event that will, on the average, be exceeded every 100 years, and forms the standard, or criterion for flood protection works for a city like Kuala Lumpur.

protection in the capital city of Kuala Lumpur and its environs, thereby minimizing property damage and disruption from floods. The private sector is involved in this effort, a major recent development being the proposed 12-km-long "linear city" along the Klang River in the Federal Territory. The development and management of the linear city, to begin in 1997, will be undertaken by private developers, who will be responsible for channelization of the Klang River along the 12-km reach to provide immunity from the 100-year flood, and for construction and maintenance of three sedimentation and flood detention ponds in the catchment of the Klang River and its tributaries, as well as commercial developments. Flood mitigation programs under the Seventh Malaysia Plan (1996 to 2000) (7MP) will mainly involve continuation of the incomplete flood mitigation projects under the Sixth Malaysia Plan (1991 to 1995) (6MP), with the addition of several new small-scale river conservation projects. The major increase in budget allocation will be for the river cleanup program, indicating the heightened priority that the Government has attached to environmental improvement under the flood mitigation program.

24. A flood forecasting and telemetry system was established by DID in 1978 for real time monitoring of rainfall and river flood levels at key locations, to forecast flood flows at strategic locations and to issue warnings as necessary. The reservoir levels of the Klang Gates Dam and Batu Dam are also monitored, and operation of the gates of these dams is controlled by the system. The system consists of a master station, eight river gauging stations, and nine rainfall recording stations connected through a telemetric system with the master station. From data on upstream river levels and rainfall, the system forecasts river flows and levels at key downstream locations in the Klang River Basin using empirical rainfall runoff and flood routing relationships derived during the model development stage. Since there have been major changes in river morphology during the last decade, and the empirical relationships developed in the late 1970s have not been revised, the model has not been used for forecasting river flows and flood levels since 1990. As a result of the rapid urban, commercial, and industrial developments in the Basin in the recent past, it is necessary to expand the area covered by the system. In addition, it is also desirable to make use of recent advances in communications, computing, and model development by replacing the outdated, slow, and inefficient hardware, and using more sophisticated river channel routing models for accurate forecasts of flood flows and levels. These improvements will permit flood warnings to be issued earlier, thus reducing the damage and disruption caused by flooding in the Klang River Basin.

#### **4. Sector Institutions and Activities in the Klang River Basin**

25. In 1980, the Government of Malaysia saw the need to coordinate the planning and supervision of development programs within the Klang River Basin. To meet planning and coordination requirements for the development of the Klang River Basin, the following organizations were established in 1981 within the Prime Minister's Department: (i) the Klang Valley Planning Council, (ii) the Klang Valley Working Committee, and (iii) the Klang Valley Planning Secretariat, now reorganized as the FTKVDD.

26. The Klang Valley Planning Council is the highest authority responsible for all policies, strategies, and planning in the Klang valley, and is headed by the Prime Minister. The Klang Valley Working Committee comprises representatives from the Federal and state governments as well as from various local authorities. The FTKVDD was set up under the Prime Minister's Department to act as a secretariat to these two organizations and other Klang valley development projects. The FTKVDD serves as an administrative and coordination secretariat since it has virtually no technical personnel to investigate matters related to IRBM and flood management, which are the responsibility of DID.

27. Currently, three major projects related to environmental and flood mitigation matters in the Klang River Basin are being undertaken by the Government (see para. 5). The Klang River Basin Flood Mitigation Project was started by the Federal DID in 1989 on the basis of a 1973 study of the Batu, Gombak, and Klang rivers. The study set out a program for flood proofing the Klang, Batu, and Gombak river areas by river improvement and the use of retention ponds and diversion works. The project is ongoing and includes preservation of the MWSS. The second major project, the Federal Territory Drainage Project, was started in 1978 to provide for the development and improvement of the tributaries flowing into the three main rivers (Klang, Batu, and Gombak) within the Federal Territory of Kuala Lumpur. The objective is to improve the drainage system and to overcome the frequent flooding that has resulted from the rapid pace of development in Kuala Lumpur and adjacent areas. This study deals with 26 catchments confined to the Federal Territory, and involves Federal DID and DID of Selangor State. The third major scheme is the ongoing Klang River Cleanup Program. It began in 1992 and seeks to remove and reduce sources of pollution, and eradicate sediment and rubbish from the Klang River and its main tributaries. It is also concerned with improving river quality, beautification of the river, and upgrading of recreational facilities in the Klang River Basin. Many agencies are involved in this program. Its Task Force is chaired by the Director General of DID and is assisted by an Executive Committee and a series of working committees responsible for implementation of specific program activities such as sediment removal, river beautification, and squatter resettlement, for instance. This institutional arrangement will be incorporated into the proposed Project (see paras. 60, 75, and 76) to form an integrated program.

28. Private sector involvement in improving the Klang River within Kuala Lumpur, in conjunction with commercial development, is being planned for a 12-km stretch of the river (see para. 23). The plan calls for privatization of the Klang River where it flows through Kuala Lumpur, with construction of office towers, condominiums, and shopping malls, on a 99-year lease. It is planned to construct a rapid transit system along the river to be operated by the developer for 30 years before the system reverts to the Government at no cost. River cleanup through solid waste removal, flood mitigation, and removal and resettlement of 1,400 squatter families in low-cost housing units in compliance with Government resettlement policies will be undertaken by the developer. Below the 12-km stretch of the Klang River, DID has given another contractor the responsibility for designing and building river channel improvements and levee extensions to mitigate flooding. The contractor will resettle 400 squatter families. The private sector is also involved in sediment removal and solid waste disposal from selected areas in the Klang River Basin.

29. The proposed Project seeks to integrate the three ongoing government environmental improvement and flood mitigation projects described in para. 27. The three projects are being implemented effectively, but coordination mechanisms need to be strengthened for implementation of a single program integrating the three projects. With the added involvement of the private sector in Klang River environmental improvement and flood mitigation activities, the need for improving coordination has become more compelling, particularly to address environmental improvement issues. There is therefore a need, as part of the overall Klang River environmental improvement and flood mitigation program, for a project that will coordinate Government and private sector projects for improved environmental management and flood mitigation in the Klang River Basin in an integrated manner, and to undertake tributary river flood mitigation activities.



## **B. Government Policies and Plans**

30. Malaysia has made a strong commitment to protection of the environment and sustainable development. The 7MP, announced in May 1996, places heightened emphasis on the proper management of the environment and the natural resource base. Environment and natural resource management during the 7MP will be guided by the National Policy on the Environment, which is being promulgated to ensure long-term sustainability and improvement in the quality of life. Environmental considerations will increasingly be integrated into development planning, and methods will be developed to encourage the private sector to adopt and develop environmentally sound technologies. The policy aims at promoting economic, social, and cultural progress through environmentally sound and sustainable development. An action plan will be drawn up to operationalize the different aspects of the policy. Focus will be given to providing a framework for an integrated approach to development; enhancing the effectiveness of the regulatory and institutional framework; recommending suitable mitigation measures; improving environmental education, communications and awareness, and training programs; and incorporating environmental considerations in resource management and development planning.

31. The Government policy for the development and management of rivers has the objective of ensuring that rivers meet requirements for water supplies, energy production, navigation, recreation, ecological balance, and a diversity of riverine flora and fauna. The policy also seeks to promote a holistic approach to river management that integrates water resources, flood, and environment planning and management, in recognition of the multi-functional roles of rivers in socioeconomic development. The strategy aims for cost-effective river environment improvement and flood mitigation, using an appropriate combination of structural and nonstructural measures. Emphasis is placed on monitoring and regulating all catchment activities that could lead to increases in flooding and pollution of rivers.

32. Under the 7MP, four consortiums will be contracted to undertake solid waste collection and disposal in four regions each, covering the entire country, and a new Government department will be established to regulate the consortia. In the Klang River Basin, a large landfill site has recently been opened, and will serve as the sole site for landfill disposal. While landfill will be a major component of solid waste disposal, the proposed Solid Waste Management Act will introduce three new strategies: recycling, incineration, and a direct charge to the consumer. Measures to ensure the efficiency of private solid waste management are expected to include proof of actual disposal of waste at licensed sites through payment of charges and issuance of a receipt from the disposal site, and licensing of transport companies.

33. As flood mitigation facilities require large capital investments and lack short-term financial benefits, they are less attractive for privatization, and hence will continue to need significant public investment. However, in the proposed linear city along a section of the Klang River (see paras. 23 and 28), the private sector developer will manage all aspects of the river under guidelines set by the Government, and will integrate its activities with upstream and downstream river management. Overall policy direction and coordination of specific programs for river management and flood mitigation will continue to lie with DID within the Ministry of Agriculture (MOA).

34. A Federal Cabinet decision in June 1996 set out a strategy to overcome urban flooding. The key elements of the strategy are as follows:

- (i) DID should clarify the responsibility for rivers within local government areas;

- (ii) DID should recognize the need for strict enforcement of existing drainage guidelines;
- (iii) DID should develop new guidelines to control the impact of urban development with a view to minimizing rainfall runoff and peak rainfall discharge rates;
- (iv) DID should prepare a drainage strategy as an integral part of town planning;
- (v) local authorities should examine options for financing and cost recovery of drainage and flood mitigation works to reduce reliance on Government financing; and
- (vi) privatization should be considered among the financing options, with the private sector being given the authority to levy fees to recover the costs of construction and maintenance of drainage and flood control works.

35. Rapid urbanization has increased the demand for urban drainage and flood control. In the main urban areas, the exhaustion of low-cost options and the steeply rising costs of land acquisition have resulted in rising costs for drainage and flood control. Traditionally, the Government has provided funds as grants to the states for this purpose, but the more urbanized states have gradually been implementing measures to recover from all landowners the costs of providing this infrastructure. At present six states and the Federal Territory of Kuala Lumpur levy one-time contributions on property transfers to recover part of the cost of providing this infrastructure. Selangor State first introduced a charge of RM7,500 per ha in 1976; this was increased to RM15,000 per ha in 1996. The Federal Territory introduced a charge of RM12,500 per ha in 1982. These levies have to date generated revenue of RM180 million in Selangor State and RM30 million in the Federal Territory. In addition, landowners contribute to operation and maintenance (O&M) costs through annual local government assessments.

36. Within the Klang River Basin, annual assessments provide an adequate level of funding for O&M. In line with the June 1996 Cabinet decision, the Government is considering extending to all states the practice of charging contributions for infrastructure costs, and the imposition of a drainage charge (which could be implemented under existing legislation) to be included in local government annual rating assessments to improve cost recovery of capital works. The Government recognizes, however, that to contain future capital works costs, emphasis must also be placed on requiring developers to implement higher standards of sediment and runoff control to limit peak discharges, and reduce the requirement for Government-funded capital works on the main river systems. Under the Project, the Government will initially finance O&M of Project facilities, and hand them over to local authorities, while continuing to recover O&M costs.

### **C. External Assistance to the Sector**

37. From 1970 to 1996, Malaysia received a total of 36 river environmental improvement and flood mitigation technical assistance grants amounting to about \$8 million equivalent from various funding countries and internal agencies, including the Bank, the World Bank, United Nations Development Programme (UNDP), Australia, Canada, France, Japan, and New Zealand. Most of these grants were for project preparation, survey, and study. Many completed and ongoing flood mitigation projects were based on the results of these studies.

38. The World Bank has been the principal source of multilateral development assistance to Malaysia, lending primarily for agriculture, followed by power, education, transport, and communication. The World Bank's lending program totaled \$465 million over the 6MP period, with the level of lending fluctuating from year to year. The Bank has so far provided total assistance of \$1.85 billion for 73 loans. Lending during the 6MP period totaled \$373 million. Apart from the Bank and the World Bank, other multilateral aid agencies have been the Islamic Development Bank, which extended loans totaling \$35 million during the 6MP period. Japan is clearly the major bilateral aid agency, providing \$1.6 billion in loans, including significant support to the power sector; and \$304 million in technical assistance during the 6MP. The United Kingdom provided \$448 million in loans, and \$106 million in technical assistance over the same period. Other bilateral aid agencies have small programs that emphasize human development, the environment, and the expansion of bilateral economic links. Several aid agencies have advised that their programs are decreasing in response to the increasing level of development in Malaysia. The UNDP funding is also decreasing because it is based on the level of income in the recipient country. The Danish Cooperation for Environment and Development has a very active environmental program, and is working in several areas that complement the Bank's support for environmental improvement.

39. Malaysia continued to receive significant aid agency support during 6MP. In the 7MP, Malaysia's strong fiscal position, the high level of national savings, and strong flows of foreign direct investment mean that the requirement for development financing from multilateral and bilateral institutions is no longer critical. In addition, the Government's extensive privatization program has reduced or eliminated the need for multilateral financing in several sectors. The inflow of official development assistance is expected to decline during the 7MP. The Government's strategy is to direct official development assistance resource flows to support the development of advanced industrial skills, environmental improvement, and science and technology to increase productivity.

40. The Bank has been active in supporting the Government's effort to strengthen environmental improvement and conservation, and to promote the sustainable use of natural resources. The Bank has been particularly active in supporting the evolution of Malaysia's institutional framework for environmental improvement, and the strengthening of environmental impact assessment guidelines in key sectors. The National Coastal Erosion Control Sector Project<sup>1</sup> is currently under implementation. Five environmental technical assistance grants that have been provided totaled \$1.3 million.

41. By the end of 1995, the Bank had provided four flood mitigation-related loans totaling \$89 million<sup>2</sup> that also provided significant environmental benefits. About 75 to 90 percent of the cost for these four projects was allocated to flood mitigation-related components. Implementation of the last two projects is continuing. The overall performance of these projects is considered satisfactory. If approved, the proposed loan would be the Bank's second environmental improvement-related loan to Malaysia, and the fifth flood mitigation loan.

<sup>1</sup> Loan No. 1120-MAL: *National Coastal Erosion Control Sector Project*, for \$43 million, approved on 19 November 1991.

<sup>2</sup> Loan Nos. 36/37-MAL: *Besut Agricultural Development Project*, for \$4.2 million, approved on 22 September 1970; Loan No. 497-MAL: *Kemasin Rural Development Project*, for \$40 million, approved on 15 December 1990; Loan No. 992-MAL: *Semerak Rural Development Project*, for \$33.2 million, approved on 23 November 1989; and Loan No. 1068-MAL: *Northern Terengganu Rural Development Project*, for \$15 million, approved on 13 December 1990.

#### **D. Lessons Learned**

42. The Bank has postevaluated 38 of the 64 projects approved for Malaysia between 1968 to 1988. Of the postevaluated projects, 24 were generally successful, 12 were partly successful, and 2 were unsuccessful. Of the two unsuccessful projects, one was an agricultural support services project, and the other a minihydropower project. A number of projects suffered implementation delays and cost overruns. The average delay was 2.7 years for agriculture sector projects. The major cause of delays in agriculture sector projects was the inadequacy of contractors; delays in engagement of consultants, preparation of engineering designs, and delivery of equipment; changes in project scope and design; and site reclamation and land settlement problems. Delays in social infrastructure projects were caused by difficulties in land acquisition; delays in consultant recruitment, procurement, and civil works; and inadequate site geological studies and design at appraisal. The major reason for cost overruns across sectors included expanded project scope, land acquisition difficulties, and implementation delays.

43. The major lessons learned are that thorough preparation, appropriate project design, and strong institutional capability of executing agencies are the key to the success of projects.

44. The proposed Project will be the Bank's first primarily environmental improvement and urban flood mitigation project in Malaysia. The lessons learned from the two completed and two ongoing rural flood mitigation projects are relevant to the Project: (i) project preparation should give adequate attention to socioeconomic factors to minimize impacts on adversely affected groups and to ensure that beneficiary participation is obtained at all stages of project implementation; (ii) implementation plans and schedules, including land acquisition and resettlement plans, should be prepared in sufficient detail before project appraisal; (iii) frequent reassignment of key project staff should be avoided as it causes discontinuities and interruption of Project implementation; (iv) implementation of associated or complementary components of the Project involving irrigation, drainage, water supply, rural infrastructure, and crop development should have a flexible schedule to avoid flood damage to these components; (v) the project design should anticipate and integrate the many uses and functions of the infrastructure; and (vi) dumping sites for disposal of earth excavated during river channelization and desilting operations should be carefully planned to minimize environmentally adverse impacts on wetlands, swamps, and former mining ponds. These lessons have been taken fully into account in the design and formulation of the proposed Project.

#### **E. The Bank's Country and Sector Strategy**

45. The Bank's operational strategy for Malaysia, prepared in June 1991, supported the Government's drive to increase productivity and efficiency, primarily through private sector initiatives. The strategy focused on the following areas: (i) environmental policy support, in particular to enhance the role of the private sector in the economy; (ii) development for both physical and social infrastructure; (iii) environmental protection and improvement; and (iv) poverty reduction. The Government has confirmed that it will continue to require assistance from the Bank and other multilateral agencies during the 7MP period. In this context, the Bank, together with the Government, will undertake a Country Operational Strategy Study in 1996 to determine the broad parameters for Bank assistance in the medium term.

46. While the development priorities identified in the 1991 Country Operational Strategy Study remain generally valid, the following operational priorities have emerged, and have been agreed upon by the Government and the Bank as guidelines for the Bank's current operations:

- (i) support for human development,
- (ii) support for capacity building in selected sectors,
- (iii) support for improved environmental protection and management,
- (iv) promotion of balanced regional economic growth by providing assistance to Sabah and Sarawak for rural infrastructure, and
- (v) support for Malaysia's participation in regional growth areas with its regional neighbors.

47. Given the Bank's strategic support for environmental protection, infrastructure support, and capacity building, the Bank's strategy in the environmental improvement sector in Malaysia is to (i) support the sustainable management of land resources in catchments and in flood-prone areas; (ii) upgrade technology and skills to carry out a cost-effective environment improvement and flood mitigation program; (iii) create adequate infrastructure to remove constraints to soundly based economic development; and (iv) assist in expanding the cross-sharing of experiences and exchange of information in environmental improvement and flood mitigation among countries in the region.

## **F. Policy Dialogue**

48. The Bank has maintained ongoing dialogue with the Government in support of environmental policy development and institutional strengthening in the context of its loan and technical assistance programs. Institutional strengthening of shoreline management, improvement of environmental impact assessment (EIA) guidelines for key sectors, and review of the institutional framework to promote sustainable development have been areas of focus. Policy dialogue conducted during processing of the Project focused on several sector-specific issues.

### **1. Integrated Approach to Environmental Improvement and Flood Mitigation**

49. The Bank's policy dialogue with the Government emphasized the need for an integrated approach to environmental improvement and flood mitigation, including appropriate institutional arrangements to achieve this objective. The Government agreed that an Integrated River Basin Management Working Committee will be established to implement Project activities, and that an institutional mechanism for IRBM to be formulated under the Project would be implemented and sustained after Project completion. The Government also agreed that local governments will enforce penalties on illegal deforestation, encroachment on forest reserves and swamps in the Klang River Basin, and illegal disposal of solid and liquid waste into the rivers. A major concern of the Project will be to address the environmental problems caused by inadequately planned and unregulated land development in the Klang River Basin. Existing measures will be examined, improved, and enforced through a variety of Project initiatives to ameliorate the current situation.

## 2. Resettlement Plan

50. The Government of Malaysia, Selangor State, and DBKL have well-established policies, and considerable experience in dealing with involuntary resettlement, including resettlement of squatter communities. The Bank conducted considerable dialogue with the Government concerning the involuntary resettlement issue during the processing of the Project. The Government responded to the Bank's policy on Involuntary Resettlement<sup>1</sup> by preparing a Resettlement Plan, which was revised through a process of consultation with the Bank and the two jurisdictions involved (Selangor State and DBKL). The Plan finally submitted to the Bank is in conformity with the Bank's policy. Resettlement practice for past and ongoing projects in the Klang River Basin was also reviewed. Resettlement programs were found to be well managed, adequately funded, and sensitive to the needs of the resettled families.

## 3. Cost Recovery

51. In the Klang River Basin, the Government already obtains partial cost recovery of urban drainage and flood control infrastructure. Institutional arrangements and mechanisms for O&M collection are satisfactory, and adequate funds for O&M are already collected by the Government. Nonetheless, as indicated in paras. 34 to 36, the Government is attempting to improve recovery of the costs of infrastructure from more urbanized states, and is reviewing options for further cost recovery as a result of the June 1996 Cabinet decision (see para. 34). The Government agreed to consider increasing the relevant house assessments tax and other means of cost recovery such as increased drainage contributions on land rezoned for development, to recover a greater part of the initial investment and total O&M costs in the context of its broad review of cost recovery options to be undertaken consequent to the June 1996 Cabinet decision. The Government will review regulations with the objective of requiring developers to provide more effective measures to limit runoff from their properties, and thereby reduce capital expenditure in the main drainage and river systems. The Government will also make sufficient budgetary provisions to finance, in a timely manner, (i) the annual incremental O&M requirements for all Project facilities, calculated at 2 percent of the cost of civil works completed under the Project; and (ii) ongoing O&M requirements in the Klang River Basin. The appropriate level of funding will be reviewed periodically by the Project in consultation with the Bank.

## 4. Privatization of Solid Waste Management

52. The Government agreed that during the contract negotiations for nationwide privatization of solid waste management, the collection and disposal of river rubbish will be fully covered under the scope of the privatization contract to complement the Project's initiatives to reduce solid waste in the river systems.

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<sup>1</sup>

Asian Development Bank, *Involuntary Resettlement*, October 1995.

#### IV. THE PROJECT

##### A. Rationale

53. Serious environmental degradation and flood problems are experienced in the catchment areas as well as the floodplains of the Klang River Basin. The problems in both areas are worsening with the rapid changes in land use to meet the needs of population growth, urbanization, and industrialization. The major constraints have been the difficulty in achieving a coordinated approach among the agencies involved at various levels in river basin management, and inadequate planning and enforcement of existing guidelines, leading to environmental degradation. The problem of soil erosion and high suspended sediment content of the rivers in the Klang River Basin needs to be resolved, since erosion rates in the Klang River Basin are very high by both Malaysian and international standards. It is likely that excessive sedimentation of the rivers in the Basin, estimated at approximately 1.2 million t per year, will continue for a considerable period unless effective land use planning, watershed management, and specific erosion control strategies are implemented. Annual environmental quality reports list the Klang River as among the most polluted rivers in Malaysia. Pollution is compounded by the presence of squatter settlements along the river. Floating debris in the rivers remains a problem despite general improvement in the solid waste collection service, with an average of about 30 t per day of solid waste collected daily from river trash booms.

54. Flooding, which is made more severe by environmental deterioration in the Basin, is a major constraint to economic activities. It causes loss of life, property damage, disruption of economic activities, and poses health hazards; it also increases the costs and risks of economic investments. Average annual losses from flood damage and disruption in the Klang River Basin are currently estimated at \$13 million.

55. To improve environmental conditions in the Klang River Basin, and control soil erosion and water runoff, there is a need for an IRBM program that strengthens coordinated land use and land use planning, legislative and regulatory measures, monitoring and enforcement, and specific soil erosion and water runoff control strategies. There is a need to improve existing solid waste collection and disposal operations in the local authority areas, to assist the local authorities to remove solid waste in presently unserved areas, to strengthen public education campaigns, and to ensure that the privatization of solid waste disposal meets the Government's objective of reducing uncollected solid waste. There is a need to improve sediment removal from rivers draining into the Klang River to reduce the impact of flooding and the disruption of economic activity. Improved flood mitigation infrastructure is also required to provide a degree of flood immunity that minimizes the flood damage and economic losses currently experienced in the Klang River Basin. Losses due to flooding can be further reduced by improving the flood forecasting and warning system.

56. In the 7MP, the Government has accorded high priority to provision of adequate social and physical infrastructure to support private sector-led expansion of the economy, address environmental problems, and mitigate flooding in the Project area. The improvement of environmental management and provision of flood mitigation infrastructure is critical to long-term, sustainable economic development in the Klang River Basin. Experience gained from the implementation of previous programs has indicated that effective solutions depend on a combination of structural and nonstructural measures. An IRBM program has to be adopted to control soil erosion and reduce runoff rates; to introduce proper floodplain and urban development management; to coordinate and improve water quality control, beautification of river corridors, solid waste management, and flood forecasting and warning; and to continue resettlement of squatters from river reserves.

57. The proposed Project provides an opportunity for the Bank to play a catalytic role in improving the current approach to environmental improvement in the dynamic and rapidly changing area of the Klang River Basin. To mitigate environmental and flood problems in the Basin now and in the future, the Project will introduce an integrated approach involving the comprehensive and coordinated management of river systems and their basins to foster the maintenance of a sound environment while meeting socioeconomic development objectives. The Project will integrate the three ongoing Government projects for cleaning up the Klang River, flood mitigation, and private sector initiatives under a single program to provide a stronger focus on environmental improvement of the Basin, minimize overlapping, provide more cost-effective and long-term flood protection measures, and improve administrative efficiency. The Bank's policy dialogue with the Government has led to policy changes that will enhance the sector's efficiency (paras. 48 to 52), including (i) an integrated approach to environmental improvement and flood mitigation, (ii) resettlement of squatters, (iii) recovery of capital and O&M costs, and (iv) solid waste management. The Project objectives complement the Bank's strategy for the environmental improvement and flood mitigation sector in Malaysia (see para. 47).

## **B. Objectives and Scope**

58. The overall objectives of the Project are to (i) improve environmental conditions, including those that worsen flooding, through an IRBM approach that addresses environmental and economic development needs; and (ii) minimize the adverse economic, social, and environmental impacts of flooding in the Klang River Basin. Specifically the Project will (i) implement IRBM and solid waste management to improve water quality and enhance the Klang River Basin environment; and (ii) provide a high level of flood protection to tributary river and downstream communities through the provision of flood mitigation measures, and an improved flood forecasting and warning system. Project interventions will lead to reduced soil erosion, cleaner rivers that can be used for recreational purposes, and reduced damage and disruption from flooding in the Klang River Basin. The Project seeks to contribute to a significant reduction in total soil erosion in the Klang River Basin from 2.3 million t annually to 1.5 million t by the year 2003, and to reduce the suspended sediment load of the lower Klang River to achieve a class III standard of 150 milligrams of suspended sediments per liter. Preservation of the MWSS will result in annual carbon sequestration of 19,800 t, and tourism, biodiversity, and flood retardation benefits valued at \$0.4 million in 2003. Solid waste levels in the river systems will be reduced by 30 percent, from 11,000 t to 7,700 t per year by 2003. About 130,000 m<sup>3</sup> of river sediment will be trapped annually. Flood warnings will be issued no less than three hours prior to flood events caused by main rivers overflowing their banks. About \$17 million worth of property damage and disruption losses due to floods will be saved from 2003 onward in the Basin under the Government's overall environmental improvement and flood mitigation program, and expected losses of \$6 million will be directly saved by the Project. The higher level of flood protection will also improve the health and well-being of residents in the currently flood-prone areas, and improve aesthetic and recreational values of the rivers. In tributary rivers, fish life will be increased by 20 percent and water pollution reduced by 50 percent by 2003.

59. The primary focus of the Government's overall Klang River Basin environmental improvement and flood mitigation program is on river flood mitigation and drainage generally. The focus of the proposed Project is on environmental improvement, and tributary river flood mitigation components of the program. The Project comprises three components that directly address environmental improvement needs including (i) IRBM, (ii) solid waste management, and (iii) sediment trapping; and two flood mitigation components with environmental aspects including (i) tributary river corridor improvement, and (ii) an improved flood forecasting and



warning system. The objectives and components of the Project are described in detail in the Project Framework in Appendix 1.

## **1. Environmental Improvement**

### **a. Integrated River Basin Management**

60. A key to the success of the IRBM component will be the integration of the IRBM program with statutory processes as well as with the overall Basin environmental improvement activities currently under implementation. The IRBM component will seek improvements in land use planning, legislation, monitoring, enforcement, and specific soil erosion and flood runoff control strategies targeting, in particular, inappropriate land development. The initial steps in the process will be to integrate the three ongoing environmental improvement and flood mitigation programs in the Basin through the integration of the existing multiagency Task Force for the Klang River Cleanup Program into the Program Steering Committee<sup>1</sup> (see para. 76). The existing Executive Committee and working committees under the Task Force will also be used in an integrated fashion, and will include additional working committees to implement IRBM and flood mitigation activities. Consultants will study institutional arrangements at the outset of the Project, and make recommendations for improving coordination, including the possible creation of a permanent institutional arrangement for IRBM to assume the responsibilities of the river basin management working committees.

61. In addition to the study of institutional arrangements to improve coordination, five other major activities will be implemented under the IRBM component. The first will be final selection of three subcatchments in the Klang River Basin having the greatest risk of erosion, and sedimentation problems. Management plans will be prepared for each of the subcatchments. The plans will be prepared by the consultants in consultation with local IRBM groups composed of community leaders, local government authorities, and representatives from the private sector. Demonstration projects will be undertaken at each of these subcatchments to test and illustrate how engineering and vegetative techniques can be effectively implemented to decrease soil erosion and rainfall runoff in urban development projects. Detailed erosion and runoff control guidelines will be prepared.

62. Second, from experience gained in the subcatchments and the results of the study of institutional arrangements, the consultants will prepare a strategic IRBM plan for the Basin as a whole. The plan will complement existing local and regional plans by integrating relevant portions of the plans into an overall river basin plan that will articulate a preferred land use configuration for the Basin for the year 2010, and enunciate specific objectives and implementation criteria to attain such a configuration.

63. Third, training and public participation will be key aspects of the IRBM component. The subcatchment demonstration projects will be used as training sites for local authority officers from throughout the Basin who are responsible for enforcement of environmental legislation pertaining to urban development. Similarly, local planners, designers, contractors, and developers will be brought to the sites to become familiar with the range of the required soil conservation and rainfall runoff minimization measures, and how they can be effectively implemented. Visits to the sites will be complemented by workshops and seminars.

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<sup>1</sup> The Program Steering Committee is so titled to indicate that it will not only act as the Project Steering Committee, but also have responsibility for all of the Government's integrated Klang River Basin environmental improvement and flood mitigation program activities, including private sector developments.

64. Fourth, the major subprograms of the Klang River Cleanup Program will be included in the IRBM component. River landscaping will be undertaken based on the landscape master plan for the Klang River. Setbacks on selected portions of the river reserves will be created, landscaped, and modified to serve as recreational sites. Public education campaigns will be supported to promote the concept of IRBM, and, more specifically, the urgent need for control of erosion and solid waste. Fish life will be rehabilitated in the rivers, piggery wastes will be controlled, and the water pollution control program will be supported through the Program working committees. Consulting services will be required in the fields of watershed and natural resource management, land use planning, soil erosion and rainfall runoff control, institutional strengthening, public participation, and hydrology.

65. Fifth, the MWSS, covering an area of approximately 1,800 ha and one of the last remnants of lowland swamp forest in the region, will be protected from land development activities and landfilling to preserve its ecological integrity (see paras. 13 and 14). The Selangor State government is currently working to designate the MWSS as a Ramsar Site to provide international recognition of the MWSS's ecological importance, and to gazette the MWSS as a forest reserve area. The Project will support additional studies of the MWSS to clarify the expected impacts of development in adjacent areas on the MWSS, and to recommend any additional measures that may be required to protect the MWSS's ecological functions.

#### **b. Solid Waste Management**

66. The Project will strengthen solid waste management along the river system to enhance the rivers' environmental quality. Seven automated trash booms will be provided to improve the system of rubbish collection on the rivers. Local authorities will be responsible for improvements in the system of trash collection in squatter areas using bins and collection equipment. The Project will assist the local authorities by providing 1,200 trash bins and improving access roads to squatter areas for trash collection. Management of the systems will be turned over to the local authorities after five years. Consulting services will be provided in mechanical, civil, and electrical engineering to install the automated trash booms. A key initiative of the component will be a public awareness campaign to complement the trash collection improvements and to reduce solid waste dumped into the river. Incremental operating costs incurred in implementing the improved trash collection service will also be funded for five years, before the responsibility is handed over to local authorities, to ensure that the program is effectively established and that local authorities are adequately involved and consulted prior to the handover. The Project solid waste working committee will monitor and coordinate closely with the new Government agency regulating the privatized solid waste program to ensure that uncollected solid waste levels are reduced.

#### **c. Sediment Trapping**

67. Given the pace of development in the Klang River Basin, sedimentation levels in the Klang River and its tributaries are likely to increase significantly unless suitable land use planning and erosion control strategies are implemented. While the overall objective should be to limit sediment flow into the rivers by more effective management of the catchments, a system of siltation basins (sediment traps) such as those currently being utilized to remove sediment from the river systems is regarded as the least-cost measure to reduce the costs and disruption caused by the need for desilting the entire length of the rivers. The use of sediment traps or ponds needs to be expanded and rationalized to achieve maximum benefits. A total of 12 sediment traps are planned as part of the Klang River environmental improvement and flood mitigation program. The Project will provide support for the construction of four sediment

traps or ponds on the Kerayong, Kuyoh, Penchala, and Damansara rivers. The Government will finance the land acquisition necessary under this component. Consulting services will be provided in sediment transport, hydraulics, and structural and civil aspects to assist DID in design and construction supervision.

## **2. Flood Mitigation**

### **a. Tributary River Corridor Improvement**

68. The Project will provide for improvement of 28.6 km of tributary rivers, construction of three bridges on the tributaries, and widening of selected river reaches to provide the area needed for beautification and recreational improvements. The tributaries to be improved include the Gombak (9 km), Keroh (3 km), Kemusing (2.5 km), Kuyoh (5.5 km), Ampang (3.2 km), Gisir (1.4 km), Bohol (0.8 km), and Kerayong rivers (3.2 km). Of the three bridges to be constructed under the Project, one is located on the Gombak River and two are on the Keroh River. The proposed tributary river corridor improvement interventions will provide the Basin with a very high level of flood immunity, with protection against a 100-year flood return period by increasing flood conveyance capacities; provide additional allowances for siltation; reduce riverbank soil erosion; and contribute to improved river aesthetic values, recreational values, public health, and public safety.

69. The proposed improvements are part of the Government's program of tributary river improvement that envisages a total of 80 km of channel improvement in 23 tributaries. Improvement of 33 km has been completed, while improvement of 14 km of river reaches is ongoing. The Government has already completed the design of improvements to the Keroh and Bohol rivers to be implemented under the Project. Implementation of improvements in these two rivers will be started in the first year of implementation. For other river reaches and bridges, the required surveys, investigations, and designs will be undertaken under the Project. For this purpose, and to supervise the construction, the Project has provided engineering consulting services.

70. The improvement and widening of the river corridors and construction of the three bridges will necessitate relocation of about 640 families, most of whom are squatters. Owners with legal titles to land and structures that need to be acquired will be compensated at prevailing market prices. Squatter families with houses and other structures will be resettled in accordance with the Government's Resettlement Plan for the Klang River flood mitigation program. The Resettlement Plan complies with the Bank's policy on involuntary resettlement.

### **b. Flood Forecasting and Warning System**

71. The Project will significantly improve the existing flood forecasting and telemetry system established in the Federal Territory DID in 1978. The Project will provide for (i) enhancement of area coverage and improvement of equipment, (ii) establishment and calibration of a flood routing model, and (iii) training and information dissemination. These improvements will minimize the flood damage to private and public assets, and disruption to public transportation, with flood warnings issued no less than three hours prior to a flood event. The improvements will also contribute to the optimal operation of the whole Klang River system, including the existing Klang Gates and Batu Dams in association with the Batu retention pond, enabling them to function as water resource storage reservoirs as well as flood mitigation facilities.

72. Under the Project, a new master station and three submaster stations will be constructed; and river gauging and rainfall recording equipment, telemetric system equipment, and flood routing software will be procured. The geographic coverage of the system will be increased by installing three new river gauging stations, and 35 new rainfall recording stations. In addition, four existing river gauging stations and 15 rainfall recording stations will be improved; and all river gauging and rainfall stations will be connected telemetrically to the master station and submaster stations. A flood routing computer model will be procured and calibrated during the first year. The model will be refined during the second and third years of implementation. After successful refinement of the model in the third year, a seminar will be conducted to disseminate information to the administrators of emergency relief, town planners, local authorities, and representatives of residents of the river corridors. The model will then be used by the Federal Territory DID for normal operations at the end of the third year of Project implementation. International consulting services will be provided in the fields of hydrologic modeling, and meteorological equipment and telemetry. Domestic consultants will be recruited in the fields of hydrology, structural engineering, and construction engineering. Training of DID staff responsible for running the model will also be provided by the domestic consultants.

### C. Cost Estimates

73. The total Project cost (including interest and commitment charge on the proposed loan during construction) is estimated at \$101.8 million equivalent, comprising a foreign exchange component of \$40.2 million (40 percent of the total cost) and a local cost of \$61.6 million equivalent. Cost estimates are summarized in Table 1 and details are presented in Appendix 2.

**Table 1: Cost Estimates**  
(\$ million)

Item	Foreign Exchange	Local Currency	Total Cost
<b>A. Base Cost<sup>a</sup></b>			
1. Integrated River Basin Management	3.0	10.5	13.5
2. Solid Waste Management	3.7	4.6	8.3
3. Sediment Trapping	0.8	2.4	3.2
4. Tributary River Corridor Improvement	19.1	35.0	54.1
5. Flood Forecasting & Warning	1.1	0.5	1.6
<b>Subtotal (A)</b>	<b>27.7</b>	<b>53.0</b>	<b>80.7</b>
<b>B. Contingencies</b>			
1. Physical <sup>b</sup>	3.6	4.7	8.3
2. Price <sup>c</sup>	2.0	3.9	5.9
<b>Subtotal (B)</b>	<b>5.6</b>	<b>8.6</b>	<b>14.2</b>
<b>C. Interest During Construction</b>	<b>6.9</b>	<b>0.0</b>	<b>6.9</b>
<b>Total</b>	<b>40.2</b>	<b>61.6</b>	<b>101.8</b>
<b>Percent</b>	<b>40</b>	<b>60</b>	<b>100</b>

<sup>a</sup> Including taxes and duties estimated at \$9.5 million equivalent.

<sup>b</sup> At 15 percent for civil works, and 5 percent for other expenditure accounts.

<sup>c</sup> At 6.0 percent annually for 1997 to 2002 for local currency costs, and 2.7 percent annually for the same period for foreign exchange costs.

## D. Financing Plan

74. It is proposed that the Bank provide a loan of \$26.3 million, or about 26 percent of the total Project cost, which will cover 65 percent of the foreign exchange costs.<sup>1</sup> The proposed Bank financing will be provided through a loan from the Bank's ordinary capital resources. The Borrower will be Malaysia. The proposed Bank loan will have an amortization period of 15 years, including a grace period of 6 years, with an interest rate calculated in accordance with the Bank's pool-based variable lending rate system for US dollar loans, and a commitment charge of 0.75 percent per annum. The Government will provide the remaining funds required for Project implementation, including local currency costs, and the foreign exchange cost of price escalation, physical contingencies, interest during construction and commitment charge of \$6.9 million equivalent. A summary of the financing plan is shown in Table 2, with details in Appendix 2.

**Table 2: Financing Plan**  
(\$ million)

Source	Foreign Exchange	Local Currency	Total Cost	Percent
Bank	26.3	0.0	26.3	26
Government	13.9	61.6	75.5	74
<b>Total</b>	<b>40.2</b>	<b>61.6</b>	<b>101.8</b>	<b>100</b>

## E. Implementation Arrangements

### 1. Organization

75. The Ministry of Agriculture (MOA) will be the Executing Agency (EA), with DID being responsible for the planning, organization, management, and implementation of the Project. A Program Management Unit (PMU) will be established within DID to carry out Project activities, including coordination of benefit monitoring and evaluation (BME), and environmental impact monitoring with concerned agencies such as DOE. The Director of the DID Federal Territory/Klang River Basin Flood Mitigation Project will assume the role of Program Director of PMU, assisted by additional suitably qualified and experienced staff. The existing working committees supervising the implementation of the three ongoing programs in the Klang River Basin will be responsible for implementing the Project components, and new working committees will be established to carry out IRBM, and flood mitigation activities in association with local government authorities. The organization charts of DID and the Project are shown in Appendix 3.

### 2. Project Coordination

76. The existing Task Force for the Klang River Cleanup Program will be integrated into the Program Steering Committee (PSC). The PSC will provide guidance and direction for Project implementation, and coordination with concerned agencies. The PSC will be cochaired

<sup>1</sup> The Bank will not finance the foreign exchange costs of river cleanup activities, and operating costs.

by the Secretary General of MOA and the State Secretary of Selangor, or their designated representatives. The other members of the PSC will include representatives from the Implementation Coordination Unit and Economic Planning Unit of the Prime Minister's Department, the Ministry of Finance, FTKVDD, DID, DOE, Ministry of Housing and Local Government, Ministry of Health, Department of Fisheries, Department of Information, Department of Veterinary Services, Selangor State government, DBKL, and the seven relevant local authorities. The PSC will meet at least once every six months during the Project implementation period. It will be assisted by a Program Executive Committee, chaired by the Director General of DID or a designated representative. The existing Executive Committee of the Klang River Cleanup Program will be integrated into the Program Executive Committee. Coordination of activities that are being undertaken by local authorities and the private sector, such as solid waste management for example, will be the responsibility of the PMU, in cooperation with the relevant Project Working Committee.

### **3. Participatory Approach**

77. To ensure beneficiaries' participation in the Project design, the residents of flood prone areas were consulted at various stages during Project preparation. The participatory process will continue during Project implementation. Before finalizing the delineation of channel alignment, sites of sediment traps, and the location and design of major infrastructure, local residents will be consulted to ensure that the planned flood mitigation facilities can render their design function. In selecting resettlement sites, further surveys of squatters and existing residents will be made, taking into account the resettlement sites' access to places of employment, schools, hospitals, and markets. The concerned jurisdictions have considerable experience in resettlement, and established procedures for consultation, assessment, notice, appeals, coordination, and monitoring. Resettlement will be carried out by the local authorities with close supervision by DID to ensure that established procedures are followed.

78. Participation in the IRBM component will be fostered through establishment of local groups at each of the subcatchment demonstration sites. The groups will include representatives from community groups, the private sector, and local authority agencies. Interaction with residents of the subcatchments will also be undertaken through the public education campaigns.

### **4. Implementation Schedule**

79. It is envisaged that the Project will be implemented over a period of six years. As advance action has already been undertaken by DID, the major construction works are expected to be completed by the end of 2002. The implementation schedule of the Project is shown in Appendix 4.

### **5. Procurement**

80. All procurement for the Project financed under the Bank loan will be carried out by DID in accordance with the Bank's *Guidelines for Procurement*. Contracts for civil works estimated to cost \$5.0 million or more, or equipment valued at \$500,000 or more, will be awarded on the basis of international competitive bidding (ICB). Civil works contracts of less than \$5.0 million will be carried out by contractors selected through local competitive bidding (LCB) in accordance with standard Government procedures acceptable to the Bank. For LCB contracts exceeding \$2 million equivalent, selection and engagement of contractors will be subject to prior approval of the Bank.

81. Supply contracts for equipment costing less than \$500,000 equivalent will be carried out using international shopping procedures. Supply contracts for vehicles less than \$500,000 equivalent will be carried out under standard procurement procedures of the Government, provided that the Bank is satisfied that (i) the contract is awarded on a competitive basis, and (ii) the vehicle concerned is produced and supplied from a Bank member country. This arrangement is necessary because the annual vehicle requirements of all Government departments are tendered together once a year.

## 6. Consulting Services

82. Consulting services will be provided under the Project to assist DID in design and implementation of all five Project components. As competent domestic expertise is available, the Government intends to use domestic consultants to carry out the Project components to the extent possible, assisted by international consultants. It is estimated that a total of 1,159 person-months of domestic consultants of various expertise (including 777 person-months of subengineers) will be engaged as part of a single contract for international and domestic consultants.

83. A total of 61 person-months of international consultants will be recruited to assist the Government: (i) 34 person-months for IRBM, (ii) 7 person-months for solid waste management, (iii) 2 person-months for sediment trapping, (iv) 9 person-months for tributary river corridor improvement, and (v) 9 person-months for the flood forecasting and warning system. The total of 1,220 person-months of foreign and domestic consultants will be provided in one contract by an international consulting firm in association with domestic consultants. The consultants will be recruited in accordance with the Bank's *Guidelines on the Use of Consultants*. The outline terms of reference for domestic and international consultants are indicated in Appendix 5.

## 7. Advance Action and Retroactive Financing

84. In response to a request from the Government, the Bank has approved advance action and retroactive financing, in principle, of an amount not exceeding \$2 million in connection with the procurement of civil works, equipment, and consulting services. Since tributary flood mitigation work is in progress, activities associated with environmental improvement are urgently needed, and planned works are to be implemented on a tight schedule that is aligned to the critical path for completion of other major infrastructure projects in the Basin. The Government has been advised that approval of advance action and retroactive financing does not commit the Bank to finance the Project or relevant expenditures of the Project. All advance procurement action will be undertaken in accordance with the Bank's *Guidelines for Procurement* and *Guidelines on the Use of Consultants*. Withdrawals from the loan account may be made for reimbursement of reasonable expenditures incurred under the Project before the date of loan effectiveness, but not earlier than 11 September 1996.

## 8. Loan Disbursement Arrangements

85. The operating and development funds for the Project will come from the Federal Government's annual budgetary allocations, and will be channeled to the relevant implementing agencies, as has been the practice in previous Bank-financed projects. The accounting capability of DID was examined from its performance in three ongoing Bank-financed projects. It was found that DID is capable of adopting the statement of expenditures procedure. It has been agreed that this procedure may be utilized for civil works contracts,

supply contracts for equipment or materials, or consulting services contracts provided that the individual payment for each contract does not exceed the equivalent of \$400,000. The withdrawal application for the loan proceeds would be submitted by DID.

## **9. Accounts, Audit, and Reports**

86. DID will prepare and promptly submit the following reports to the Bank under the Project: (i) quarterly progress reports upon completion of each quarter, (ii) audited financial statements not later than nine months after the close of each fiscal year, and (iii) a Project completion report within three months of physical completion of the Project. DID will have the Project expenditures audited by the Auditor General of Malaysia, or independent auditors whose qualifications, experience, and terms of reference are acceptable to the Bank.

## **10. Benefit Monitoring and Evaluation**

87. A baseline socioeconomic survey of the Project area was conducted as part of the resettlement studies. Further baseline studies will be coordinated by the PMU for solid waste management, sediment trapping, and tributary river corridor improvement to determine baseline conditions at the start of the Project. DID and DOE will use existing units conducting BME that will coordinate with the PMU to carry out BME of the environmental, economic, and socioeconomic impacts of the Project, including appropriate measures to minimize any adverse environmental impact during design, construction, and operation of the Project. During the Project implementation period, the PMU will prepare and submit to the Bank an annual BME report within six months after the close of the year to which the report relates. The annual BME report can be included in the quarterly progress report, if necessary. A BME impact study examining the benefits derived from the Project will also be prepared by DID within a period of two years from completion of the Project in accordance with terms of reference to be agreed upon by the Bank and DID. MOA and DOE will assist DID in carrying out these activities by providing the PMU with the required information.

## **11. Operation and Maintenance**

88. DID will be responsible for O&M of the Project facilities before transfer of that responsibility to the relevant agency. DID will make arrangements satisfactory to the Bank for transfer of that responsibility to the Selangor State DID, Federal Territory of Kuala Lumpur DID, and DBKL, and other relevant local authorities. Adequate revenue has in the past been allotted from the Federal and state budgets to cover the entire O&M cost of completed facilities, and DID will ensure that adequate revenue from the same budgets will be allocated by the concerned authorities to cover the entire O&M cost of the completed facilities. The respective agencies have the fiscal capacity to absorb the additional O&M burden.

89. The annual costs of collection and disposal of rubbish from trash booms and screens will be financed by the Government under the Project for five years, after which time they will be assumed by each local authority, and the costs will be incorporated into existing contracts, or local authority arrangements. These costs are expected to decrease after the Project as a result of Project interventions, such as the public education campaign, and improved collection services.

## **F. Executing Agency**

90. By mid-1996, MOA had been the EA for 11 Bank-financed agriculture sector projects, of which six are still being implemented. DID has implemented seven Bank-financed



flood mitigation, irrigation, drainage, and rural development related projects, out of which four are still ongoing. The performance of MOA and DID in implementing Bank-financed projects is satisfactory. DID has carried out flood mitigation projects since the early 1900s; this experience will enable it to carry out the planning, design, and construction supervision of the Project.

## **G. Environmental and Social Measures**

### **1. Environment**

91. The Project is classified as environmental category A. A detailed EIA carried out during the PPTA feasibility study was approved by the Government in October 1994. The summary EIA was circulated to the Board on 17 March 1995. The EIA study found that the proposed activities under the Project will have a significant, positive, long-term impact on the environment in the Klang River Basin ( see paras. 109 to 111).

92. The main adverse impacts of the Project are for the most part expected to be short term and localized. During the EIA study, changes in the alignment of the Klang River levee improvement works were made to conserve the few remaining areas of significant riverine and intertidal vegetation in the Project area, and provisions will be made to ensure that the MWSS and its associated forest reserve will be maintained. The Project's adverse impacts include (i) a minor increase in turbidity level during construction of earthworks, (ii) resettlement of about 640 families, (iii) temporary air and noise quality deterioration in local areas during construction, (iv) the short-term impact of traffic disruption during construction, (v) removal of minor areas of riverine trees, and (vi) a moderate and short-term increase in downstream turbidity levels caused by the operation of sediment traps. The latter, however, is not expected to significantly affect the coastal areas.

93. The BME unit of the PMU, in association with DOE, will undertake a comprehensive monitoring program, that will include (i) making a photographic record of existing conditions and establishing a data bank, (ii) liaising with local communities to ascertain remedial action to be undertaken as necessary, (iii) monitoring of water quality and turbidity levels adjacent to construction sites, (iv) monitoring the implementation of the Resettlement Plan, and (v) surveying river sediment content to monitor the impact of sediment traps.

### **2. Social Analysis**

94. It has been estimated that about 500,000 of the 3.3 million population<sup>1</sup> of the Klang River Basin live in flood-prone areas and will be the direct beneficiaries of the Project. Of these beneficiaries, about 190,000 are squatters. The total squatter population in the Klang River Basin is estimated at 420,000 people living in 70,000 dwellings. About 50 percent of the squatter population live along low-lying river reserve areas. Squatter settlements are generally haphazard, having only narrow access paths, lacking sanitation and utilities, and frequently suffering serious flood damage. More than 5,000 residents are usually evacuated from their homes at least three times each year. About 640 squatter families living within the river reserve areas are expected to be affected by works related to the proposed Project's tributary river corridor improvements, and will require resettlement.

<sup>1</sup>

Estimated from the 1991 census figures of 2.95 million, with 4 percent annual growth assumed.

95. The residents of the squatter settlements are generally from lower income groups, and surveys have shown that the total household income is normally less than \$600 (RM1,500) per month. Surveys indicate that the majority of the squatters are willing to be resettled, although some prefer to endure the periodic flooding as long as their residence is close to their work place and they do not have to pay any rental.

96. To ensure that squatter families are properly resettled in accordance with the Bank's policy on Involuntary Resettlement, the Government was requested to prepare a detailed Resettlement Plan for the Klang River Basin environmental improvement and flood mitigation program prior to appraisal. The Plan provides \$5.2 million for resettlement activities. The 640 squatter families to be resettled will be moved into accommodations in single- or two-story wooden frame buildings that have electricity, running water, and sewerage, and are far superior to those that they presently occupy. The resettlement arrangements generally include adequate provision to assist the Project-affected families to transport their household and personal effects to their new residence. The provisions of the Government's Resettlement Plan, and the Project's resettlement activities are fully in compliance with the Bank's policy on Involuntary Resettlement. Details of the Resettlement Plan are in Appendix 6.

## V. PROJECT JUSTIFICATION

### A. Economic Analysis

#### 1. Project Beneficiaries and Benefits

97. The major benefits of the Project are attributable to the impacts of environmental improvements, and reduction in flood damage and costs of traffic disruption, which provide direct, indirect, and nonuse benefits. The direct benefits of the Project include (i) the reduced cost of removing solid waste from rivers and riverbanks; (ii) reduced costs of removing sediment from the reaches of the Klang River; (iii) sale of sand from sediment ponds and traps; (iv) reduction in flood damage to residential houses, industrial enterprises, commercial enterprises, retail enterprises, schools, places of worship, agricultural crops, land, and public utilities such as roads; (v) savings in time from reduced traffic disruption and vehicle operating costs; and (vi) increased land values in areas provided with flood immunity. The Project's environmental benefits account for 60 percent of the total benefit stream, as indicated in Tables 1 and 2 of Appendix 7.

98. The direct economic benefits from the solid waste component are annual savings of \$1.2 million from the reduced cost of clearing solid waste from trash screens and rubbish booms; the amount of uncollected solid waste in the Project areas will be reduced by 30 percent to 105,000 t by 2003, and solid waste in the rivers will be reduced from 11,000 t to 7,700 t per year by 2003. Direct benefits from the sediment trapping component of the Project are estimated to be the reduction in annual sediment removal costs as a result of the operation of the four sediment removal ponds and traps to be constructed or improved by the Project. The four ponds and traps will trap 130,000 m<sup>3</sup> of sediment annually. The resultant reduction in sediment removal costs is valued at \$0.6 million annually. The sale of sand removed from the traps and ponds is valued at about \$0.2 million yearly. The annual economic benefits from improved flood protection, including the flood warning and forecasting system, are valued at about \$6.2 million in 2003. Incremental property benefits from improved flood protection are assumed to benefit 500 ha of property per year for five years, at an incremental value of about \$0.7 million per year.

99. In addition to the direct benefits, four types of indirect benefits from the Project are valued. Indirect benefits are estimated for the IRBM component as a result of improved land values owing to the control of soil erosion and rainfall runoff. These benefits are estimated for 30 percent (the critical erosion-prone lands) of the total Basin area at a value of \$130 per ha. Intangible benefits will accrue from the solid waste management component in terms of improved community health as a result of solid waste removal, primarily in squatter areas, markedly improved aesthetic value, and civic pride. These significant indirect benefits are valued at 50 percent of the value of the estimated direct benefits of the solid waste component. Estimated indirect benefits from the preservation of the MWSS are from its tourism and carbon sequestration values. It is assumed that 15,000 tourists per year will visit the MWSS starting in 2001, spending \$10 per person. It is assumed that without the Project, the MWSS would disappear at the rate of 300 ha per year. The annual carbon sequestration value of the MWSS with the Project is therefore estimated to be 11 t per ha for the MWSS area that is preserved, at a price of \$12.76 per t from 1990 to 2000, and increasing thereafter. A number of other significant indirect benefits generated by the Project, but are not included in the economic analysis include beautification and improved amenity of the rivers, the river corridors, and the Klang River Basin generally, including recreational and visual improvements. Water pollution control, fish life rehabilitation, public education programs, and the diffusion effect of the soil erosion demonstration projects of the IRBM component will also contribute benefits in terms of improved river amenity and catchment improvement. Unquantified benefits such as child safety, and improved health conditions as a result of reduction in waterborne diseases would also accrue from other components of the Project.

100. The MWSS and its associated forest reserve have significant ecological value, especially since it represents one of the last remnants of the lowland swamp forest in western peninsular Malaysia. The IRBM component will ensure that the MWSS is protected from further development, and prevent its irreversible loss. However, calculating the value of retaining an option to future uncertain alternative uses of the MWSS is difficult, and given data limitations, the "option value," although assumed to be substantial, has been conservatively estimated at \$15 per ha annually.

101. The major beneficiaries of the Project will be the residents of the Klang River Basin who are directly and indirectly affected by environmental degradation and flooding. The Government is a potential beneficiary not only from the savings in resources for rubbish collection, sediment removal, relief work during floods, but also from the higher tax revenues that will be generated from the increased value of land hitherto subject to soil erosion and flooding. Labor employment to be generated by the Project during implementation is estimated at about 12,300 person-months over five years. Other Project-created employment will be derived from erosion and soil conservation measures.

## **2. Economic and Sensitivity Analyses**

102. A substantial portion of the Project benefits are not evaluated; therefore the calculation of the economic internal rate of return (EIRR) underestimates the benefits of the Project, and should be considered as a conservative estimate. The Project is economically viable with an estimated EIRR of 14.9 percent. The detailed economic analysis is presented in Appendix 7.

103. A sensitivity analysis was undertaken to test the effect of the most likely variations in the estimated costs and benefits of the Project by assuming (i) a 10 percent increase in total Project costs, (ii) a decrease in benefits of 10 percent, and (iii) the combined effect of a 10 percent cost increase and a 10 percent decrease in benefits. The results indicate

that the EIRR's sensitivity to adverse changes in incremental benefits or incremental capital and recurrent costs is low. A 10 percent increase in costs will only reduce the base case EIRR from 14.9 percent to 13.4 percent, and a 10 percent decline in benefits will only reduce the EIRR to 13.3 percent. The more severe, but nonetheless possible, scenario — a combination of a 10 percent increase in costs and a 10 percent decrease in benefits — results in an EIRR of 12.0 percent, which is still relatively robust, given the severity of this assumption.

104. Calculation of switching values of the EIRR indicates that incremental costs could rise by 22.4 percent before the EIRR falls to 12 percent, indicating that the Project can withstand a reasonable increase in costs while remaining economically viable. The incremental benefits could also decrease by a reasonable amount of 18.3 percent before a 12 percent EIRR is reached. The sensitivity analysis indicates, therefore, that the Project's viability is more sensitive to reductions in assumed benefit levels than it is to cost increases, and that the Project can tolerate relatively large, unfavorable changes to its benefits and cost streams and still remain viable. In any case, the benefits, while realistic, have been conservatively estimated in the analysis, with several indirect use and nonuse benefits not evaluated.

### 3. Project Risks

105. Although the Project seeks to provide flood protection with levels of immunity to 100-year flood recurrence intervals for tributary areas, the flood risk still remains as the flood conveyance capacity is dependent on adequate maintenance of river channels, flood control structures and equipment, and drainage channels. The Government has provided assurances that adequate O&M budget will be allocated to local authorities and Federal Territory DID to maintain the flood conveyance capacities of the Klang River, its tributaries, and drainage systems at designed levels to reduce the risks of flooding.

106. The quantity of solid waste generated in the Klang River Basin is increasing because of rapid urbanization and industrialization. The Government expects privatization of solid waste management and the Project's support to local authorities for improved trash collection along the river corridor to result in a significant improvement in waste collection and disposal. However, there is a risk that the new Government department to be established under pending legislation to regulate the waste management consortium will not be fully successful in its regulatory functions. There is also a risk that the local authorities will not adequately undertake solid waste collection in squatter areas along the river corridor, but rather perceive this as the responsibility of the private sector consortium, and that the public education program will not be completely successful. In this regard, the Government has provided assurances that the solid waste management privatization program will be effectively regulated, and that adequate measures will be undertaken to collect and dispose of solid waste along the river corridors.

107. Another risk is the possibility of delays in the process of land acquisition and resettlement. Although sufficient budget for land acquisition will be provided and a detailed Resettlement Plan has been prepared in advance, problems that could delay implementation could emerge during negotiation of land prices and compensation in the construction areas. However, DID and the local implementing authorities have extensive experience in the application of the resettlement policies in place in Selangor State, and DBKL. Consultations with affected groups and individuals, including village heads and council members, are a part of the routine resettlement implementation process. Appeals and grievance procedures would be administered by local authority staff in full consultation with DID, using established and acceptable procedures for past and ongoing resettlement programs. The BME Unit under DID will monitor the progress of land acquisition and

resettlement. It is expected that social disruption will be avoided or minimized through close consultation, coordination, and monitoring.

108. The key to the success of the IRBM program will be the commitment of various levels of Government to the program's implementation, the degree of community support, and the integration of the program with statutory planning processes. Effective land controls are also critical in containing erosion and sedimentation to acceptable levels. The Government has given assurances that existing institutional arrangements will be reviewed by the Project consultants, and recommendations will be made to ensure that the necessary land use procedures and land use planning, legislation, monitoring, and specific erosion control strategies are introduced, improved, or continued. Local IRBM groups will also be established in demonstration subcatchments, and public education campaigns will be launched to increase awareness and participation in subcatchment management. The Government has assured that demonstration subcatchment management schemes will be replicated in other subcatchments of the Klang River Basin to improve soil erosion and rainfall runoff control, and for IRBM.

## **B. Environment**

109. The Project has a primary strategic development objective of environment, and is expected to have a significant positive long-term impact on the environment of the Project area. The Project was designed to incorporate many of the proactive and long-term environmental enhancement measures that have been lacking in the overall Klang River Basin environmental improvement and flood mitigation program.

110. The IRBM component, which accounts for 17 percent of the Project base cost, will provide support for the technical, regulatory, and hardware requirements necessary to correct and control improper land development that is causing serious soil erosion in the Basin area. The modalities for effectively managing the Basin's subcatchments will be tested in a phased manner and with full participation by beneficiaries so that there is a clear understanding of potential benefits and constraints before large-scale implementation is undertaken. This component is expected to result in a 35 percent decrease in soil erosion by the end of the Project period, reducing the sediment load in tributary rivers from 560,000 m<sup>3</sup> to 364,000 m<sup>3</sup> per year by 2003. Additionally, a riverside beautification subcomponent will improve the aesthetic conditions along the river by establishing river reserves. Fish life in tributary rivers will be increased by 20 percent and water pollution reduced by 50 percent by 2003.

111. The solid waste management component will enhance ongoing efforts by the Government to manage solid waste disposal in the Klang River. The activities will include public awareness and enforcement in addition to collection, and will have positive, long-term impacts on river aesthetics and the health of communities near the river. The sediment trapping component will complement IRBM efforts by removing excess sediment from the river. This action is expected to improve downstream water quality without adversely affecting coastal areas that rely on sediment to maintain their marine ecological conditions. The tributary river corridor improvement and flood forecasting and warning system components will also confer environmental and quality of life benefits related to reduced flooding. The Project will include a comprehensive environmental monitoring system that will allow relevant authorities to determine the effectiveness of these components and adapt to environmental and social changes as they occur (see para. 93).

### C. Social Dimensions

112. After completion of the Klang River Basin environment improvement and flood mitigation program, a total flood-prone area of 5,000 ha will be protected from flood events with a recurrence interval equal to or less than 100 years. The current flood immunity level in these areas is only for floods with a recurrence interval of 10 years. About 500,000 people will directly or indirectly benefit from the program, of which about 190,000 are squatters.

113. About 640 families (250 under DBKL's jurisdiction, and 390 in Selangor State) squatting on Government-owned land will be resettled by the Project. The resettlement will be coordinated by DID, and implemented by DBKL and Selangor State. The resettlement will be conducted in accordance with the Resettlement Plan that was prepared and agreed upon by DID, DBKL, and Selangor State, and is in accordance with the Bank's policy on Involuntary Resettlement.

114. About 100,000 urban residents living in low-lying areas but who do not suffer from flood damage will also benefit from the Klang River Basin flood mitigation program. These residents will not experience the same levels of inconvenience previously caused by restricted or difficult access to their houses, school, and working places during floods; disruption caused by heavy traffic jams; and increased travel time caused by even small local floods. The human development benefits of the Project include improved child safety with tributary river corridor improvements, including flood mitigation, and improved health conditions as a result of reduction in waterborne diseases.

## VI. ASSURANCES

115. The Government has given the following assurances, in addition to the standard assurances, which have been incorporated in the legal documents:

- (i) The PMU established within DID will carry out the day-to-day Project implementation activities, including BME, and environmental impact monitoring. The Director of the DID Federal Territory/Klang River Basin Flood Mitigation Project has assumed the role of Program Director of the PMU, and will be assisted by additional suitably qualified and experienced staff for efficient functioning of the PMU, to be assigned within three months of loan effectiveness.
- (ii) Within three months of loan effectiveness, the Government will establish a PSC within MOA to provide guidance and direction in Project implementation, and coordination of the Project by liaising with concerned agencies. The PSC will be cochaired by the Secretary General of MOA and the State Secretary of Selangor State, or their designated representatives. The other members of the PSC will include representatives from the Implementation Coordination Unit and Economic Planning Unit of the Prime Minister's Department, the Ministry of Finance, the FTKVDD, DID, DOE, Ministry of Housing and Local Government, Ministry of Health, Department of Fisheries, Department of Information, Department of Veterinary Services, the Selangor State government, DBKL, and the seven relevant local authorities.
- (iii) The Government will establish an IRBM Working Committee and a Flood Mitigation Working Committee to assist in implementing the IRBM component.

The existing Executive Committee and working committees under the Task Force for the Klang River Cleanup Program will assist the Program Director in the implementation of Program activities in an integrated fashion. Consultants will be recruited to recommend more permanent institutional arrangements for IRMB in both DID and Selangor State government.

- (iv) The Government will review and take necessary action to recover part of the initial investment, and total O&M cost of the Project facilities upon completion of the works.
- (v) DID will, through the PMU, carry out BME of the environmental, economic, and socioeconomic impacts of the Project, including implementation of measures to minimize any adverse environmental impact during design, construction, and operation of the Project.
- (vi) DID will be responsible for O&M of the Project facilities until transfer of such responsibility to the relevant agencies. DID will make arrangements satisfactory to the Bank for the transfer of its responsibility for O&M of the Project facilities to the Selangor State DID, Federal Territory of Kuala Lumpur DID, DBKL, and other relevant authorities.
- (vii) The Government will make sufficient budgetary provisions to finance, in a timely manner, (a) the annual incremental O&M requirements for all Project facilities, calculated at 2 percent of the cost of completed civil works; and (b) ongoing O&M requirements in the Klang River Basin. The appropriate level of funding will be reviewed periodically by the PMU in consultation with the Bank.
- (viii) The Government will closely supervise the implementation of the Resettlement Plan, including the procedures for preparation, consultation, assessment, notice, appeals, and coordination.
- (ix) The Government will ensure that the ecological integrity and flood retention capacity of the MWSS will be preserved, including protection from land development activities, landfilling, and illegal logging.
- (x) The development schemes on the embankments of the Klang River and its tributaries within the Federal Territory of Kuala Lumpur and Selangor State, including those for environmental and flood mitigation improvement, will continue to be subject to the review and approval of DID. The Government will provide environmental and river management guidelines, and will monitor private companies in charge of river channel improvement, sediment trapping, sewage treatment, and solid waste management programs for the Klang River system during Project implementation to ensure their effectiveness. The Government will also ensure that water quality and river corridors will be sufficiently improved for recreational use of the river corridors within three years of Project completion.
- (xi) DID will implement soil erosion and rainfall runoff control demonstration schemes in selected subcatchments, and will establish local IRBM groups at each of the demonstration sites. These groups will comprise community leaders, representatives from the private sector, and local authorities to provide input in the preparation of subcatchment management plans. The Government will

replicate the subcatchment demonstration schemes in other subcatchments of the Klang River Basin to improve soil erosion and rainfall runoff control, and IRBM.

- (xii) The Government will effectively regulate the solid waste management privatization program and ensure that adequate measures will be undertaken to collect and dispose of solid waste along the river corridors.
- (xiii) The Government will take necessary action, through local authorities, to enforce penalties on illegal deforestation, encroachment on forest reserves and swamps in the Klang River Basin, and illegal disposal of solid and liquid wastes into the rivers of the Klang River Basin.

## VII. RECOMMENDATION

116. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Bank and recommend that the Board approve the loan of \$26.3 million to Malaysia for the Klang River Basin Environmental Improvement and Flood Mitigation Project from the Bank's ordinary capital resources, with interest to be determined in accordance with the Bank's pool-based variable lending rate system for US dollar loans and with an amortization period of 15 years, including a grace period of 6 years, and such other terms and conditions as are substantially in accordance with those set forth in the draft Loan Agreement presented to the Board.

MITSUO SATO  
President

11 November 1996



## APPENDIXES

<b>Number</b>	<b>Title</b>	<b>Page</b>	<b>Cited On (page,para.)</b>
1	Project Framework	34	16,59
2	Project Cost Estimates	39	20,73
3	Organization Charts	44	21,75
4	Implementation Schedule	46	22,79
5	Terms of Reference for Consulting Services	47	23,83
6	Summary Resettlement Plan for the Klang River Basin Environmental Improvement and Flood Mitigation Project	54	26,96
7	Economic Analysis	57	26,97

## SUPPLEMENTARY APPENDIXES

(available upon request)

A	External Assistance to Malaysia
B	Integrated River Basin Management
C	Flood Forecasting and Warning System
D	Procurement Arrangements

## PROJECT FRAMEWORK

Design Summary	Targets	Project Monitoring Mechanisms	Risks/Assumptions
<b>1. Goals</b>  <b>1.1</b> To improve environmental conditions, including those that worsen flooding, through an integrated river basin management approach that addresses environmental and economic development needs.	<ul style="list-style-type: none"> <li>Total soil erosion in the catchment area will be reduced from 2.3 million tons (t) per year to 1.5 million t per year by 2003.</li> <li>Watershed conditions generally improved, including preservation of the 1,800 hectare (ha) Malaysia Wetland Sanctuary, Selangor (MWSS), which has significant ecological value.</li> <li>Uncollected solid waste reduced by 30 percent from 150,000 to 105,000 t per year by 2003.</li> <li>River water quality and fish life in the rivers improved, and recreational and aesthetic value of river corridors increased.</li> </ul>	<ul style="list-style-type: none"> <li>Baseline socioeconomic surveys undertaken as part of the Project Preparatory Technical Assistance (PPTA).</li> <li>Annual Report of Kuala Lumpur City Hall (DBKL)</li> <li>Department of Environment (DOE) Annual Report</li> <li>Ministry of Agriculture (MOA) annual report</li> <li>PPTA Watershed Management Study Report</li> <li>Environmental Improvement Plan Report</li> <li>Annual Report of the Federal Territory and Klang Valley Development Division</li> </ul>	<ul style="list-style-type: none"> <li>The Project is accorded high priority and the Government budgets adequate funds.</li> <li>An effective institutional structure for integrated river basin management is established.</li> <li>Demonstration subcatchment management projects are successfully replicated and other environmental improvement programs are adopted and sustainably operated.</li> <li>Adequate operation and maintenance (O&amp;M) funding is provided and flood control works are maintained and managed on a sustainable basis.</li> </ul>
<b>1.2</b> To minimize the adverse economic, social, and environmental impacts of flooding in the Klang River Basin.	<ul style="list-style-type: none"> <li>About \$17 million worth of losses due to floods in the Klang River Basin will be avoided annually from 2003 onward as a result of the overall Klang River Basin environmental improvement and flood mitigation program.</li> </ul>	<ul style="list-style-type: none"> <li>Benefit Monitoring and Evaluation (BME) reports</li> <li>Project Completion Report (PCR)</li> <li>Project Performance Audit Report (PPAR)</li> </ul>	<ul style="list-style-type: none"> <li>Coordination between the various agencies involved in the Project is effective.</li> </ul>
<b>2. Objectives</b>  <b>2.1</b> To implement integrated river basin and solid waste management to improve water quality and enhance the Klang River Basin environment.	<ul style="list-style-type: none"> <li>In total, about 630,000 cubic meters (m<sup>3</sup>) of sediment will be trapped annually, of which 130,000 m<sup>3</sup> will be due to Project sediment traps, and the sediment load in tributary rivers will be reduced by 35% from about 560,000 m<sup>3</sup> to 364,000 m<sup>3</sup> per year by 2003 to achieve class III standard in the Klang River.</li> <li>Soil erosion loss will be reduced by 35 percent from the existing level of 30 t to 19.5 t per ha per year by 2003.</li> </ul>	<ul style="list-style-type: none"> <li>Baseline socioeconomic surveys undertaken as part of the PPTA.</li> <li>DBKL annual report</li> <li>DOE annual report</li> <li>MOA annual report</li> <li>BME reports</li> <li>Integrated River Basin Management Plan reports</li> </ul>	<ul style="list-style-type: none"> <li>Integrated catchment management and other environmental and flood mitigation measures undertaken in a timely manner.</li> <li>Public cooperates in solid waste management program.</li> <li>100-year return flood may occur before Project completion resulting in significant flood damage.</li> </ul>

Design Summary	Targets	Project Monitoring Mechanisms	Risks/Assumptions
<p>2.2 To provide a high level of flood protection to tributary river and downstream communities through the provision of structural flood mitigation measures.</p>	<ul style="list-style-type: none"> <li>Reduction in estimated uncollected solid waste by 30% from 11,000 t per year to 7,700 t per year by 2003.</li> <li>19,800 t of carbon sequestered annually by the MWSS, and biodiversity preserved.</li> <li>Fish life in tributary rivers increased by 20% and water pollution reduced by 50% by 2003.</li> <li>River corridors will be made suitable for recreational activities and aesthetic value improved.</li> <li>An amount of about \$6.2 million in losses from property damage, disruption of transport, and business activities will be saved annually by the Project from 2003.</li> </ul>	<ul style="list-style-type: none"> <li>PCR</li> <li>PPAR</li> </ul>	<ul style="list-style-type: none"> <li>River corridor improvement measures will be implemented on time.</li> <li>Land acquired and squatters compensated and resettled without delays.</li> <li>Adequate O&amp;M of sediment traps occurs and ponds are available for use as traps.</li> </ul>
<p><b>3. Project Components</b></p> <p>3.1 Integrated River Basin Management (IRBM)</p>	<ul style="list-style-type: none"> <li>Planning and coordination of Klang River Basin improved through integration of three ongoing environmental improvement and flood mitigation programs, revised institutional arrangements, training in IRBM techniques, and monitoring and enforcement.</li> <li>Prepare strategic IRBM plan for the Basin and implement the plan.</li> <li>Implement three demonstration IRBM projects.</li> <li>Implement river corridor beautification, fish life rehabilitation, public education, and water pollution control programs.</li> </ul>	<ul style="list-style-type: none"> <li>Project progress reports</li> <li>Loan review missions</li> <li>BME reports</li> <li>Initial, midterm, and end of Project surveys</li> <li>Annual reports of executing and implementing agencies</li> <li>IRBM reports</li> </ul>	<ul style="list-style-type: none"> <li>Community support for IRBM groups is strong, and recommendations of groups are implemented.</li> <li>Conservation laws in the catchment area are effectively enforced.</li> </ul>

Design Summary	Targets	Project Monitoring Mechanisms	Risks/Assumptions
<p>3.2 Solid Waste Management</p> <p>3.3 Sediment Trapping</p> <p>3.4 Tributary River Corridor Improvement</p> <p>3.5 Flood Forecasting and Warning System</p>	<ul style="list-style-type: none"> <li>Designate the MWSS as a Ramsar Site, and gazette the protection of the MWSS.</li> <li>Implement special solid waste collection services for currently underserved areas.</li> <li>Install seven mechanical trash booms.</li> <li>Improve and clear rubbish booms and trash screens.</li> <li>Four sediment traps constructed or improved by 2000.</li> <li>Eight tributary corridors improved by 2002.</li> <li>Three bridges constructed by 1999.</li> <li>About 640 squatter families relocated by 2001.</li> <li>Improve flood warning system to provide warning not less than 3 hours before flood occurs by 1999.</li> </ul>		<ul style="list-style-type: none"> <li>Privatization program works effectively and concerned consortium is adequately monitored.</li> <li>Land acquired, and consultants recruited without delays.</li> <li>Government has adequate experience in land acquisition and relocation of squatters to minimize delays.</li> <li>Competent consultants and contractors are appointed.</li> <li>No delays in payments to contractors or in procurement occur.</li> <li>Reliability of predictions is sufficient to gain public support.</li> </ul>
<p>4. Activities</p> <p>4.1 Integrated River Basin Management</p> <ul style="list-style-type: none"> <li>Institutional structure for IRBM: <ul style="list-style-type: none"> <li>- establish IRBM working committee,</li> <li>- recruit consultants,</li> <li>- establish three subcatchment IRBM groups, and</li> <li>- propose/establish more permanent IRBM institutional arrangements.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>\$15.3 million</li> <li>84 person-months of consultant services</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Impact Assessment Summary</li> <li>Resettlement Plan</li> <li>Inception Mission</li> <li>Project progress reports</li> <li>Contract documents</li> <li>Loan review missions</li> </ul>	<ul style="list-style-type: none"> <li>Effective coordination of numerous Federal and local agencies occurs.</li> <li>A Program Steering Committee chaired by the Ministry of Agriculture exists for management of the Klang River Basin program</li> </ul>

Design Summary	Inputs	Project Monitoring Mechanisms	Risks/Assumptions
<ul style="list-style-type: none"> <li>• Demonstration projects:               <ul style="list-style-type: none"> <li>- select three demonstration IRBM schemes,</li> <li>- prepare management plans for three subcatchments,</li> <li>- demonstrate erosion control and rainfall runoff measures,</li> <li>- prepare detailed erosion and rainfall runoff control guidelines, and</li> <li>- prepare conservation plans for former mining ponds.</li> </ul> </li> <li>• IRBM strategic plan:               <ul style="list-style-type: none"> <li>- integrate existing legislation and prepare new legislation, and</li> <li>- prepare strategic IRBM plan for the entire Basin.</li> </ul> </li> <li>• Training and public participation:               <ul style="list-style-type: none"> <li>- conduct 16 workshops/seminars and site visits to demonstration schemes,</li> <li>- prepare checklist for local enforcement staff, and</li> <li>- undertake public consultation campaign.</li> </ul> </li> <li>• MWSS:               <ul style="list-style-type: none"> <li>- carry out detailed studies of the MWSS, and</li> <li>- gazette the MWSS as a protected area.</li> </ul> </li> <li>• River beautification:               <ul style="list-style-type: none"> <li>- undertake landscaping;</li> <li>- undertake seminars, lectures, dialogue meetings, and radio/video broadcasts;</li> <li>- identify pollution sources and enforce regulations; and</li> <li>- introduce about 1 million fish and prawn fry.</li> </ul> </li> </ul>			

Design Summary	Inputs	Project Monitoring Mechanisms	Risks/Assumptions
<p>4.2 Solid Waste Management</p> <ul style="list-style-type: none"> <li>- prepare/improve collection sites,</li> <li>- procure equipment and improve trash booms, and</li> <li>- recruit consultants.</li> </ul>	<ul style="list-style-type: none"> <li>• \$9.6 million</li> <li>• 17 person-months of consulting services</li> </ul>	<ul style="list-style-type: none"> <li>• Executing agency communications with the Board</li> </ul>	<ul style="list-style-type: none"> <li>• No delay in appointment of Program manager and other Project staff.</li> </ul>
<p>4.3 Sediment Trapping</p> <ul style="list-style-type: none"> <li>- design and construct sediment traps,</li> <li>- acquire land,</li> <li>- construct works, and</li> <li>- operate traps.</li> </ul>	<ul style="list-style-type: none"> <li>• \$3.8 million</li> <li>• 46 person-months of consulting services</li> </ul>		
<p>4.4 Tributary River Corridor Improvement</p> <ul style="list-style-type: none"> <li>- survey and design works,</li> <li>- acquire land and resettle squatters, and</li> <li>- construct works.</li> </ul>	<ul style="list-style-type: none"> <li>• \$64.5 million</li> <li>• 1,043 person-months of consulting services</li> </ul>		<ul style="list-style-type: none"> <li>• No delays in provision of local funding.</li> </ul>
<p>4.5 Flood Forecasting and Warning System</p> <ul style="list-style-type: none"> <li>- procure equipment,</li> <li>- recruit consultants, and</li> <li>- implement improved systems.</li> </ul>	<ul style="list-style-type: none"> <li>• \$1.8 million</li> <li>• 30 person-months of consulting services</li> </ul>		<ul style="list-style-type: none"> <li>• Adequately trained staff available.</li> </ul>

## PROJECT COST ESTIMATES

Table 1: Components Project Cost Summary

Item	RM million			\$ '000			% Foreign Exchange	% Total Base Costs
	Local	Foreign	Total	Local	Foreign	Total		
<b>A. Environmental Improvement</b>								
1. Integrated River Basin Management	26.2	7.4	33.6	10,500.7	2,956.6	13,457.3	22	17
2. Solid Waste Management	11.4	9.4	20.8	4,560.1	3,774.8	8,334.9	45	10
3. Sediment Trapping	6.0	2.1	8.1	2,403.0	831.5	3,234.5	26	4
<b>Subtotal Environmental Improvement</b>	<b>43.6</b>	<b>18.9</b>	<b>62.5</b>	<b>17,463.8</b>	<b>7,562.9</b>	<b>25,026.7</b>	<b>30</b>	<b>31</b>
<b>B. Flood Mitigation</b>								
4. Tributary River Corridor Improvement	87.5	47.6	135.0	35,018.2	19,043.0	54,061.2	35	67
5. Flood Forecasting and Warning System	1.3	2.8	4.1	516.6	1,130.5	1,647.0	69	2
<b>Subtotal Flood Mitigation</b>	<b>88.7</b>	<b>50.4</b>	<b>139.1</b>	<b>35,534.8</b>	<b>20,173.5</b>	<b>55,708.2</b>	<b>36</b>	<b>69</b>
<b>Total Costs</b>	<b>132.4</b>	<b>69.3</b>	<b>201.6</b>	<b>52,998.6</b>	<b>27,736.3</b>	<b>80,734.9</b>	<b>34</b>	<b>100</b>
Physical Contingencies <sup>a</sup>	11.8	8.9	20.7	4,718.7	3,574.5	8,293.2	0	10
Price Contingencies <sup>b</sup>	25.4	13.1	38.5	3,893.8	2,015.0	5,908.8	0	7
<b>Total Project Costs before Interest during Construction</b>	<b>169.6</b>	<b>91.3</b>	<b>260.9</b>	<b>61,611.1</b>	<b>33,325.8</b>	<b>94,936.9</b>	<b>0</b>	<b>118</b>
Interest during Construction	-	17.3	17.3	-	6,942.1	6,942.1	100	9
<b>Total Project Costs</b>	<b>169.6</b>	<b>108.6</b>	<b>278.2</b>	<b>61,611.1</b>	<b>40,267.9</b>	<b>101,879.0</b>	<b>40</b>	<b>126</b>

<sup>a</sup> At 15 percent for civil works, and 5 percent for other expenditure accounts.<sup>b</sup> Annual factor of 2.7 percent for foreign exchange costs and 6.0 percent for local currency costs.

**Table 2: Project Components by Year – Totals Including Contingencies**  
(\$ '000)

Item	1997	1998	1999	2000	2001	2002	Total
<b>A. Environmental Improvement</b>							
1. Integrated River Basin Management	2,802.2	3,245.6	3,061.9	2,419.2	1,984.0	1,760.0	15,272.8
2. Solid Waste Management	1,298.3	3,083.2	2,517.5	1,207.4	1,236.3	262.3	9,605.0
3. Sediment Trapping	129.3	489.2	1,790.5	1,368.3	-	-	3,777.3
<b>Subtotal Environmental Improvement</b>	<b>4,229.8</b>	<b>6,818.0</b>	<b>7,369.8</b>	<b>4,994.9</b>	<b>3,220.3</b>	<b>2,022.3</b>	<b>28,655.2</b>
<b>B. Flood Mitigation</b>							
1. Tributary River Corridor Improvement	2,862.3	14,344.3	19,370.3	16,167.9	9,097.8	2,624.6	64,467.1
2. Flood Forecasting and Warning System	1,136.4	594.1	84.0	-	-	-	1,814.6
<b>Subtotal Flood Mitigation</b>	<b>3,998.8</b>	<b>14,938.4</b>	<b>19,454.3</b>	<b>16,167.9</b>	<b>9,097.8</b>	<b>2,624.6</b>	<b>66,281.7</b>
<b>Total Project Costs before Interest during Construction</b>	<b>8,228.6</b>	<b>21,756.5</b>	<b>26,824.1</b>	<b>21,162.8</b>	<b>12,318.1</b>	<b>4,646.9</b>	<b>94,936.9</b>
Interest during Construction	-	300.0	900.0	1,500.0	2,000.0	2,242.1	6,942.1
<b>Total Project Costs</b>	<b>8,228.6</b>	<b>22,056.5</b>	<b>27,724.1</b>	<b>22,662.8</b>	<b>14,318.1</b>	<b>6,889.0</b>	<b>101,879.0</b>



**Table 3: Expenditure Accounts by Component - Totals Including Contingencies**  
(\$ '000)

Item	Environmental Improvement			Flood Mitigation		Total
	Integrated River Basin Management	Solid Waste Management	Sediment Trapping	Tributary River Corridor Improvement	Flood Forecasting and Warning System	
A. Investment Costs						
1. Civil Works	2,535.7	1,613.9	1,759.3	42,836.7	493.9	49,239.6
2. Vehicles	237.4	-	-	-	-	237.4
3. Equipment	34.0	3,081.1	-	-	848.2	3,963.4
4. Consulting Services						
International Consultants	844.5	172.1	48.5	220.0	220.6	1,505.7
Domestic Consultants	308.3	61.5	201.7	7,086.0	128.8	7,786.3
Subtotal Consulting Services	1,152.8	233.6	250.2	7,306.0	349.4	9,292.0
5. Training	87.4	-	-	-	40.8	128.3
6. Land Acquisition and Resettlement						
Land Acquisition	-	-	1,625.4	8,167.1	-	9,792.5
Resettlement and Compensation	-	-	-	5,161.9	-	5,161.9
Subtotal Land Acquisition and Resettlement	-	-	1,625.4	13,329.1	-	14,954.4
7. River Cleanup Activities	10,109.6	-	-	-	-	10,109.6
8. Project Management	1,116.0	-	-	-	-	1,116.0
Total Investment Costs	15,272.8	4,928.6	3,634.9	63,471.8	1,732.4	89,040.6
B. Recurrent Costs						
Operating Costs	-	4,676.4	142.5	995.3	82.2	5,896.3
Total Recurrent Costs	-	4,676.4	142.5	995.3	82.2	5,896.3
Total Project Costs before Interest during Construction	15,272.8	9,605.0	3,777.3	64,467.1	1,814.6	94,936.9
Interest during Construction	-	-	-	-	-	6,942.1
Total Project Costs	15,272.8	9,605.0	3,777.3	64,467.1	1,814.6	101,879.0

**Table 4: Local and Foreign Currency and Taxes by Financier**  
(\$ '000)

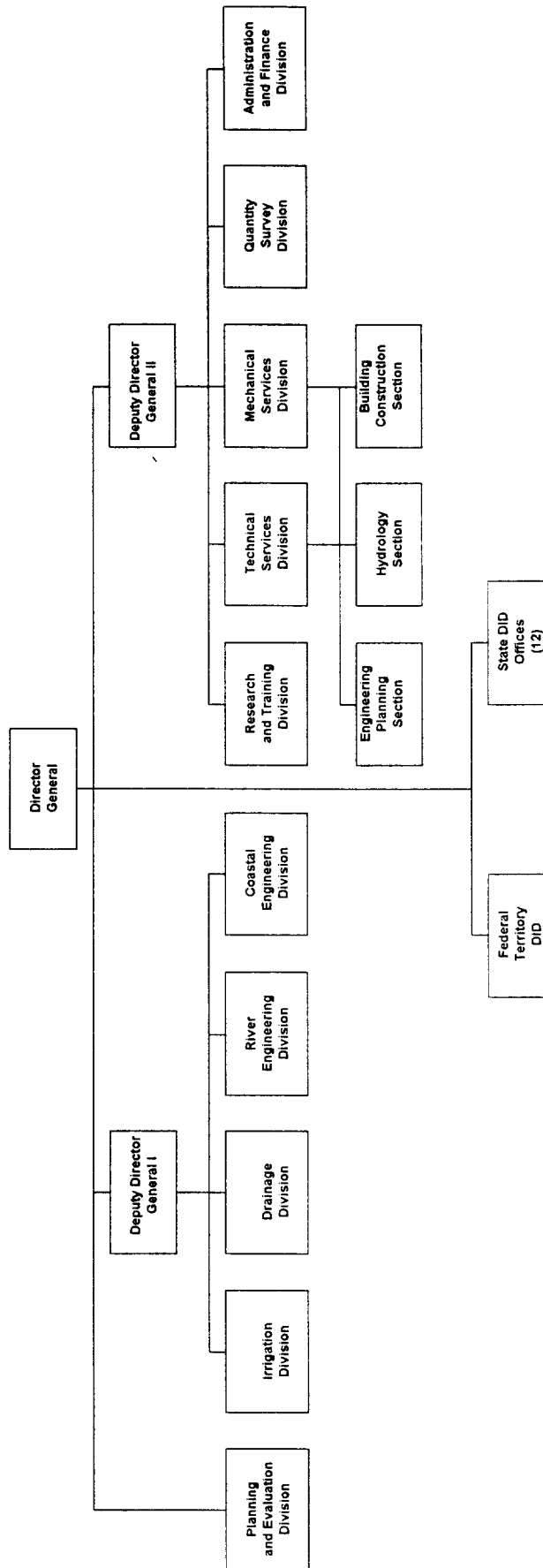
Item	Asian Development Bank		The Government		Total	
	Amount	%	Amount	%	Amount	%
A. Foreign	26,337	79	6,989	21	33,326	33
B. Local (Excl. Taxes)	-	-	52,117	100	52,117	51
C. Taxes	-	-	9,494	100	9,494	9
D. Interest during Construction	-	-	6,942	100	6,942	7
<b>Total Project</b>	<b>26,337</b>	<b>26</b>	<b>75,542</b>	<b>74</b>	<b>101,879</b>	<b>100</b>

**Table 5: Expenditure Accounts, by Financier**  
(\$ '000)

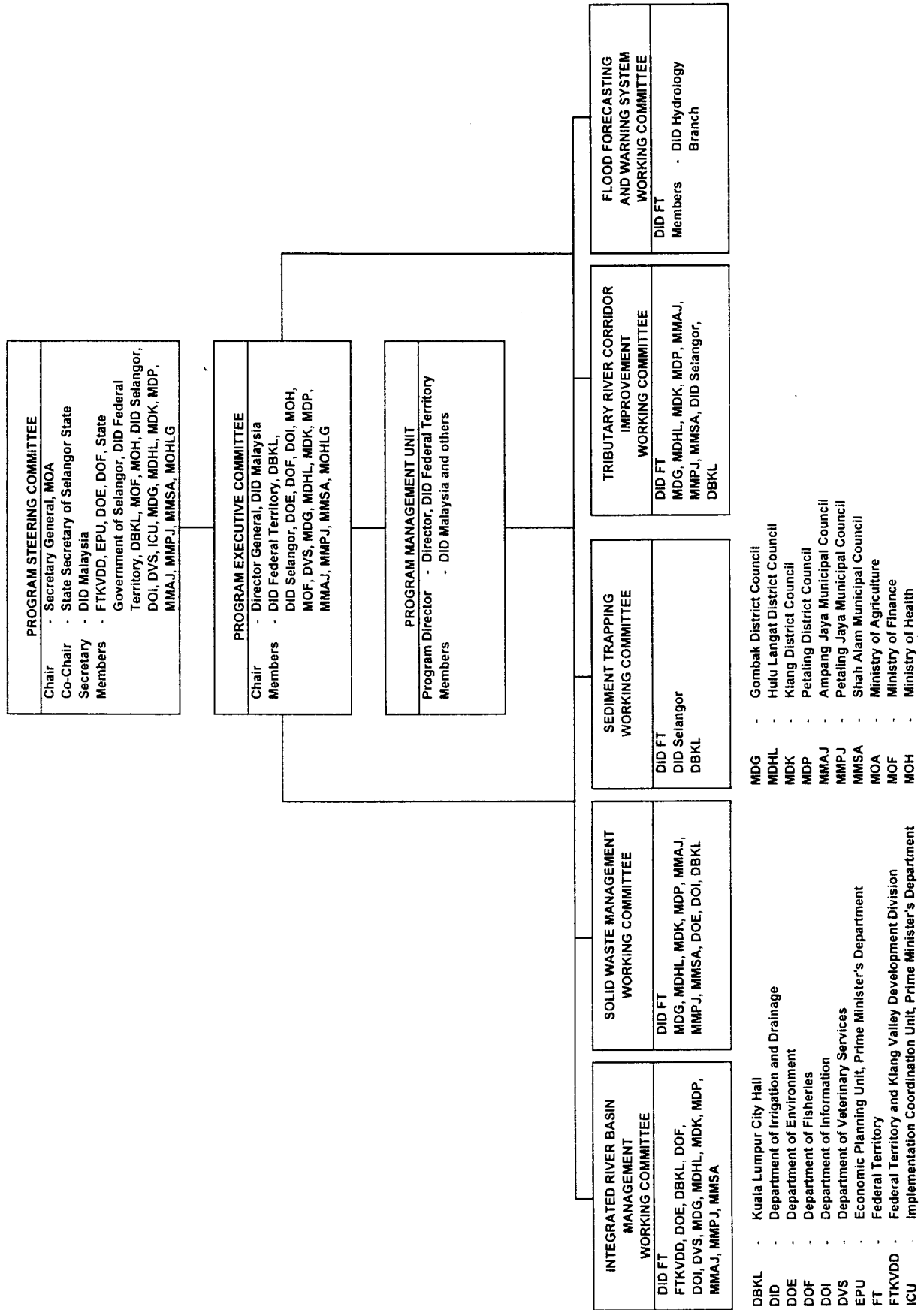
Item	Asian Development Bank			The Government			Total		Local (Excl. Taxes)		
	Amount	%		Amount	%		Amount	%	For. Exch.	Duties & Taxes	
<b>A. Investment Costs</b>											
1. Civil Works	21,624.9	43.9		27,614.7	56.1		49,239.6		26,589.4	17,726.2	4,924.0
2. Vehicles	198.2	83.5		39.2	16.5		237.4	0.2	213.6	-	23.7
3. Equipment	3,260.5	82.3		702.8	17.7		3,963.4	3.9	3,567.0	-	396.3
4. Consulting Services											
International Consultants	1,253.0	83.2		252.8	16.8		1,505.7	1.5	1,355.2	-	150.6
Domestic Consultants	-	-		7,786.3	100.0		7,786.3	7.6	-	7,007.7	778.6
<b>Subtotal Consulting Services</b>	<b>1,253.0</b>	<b>13.5</b>		<b>8,039.1</b>	<b>86.5</b>		<b>9,292.0</b>	<b>9.1</b>	<b>1,355.2</b>	<b>7,007.7</b>	<b>929.2</b>
5. Training	-	-		128.3	100.0		128.3	0.1	-	115.4	12.8
6. Land Acquisition and Resettlement											
Land Acquisition	-	-		9,792.5	100.0		9,792.5	9.6	-	8,813.2	979.2
Resettlement and Compensation	-	-		5,161.9	100.0		5,161.9	5.1	-	4,645.8	516.2
<b>Subtotal Land Acquisition and Resettlement</b>	<b>-</b>	<b>-</b>		<b>14,954.4</b>	<b>100.0</b>		<b>14,954.4</b>	<b>14.7</b>	<b>-</b>	<b>13,459.0</b>	<b>1,495.4</b>
7. River Cleanup Activities	-	-		10,109.6	100.0		10,109.6	9.9	1,011.0	8,087.7	1,011.0
8. Project Management	-	-		1,116.0	100.0		1,116.0	1.1	-	1,004.4	111.6
<b>Total Investment Costs</b>	<b>26,336.6</b>	<b>29.6</b>		<b>62,704.0</b>	<b>70.4</b>		<b>89,040.6</b>	<b>87.4</b>	<b>32,736.1</b>	<b>47,400.4</b>	<b>8,904.1</b>
<b>B. Recurrent Costs</b>											
Operating Costs	-	-		5,896.3	100.0		5,896.3	5.8	589.6	4,717.1	589.6
<b>Total Recurrent Costs</b>	<b>-</b>	<b>-</b>		<b>5,896.3</b>	<b>100.0</b>		<b>5,896.3</b>	<b>5.8</b>	<b>589.6</b>	<b>4,717.1</b>	<b>589.6</b>
<b>Total Disbursement before Interest during Construction</b>	<b>26,336.6</b>	<b>27.7</b>		<b>68,600.3</b>	<b>72.3</b>		<b>94,936.9</b>	<b>93.2</b>	<b>33,325.8</b>	<b>52,117.4</b>	<b>9,493.7</b>
Interest during Construction	-	-		6,942.1	100.0		6,942.1	6.8	6,942.1	-	-
<b>Total Disbursement</b>	<b>26,336.6</b>	<b>25.9</b>		<b>75,542.4</b>	<b>74.1</b>		<b>101,879.0</b>	<b>100.0</b>	<b>40,267.9</b>	<b>52,117.4</b>	<b>9,493.7</b>

# ORGANIZATION CHARTS

Organization Chart of the Department of Irrigation and Drainage (DID)



### Organizational Structure for Project Implementation



## Klang River Basin Environmental Improvement and Flood Mitigation Project

[illegible]

## TERMS OF REFERENCE FOR CONSULTING SERVICES

### A. Introduction

1. The Project provides for 1,220 person-months of consulting services, consisting of 61 person-months of international, and 1,159 person-months of domestic consultants (including 777 person-months of subengineers) to guide and supervise surveys and investigations where required; and to carry out detailed engineering design, preparation of tender documents, assistance in bid evaluation, construction supervision, preparation of Project progress reports, and other tasks. The detailed terms of reference (TOR) for the consulting services will be prepared by the Department of Irrigation and Drainage (DID), and submitted to the Bank for concurrence prior to the consultant's engagement. Details regarding consultant inputs, and terms of reference specific to each of the Project components are described here.

### B. General Scope of Work

#### 1. Integrated River Basin Management

2. The consultants for this component will act as an integrated river basin management (IRBM) advisory group to the Government. Their general TOR are as follows:

- (i) review the existing institutional capability and practices in implementing IRBM, and propose an IRBM policy, institutional arrangements, and an institutional strengthening program for Government approval;
- (ii) assist the Government in establishing recommended new institutional arrangements in DID, and the Selangor State government;
- (iii) propose a long-term IRBM strategic plan, and formulate a short-term IRBM program for immediate implementation;
- (iv) conduct necessary training programs for the staff of possible IRBM units to familiarize them with their responsibilities, and provide them with skills to undertake IRBM tasks;
- (v) review existing laws, acts, or regulations related to IRBM, and propose practical approaches to effectively enforce these related laws and regulations, in particular on the prevention of deforestation, and reducing soil erosion from improper land development;
- (vi) assist DID and Selangor State to identify three pilot demonstration schemes to implement a soil conservation, soil erosion, and rainfall runoff control program; and
- (vii) assist the Government to undertake river corridor planning to keep noxious and heavy industry well away from the river, and to carry out the beautification of river corridors.

3. The expertise required to complete the services includes, but is not limited to, IRBM, land use, soil erosion control, and institutional strengthening. The estimated person-months for the services are presented in Table 1.

**Table 1: Consultant Input (person-months) for the IRBM Component**

Specialist	Year				Total
	1	2	3	4	
<b>International Consultants</b>					
Watershed Management Specialist	3	3	2	1	9
Land Use Specialist	2	2	2	-	6
Soil Erosion Control Engineer	2	2	2	-	6
Institutional Strengthening Specialist	2	2	2	-	6
Hydrologist	3	2	2	-	7
Subtotal	12	11	10	1	34
<b>Domestic Consultants</b>					
Watershed Management/Natural Resources Management Specialist	6	6	1	1	14
Soil Erosion Specialist	2	2	2	-	6
Hydrologist	3	2	1	-	6
Institutional Strengthening Specialist	3	2	1	-	6
Training Specialist	3	-	-	-	3
Water Ecology Specialist	1	2	-	-	3
Financial Analyst	2	1	-	-	3
Sociologist	-	2	-	-	2
Agricultural Systems/Soil Specialist	-	1	-	-	1
Biodiversity Specialist					
Subtotal	23	20	6	1	50
Total	35	31	16	2	84

## 2. Solid Waste Management

4. With the introduction of privatization of solid waste collection and disposal services throughout the Klang River Basin, consulting services requirements will be limited to the location and design of the rubbish booms. The general TOR include:

- (i) examine the existing rubbish boom installations, and propose changes to the design and operation methods to increase the efficiency of rubbish collection and minimize the need for labor to operate and maintain the rubbish booms;
- (ii) locate and design the automatic trash booms at seven sites along the river, including the mechanical, electrical, and civil works design; and



- (iii) for the civil works design, give particular attention to the need for adequate access to the sites, structural requirements, such as equipment, housing, and river bank widening and anchor placement to accommodate the automated trash booms.

5. The Project provisions for consultant input for the solid waste component are presented in Table 2.

**Table 2: Consultant Input (person-months) for the Solid Waste Management Component**

<b>Specialist</b>	<b>Year</b>		<b>Total</b>
	<b>1</b>	<b>2</b>	
<b>International Consultant</b>			
Mechanical Engineer	3	4	7
<b>Domestic Consultants</b>			
Civil Engineer	3	4	7
Electric Engineer	1	2	3
<b>Subtotal</b>	<b>4</b>	<b>6</b>	<b>10</b>
<b>Total</b>	<b>7</b>	<b>10</b>	<b>17</b>

### 3. Sediment Trapping and Tributary River Corridor Improvement

6. The detailed TOR of the consulting services will be prepared by DID and submitted to the Bank for concurrence prior to the consultants' engagement. The general TOR for these components include:

- (i) undertake detailed topographical and engineering surveys, and geotechnical investigations necessary for finalizing the layouts and the preparation of detailed design of the various engineering works;
- (ii) undertake detailed design of all Project components and structures, with the design of all engineering works, in general, being compatible with DID standards, suitable for local conditions, economical to construct, and simple to operate and maintain; and provide an operation manual to the DID for use in the operation and maintenance of the completed works;
- (iii) prepare, in consultation with Kuala Lumpur City Hall, and Selangor State government, a detailed resettlement program in accordance with the approved Resettlement Plan of the Project for those people who will be affected by the construction of the Project works. The Plan shall include the identification of the resettlement areas, land acquisition, infrastructure and housing requirements, cost estimates, and a timetable for implementation;

- (iv) prepare land acquisition plans to the level of detail required for the purpose of land acquisition;
- (v) prepare working drawings and tender documents to enable the calling of tenders for the implementation of the proposed works, as well as tender schedules; and propose contract packages where appropriate;
- (vi) administer all contracts; including prequalification of contractors, calling of tenders and recommendation of award, and preparation of contract documents during the preconstruction stage; be responsible, during the construction stage, for certification and approval of works, measurements, and computation of quantities, recommendation of progress payment and variation orders, holding of site meetings, and other related matters; provide personnel familiar with the standard procedures of procurement, disbursement, and financial recording in use by DID; and provide suitable personnel able to commission all completed works for a period of six months;
- (vii) provide the necessary human resources, equipment, and facilities for the construction supervision of all Project works; including programming and monitoring of work progress, approval of initial work, direct supervision and quality control, material testing, and measurements; and
- (viii) prepare and update detailed cost estimates, including cost analysis for the full implementation of all proposed works to be submitted together with the draft tender documents.

7. The Project provision for consultants for sediment trapping are presented in Table 3.

**Table 3: Consultant Input (person-months) for the Sediment Trapping Component**

<b>Specialist</b>	<b>Year</b>			<b>Total</b>
	<b>1</b>	<b>2</b>	<b>3</b>	
<b>International Consultant</b>				
Sediment Transport Engineer	2	-	-	2
<b>Domestic Consultants</b>				
Hydraulic Engineer	4	-	-	4
Structural Engineer	4	-	-	4
Construction Engineer	-	6	6	12
Subengineers (Construction Supervision)	-	12	12	24
<b>Subtotal</b>	<b>8</b>	<b>18</b>	<b>18</b>	<b>44</b>
<b>Total</b>	<b>10</b>	<b>18</b>	<b>18</b>	<b>46</b>

8. The Project provision for consultant input for the tributary river corridor improvement component is presented in Table 4.

**Table 4: Consultant Input (person-months) for the Tributary River Corridor Improvement Component**

Specialist	Year						Total
	1	2	3	4	5	6	
<b>International Consultants</b>							
Senior Hydrologist	1.5	-	-	-	-	-	1.5
Senior River Hydraulic Engineer	3	3	-	-	-	-	6
River Modeling Specialist	1.5	-	-	-	-	-	1.5
Subtotal	6	3	-	-	-	-	9
<b>Domestic Consultants</b>							
Hydrologist	3	-	-	-	-	-	3
River Hydraulic Engineer	12	12	-	-	-	-	24
Geotechnical Engineer	11	11	-	-	-	-	22
Structural Engineer	12	14	-	-	-	-	26
Landscape Architect	2.5	2.5	-	-	-	-	5
Bridge Engineer	1	2	-	-	-	-	3
Subengineers (Design Review)	15	12	-	-	-	-	27
Senior Construction Engineer	-	12	12	12	12	6	54
Construction Engineer	-	36	36	36	24	12	144
Subengineers (Construction Supervision)	-	178	178	178	120	72	726
Subtotal	56.5	279.5	226	226	156	90	1,034
Total	62.5	282.5	226	226	156	90	1,043

#### 4. Flood Forecasting and Warning System

9. The consultants will assist the executing agency in upgrading the existing flood forecasting and telemetry system. Specific terms of reference will include the following:

- (i) prepare specifications for the hydrological, and communication equipment and assist DID in their procurement;
- (ii) prepare specifications and design for one master station and three substations and the establishment of new, and upgrading the existing, river gauging and rainfall recording stations, and supervise the construction of these stations;
- (iii) assist DID in the procurement of a suitable rainfall runoff and flood routing and forecasting computer model, and suitable hardware to run this model; review and verify rating curves of the key gauging sites and morphologic data of the river; and make adjustments as deemed

necessary, feed this information into the model, and calibrate the model using historic hydrologic data;

- (iv) refine calibration of the model during the second and third years of implementation using the data collected during the previous years;
- (v) undertake training of DID staff, who will be responsible for the operation and maintenance of the system after its completion, in maintenance of the river gauging and rainfall recording stations, telemetric and communication equipment and rainfall runoff and flood routing model; and
- (vi) undertake a seminar at the end of the third year of Project implementation to disseminate information related to flood forecasting and warning to the relevant higher authorities of DID, administrators of the disaster control, town planners, local authorities, and selected representatives of residents of areas close to the river corridor.

10. The Project provisions for consultant input for the flood forecasting and warning system component are presented in Table 5.

**Table 5: Consultant Input (person-months) for the  
Flood Forecasting and Warning System Component**

<b>Specialist</b>	<b>Year</b>			<b>Total</b>
	<b>1</b>	<b>2</b>	<b>Year 3</b>	
<b>International Consultants</b>				
Hydrologist/Modeling Specialist	4	1	1	6
Meteorological Equipment and Telemetry Specialist	2	1	-	3
<b>Subtotal</b>	<b>6</b>	<b>2</b>	<b>1</b>	<b>9</b>
<b>Domestic Consultants</b>				
Hydrologist	6	4	2	12
Structural Engineer	3	-	-	3
Construction Engineer	4	2	-	6
<b>Subtotal</b>	<b>13</b>	<b>6</b>	<b>2</b>	<b>21</b>
<b>Total</b>	<b>19</b>	<b>8</b>	<b>3</b>	<b>30</b>

11. A summary of all consultant inputs is contained in Table 6.

**Table 6: Consultant Requirements**  
(person-months)

	Quantities						Total
	1997	1998	1999	2000	2001	2002	
<b>1. International Consultants</b>							
<b>Integrated River Basin Management</b>							
Watershed Management Specialist	3	3	2	1	-	-	9
Land Use Specialist	2	2	2	-	-	-	6
Soil Erosion Control Specialist	2	2	2	-	-	-	6
Institutional Strengthening Specialist	2	2	2	-	-	-	6
Hydrologist	3	2	2	-	-	-	7
<b>Subtotal Integrated River Basin Management</b>	<b>12</b>	<b>11</b>	<b>10</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>34</b>
<b>Solid Waste Management</b>							
Mechanical Engineer	3	4	-	-	-	-	7
<b>Sediment Trapping</b>							
Sediment Transport Engineer	2	-	-	-	-	-	2
<b>Tributary River Corridor Improvement</b>							
Senior Hydrologist	1.5	-	-	-	-	-	1.5
Senior River Hydraulic Engineer	3	3	-	-	-	-	6
River Modeling Specialist	1.5	-	-	-	-	-	1.5
<b>Subtotal Tributary River Corridor Improvement</b>	<b>6</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>9</b>
<b>Flood Forecasting and Warning System</b>							
Hydrologist/ Modeling Specialist	4	1	1	-	-	-	6
Meteorological Equipment and Telemetry Specialist	2	1	-	-	-	-	3
<b>Subtotal Flood Forecasting and Warning System</b>	<b>6</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>9</b>
<b>Subtotal 1. International Consultants</b>	<b>29</b>	<b>20</b>	<b>11</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>61</b>
<b>2. Domestic Consultants</b>							
<b>Integrated River Basin Management</b>							
Watershed Management/Natural Resource Management Specialist	6	6	1	1	-	-	14
Soil Erosion Specialist	2	2	2	-	-	-	6
Hydrologist	3	2	1	-	-	-	6
Institutional Strengthening Specialist	3	2	1	-	-	-	6
Training Specialist	3	2	1	-	-	-	6
Water Ecology Specialist	3	-	-	-	-	-	3
Financial Analyst	1	2	-	-	-	-	3
Sociologist	2	1	-	-	-	-	3
Agricultural Systems/Soils Specialist	-	2	-	-	-	-	2
Biodiversity Specialist	-	1	-	-	-	-	1
<b>Subtotal Integrated River Basin Management</b>	<b>23</b>	<b>20</b>	<b>6</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>50</b>
<b>Solid Waste Management</b>							
Civil Engineer	3	4	-	-	-	-	7
Electrical Engineer	1	2	-	-	-	-	3
<b>Subtotal Solid Waste Management</b>	<b>4</b>	<b>6</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>10</b>
<b>Sediment Trapping</b>							
Hydraulic Engineer	4	-	-	-	-	-	4
Structural Engineer	4	-	-	-	-	-	4
Construction Engineer	-	6	6	-	-	-	12
Subengineers	-	12	12	-	-	-	24
<b>Subtotal Sediment Trapping</b>	<b>8</b>	<b>18</b>	<b>18</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>44</b>
<b>Tributary River Corridor Improvement</b>							
Hydrologist	3	-	-	-	-	-	3
River Hydraulic Engineer	12	12	-	-	-	-	24
Geotechnical Engineer	11	11	-	-	-	-	22
Structural Engineer	12	14	-	-	-	-	26
Landscape Architect	2.5	2.5	-	-	-	-	5
Bridge Engineer	1	2	-	-	-	-	3
Subengineers (Review and Design)	15	12	-	-	-	-	27
Senior Construction Engineer	-	12	12	12	12	6	54
Construction Engineer	-	36	36	36	24	12	144
Subengineers (Construction Supervision)	-	178	178	178	120	72	726
<b>Subtotal Tributary River Corridor Improvement</b>	<b>56.5</b>	<b>279.5</b>	<b>226</b>	<b>226</b>	<b>156</b>	<b>90</b>	<b>1,034</b>
<b>Flood Forecasting and Warning System</b>							
Hydrologist	6	4	2	-	-	-	12
Structural Engineer	3	-	-	-	-	-	3
Construction Engineer	4	2	-	-	-	-	6
<b>Subtotal Flood Forecasting and Warning System</b>	<b>13</b>	<b>6</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>21</b>
<b>Subtotal 2. Domestic Consultants</b>	<b>104.5</b>	<b>329.5</b>	<b>252</b>	<b>227</b>	<b>156</b>	<b>90</b>	<b>1,159</b>
<b>Total</b>	<b>133.5</b>	<b>349.5</b>	<b>263</b>	<b>228</b>	<b>156</b>	<b>90</b>	<b>1,220</b>

## **SUMMARY RESETTLEMENT PLAN FOR THE KLANG RIVER BASIN ENVIRONMENTAL IMPROVEMENT AND FLOOD MITIGATION PROJECT**

### **A. Background**

1. The Government will acquire 36.6 hectares (ha) of private land and resettle 640 families who are squatting on government-owned land. About 390 squatter families live in the city of Kuala Lumpur, and the remaining 250 families live within Selangor State.<sup>1</sup> About 10 ha of the land to be acquired or vacated lies within Selangor State, the remaining 26.6 ha lies within the limits of the city of Kuala Lumpur. The land will be acquired in accordance with the Federal Land Acquisition Act (the Act). The resettlement activities will be implemented in accordance with a Resettlement Plan that was prepared and mutually agreed upon by the city of Kuala Lumpur, Selangor State, and the Federal Government. The plan is in accordance with the Bank's policy on Involuntary Resettlement.

2. The resettlement activities will constitute an element of an urban relocation program in Kuala Lumpur and the surrounding areas that has been ongoing since 1992. Depending on the location of the families that are to be resettled, the resettlement will be conducted by Kuala Lumpur City Hall (DBKL), or Selangor State. The policies of each administrative entity comply with the Act, but differ in minor ways to reflect the nature of the administrative entity. The two entities have substantial experience with resettlement, with more than 1,000 households having been resettled each year since 1992 to accommodate the large number of urban development projects in the region.

### **B. Resettlement of Squatter Families**

3. The resettled families will be moved into accommodations located within single- or two-story wooden frame buildings that have electricity, running water, and sewerage. Each family will occupy a unit consisting of about 52 square meters, with two bedrooms, living/dining area, kitchen, and bathroom. Insofar as possible, families are resettled into apartments that are within a reasonable commuting distance from their previous residence. After providing the affected families with due notice (usually 60 days), the families are assisted in transporting their household and personal effects to the new residence. Social workers provide counseling to the relocated families, and other support that the families may need to adjust to the new living situation. The resettled families pay a small rental fee ranging from \$18 to \$22 (RM45 to RM55) per month.

4. The quality of housing provided to the affected families is far superior to what they presently have, and families that are resettled are generally satisfied with the housing provided. Resettled families are also accorded priority in obtaining eligibility to purchase low cost apartments, subject to family income thresholds. However, the demand for these apartments has grown rapidly in recent years due to rapid development in the region, resulting in very long waiting lists.

5. This support is provided to squatters and low income families who are either Malaysian citizens, or aliens who have acquired permanent residence. Aliens who have entered

<sup>1</sup> Of the 250 squatter families that are to be resettled from within the city of Kuala Lumpur, about 100 are living along the banks of the Gombak River, 30 along the Kemusing River, and 120 along the Keroh River. Of the 390 squatter families to be resettled from within Selangor State, 60 are living along the banks of the Gombak River, 100 along the Gisir River, 240 along the Ampang River, and 90 along the Kuvoh River.

accordance with commitments made by the employers prior to the issuance of the temporary work permit.

6. DBKL and Selangor State provide land to resettle families within reasonable distance of their present location. The Project will provide funds to pay for the construction of apartments for the families to be resettled. DBKL and Selangor State will construct the housing accommodations and related infrastructure, and will facilitate the actual relocation of the families from their existing place of residence to the new place of residence.

#### **C. Relocation of Commercial Establishments Squatting On or Temporarily Using Government Land**

7. Businesses that are using government-owned land for commercial purposes (for example, as storage depots for machinery and heavy equipment) without the Government's consent, or with Temporary Occupancy licenses, will be given 60 days notice to vacate. The persons using this land will be expected to find another location on which to relocate these operations. If requested, the Project will disassemble and reconstruct or replace community structures on sites that will be made available for this purpose by the Project. For owners of shops attached to houses and workshops, the local authorities and resettlement staff will assist these Project-affected persons to find a location on which to reestablish their business.

#### **D. Owners of Property and Housing with Land Title**

8. Landowners will be compensated at fair market value. The price paid for the land acquired is determined through negotiation in accordance with procedures that are described in the Act. The negotiated price is expected to include adequate provision to pay the Project-affected family for the cost of transporting the household and personal effects from the existing residence to the new residence. Disputes regarding the value of the property to be acquired will be resolved through procedures prescribed under the Act. Families whose land is purchased for public development projects make private arrangements to move their household and personal effects using funds that they have acquired through the sale of the property.

#### **E. Cost Estimates and Financing Plan**

9. In addition to the land that will be provided by DBKL and Selangor State, the cost of constructing the housing for the squatters who are to be resettled is estimated to be \$4.6 million (RM11.6 million or RM18,000 per unit, including support services). In DBKL, the cost of physically relocating the families will be provided through the normal administrative operating budget, while in Selangor State the cost of relocating the families is normally included as an item in the cost of the contract for the construction of the housing accommodations.

10. Financing for resettlement activities (construction of the housing accommodations and associated infrastructure) will come from the Ministry of Agriculture capital project allocations. Housing constructed by and for DBKL and Selangor State will be paid for by funds made available by the Department of Irrigation and Drainage for this purpose. The Ministry, through the Department, will channel funds to DBKL and Selangor State to implement the resettlement activities on its behalf. DBKL and Selangor State will disburse funds in payment for resettlement works that will be implemented by contractors.

**F. Implementation Arrangements**

11. The resettlement activities of the Project will be coordinated and monitored by the concerned Project working committee. The resettlement activities will be implemented by DBKL and Selangor State. The Program Management Unit will submit quarterly progress reports on the status of the resettlement program. The Program Management Unit will also submit a completion report that evaluates the resettlement within six months after the completion of the resettlement program.



## ECONOMIC ANALYSIS

### A. Development Options

1. The Project's primary strategic development objective is the environment. The Project also provides considerable investment to facilitate economic growth. There are no identifiable viable independent financial enterprises in the Project; therefore, the economic internal rate of return (EIRR) is used as the main indicator of Project viability. The Project's incremental impact on the economy is assessed using two development options, development in the Project area with Project, and without Project.

2. In the without-Project situation, it is assumed that present conditions and practices in the Klang River Basin will continue unabated. The rate of soil erosion is assumed to continue basically unchecked (with perhaps marginal reductions) from the estimated base level of 2.3 million tons (t) per year. Water pollution will continue to affect water quality, and no attempt to improve the aquatic life in the river systems will be made. No special efforts will be made to preserve the ecological integrity of the Malaysia Wetland Sanctuary, Selangor, including its biodiversity and carbon sequestration values, and no beautification of the river corridors will occur. The current annual economic cost of about \$1.8 million for solid waste removal from trash booms and screens, and river cleaning will increase as the volume of solid waste grows in relation to the overall growth in the Project area, with the amount of uncollected solid waste also increasing, along with a corresponding increase in the amount of waste entering the rivers. No public education campaign to reduce the environmental impact of uncontrolled waste disposal will be mounted. The present annual economic cost of about \$0.6 million for continuous sediment removal along all stretches of the rivers will increase, with a concomitant increase in traffic disruption in city areas. Estimated annual flooding damage to structures, the economic cost of traffic disruption, and the economic cost of time lost due to flooding will continue to rise as growth in the Project area continues, with total annual damage estimated at \$3.5 million in the year 2003. Without river corridor improvement work, the significant levels of riverbank erosion of 200,000 t per year will continue. Development in flood-prone areas will be constrained, and land values in these areas will remain depressed, or land development costs will remain high because of land filling costs. The population of squatters living in the river corridors and surrounding flood-prone areas will continue to grow, adding to the costs of flooding, and solid waste disposal problems. The economic costs due to avoidable flood damage and disruption because of the absence of a flood forecasting and warning system will also continue to grow from a base level of \$2.5 million per year in the year 2003. The area of the MWSS will continue to be encroached upon at a rate of 300 hectares (ha) per year, and its ecological integrity, and value as a natural flood retention basin will be lost.

3. In the with Project case, Integrated River Basin Management (IRBM) institutional arrangements will be studied, an IRBM working committee will be established, and IRBM demonstration projects will be implemented with associated subcatchment IRBM groups. It is assumed that these initiatives will lead to an increase in the number of development sites using appropriate erosion control measures in the Klang River Basin. Water pollution controls will be more rigorously enforced, and a program to increase the amount of aquatic life in the river systems will be initiated. Beautification activities in the river corridors, and improvements to encourage increased recreational use of the river areas will take place. The MWSS, one of

the last intact wetland areas in western peninsular Malaysia, will be preserved. To reduce the amount of solid waste disposed into the river systems, a public education campaign will be introduced, improved collection of currently uncollected waste will be undertaken, squatters will be relocated from river corridors, the private sector will be involved in solid waste removal, and the need for collection of rubbish from river booms and trash screens will be eliminated. As a consequence of these actions, the cost of solid waste collection from trash screens, rubbish booms, and river embankments in the river corridors will be reduced. In the with Project situation, the introduction and improvement of a total of four sediment traps or ponds will significantly reduce the cost of extraction of sediment from the river channels both in built-up, and accessible areas. Approximately 130,000 cubic meters (m<sup>3</sup>) of sand will be removed from the traps and ponds annually.

4. The Project will provide protection from floods with a 100-year average recurrence interval. Improvements to about 28.6 kilometers of river channels and corridors will be introduced in eight tributaries of the Klang River. Squatters will be resettled as part of the tributary river corridor improvement program. Improvements to the flood forecasting and warning system will be introduced to reduce the time needed to warn communities of impending flood events.

## **B. Project Benefits and Benefit Valuation**

5. The economic benefits of the Project consist of directly quantifiable benefits, indirect benefits (indirect use values) and nonuse benefits or values. These benefits are summarized in Table 1, including the quantified and unquantified environmental benefits of the Project. The quantifiable benefits of Project interventions are summarized in Table 2, where it is shown that the net present value of the Project's environmental benefit stream as a percentage of the net present value of all Project benefits is 60 percent.

6. The major beneficiaries of the Project will be the residents of the Klang River Basin who are directly and indirectly affected by environmental degradation and flooding. The Government is a potential beneficiary not only from the savings in resources for rubbish collection, sediment removal, and relief work during floods, but also from the higher tax revenues that will be generated from the increased value of land hitherto subject to soil erosion and flooding. Labor employment to be generated by the Project during implementation is estimated at about 12,300 person-months over five years. Other Project-created employment will be derived from erosion and soil conservation measures.

### **1. Direct Benefits**

7. The direct economic benefits from the solid waste component are assumed to consist of the annual savings of \$1.2 million in 2003 from the reduced cost of clearing solid waste from trash screens and rubbish booms as a result of the programs described in para. 3. These benefits are conservatively assumed to grow by 4 percent annually until 10 years after the commencement of the Project, since it is assumed that uncollected solid waste will grow at a similar rate to the growth in population and generation of solid waste in the Project area in the absence of the Project. The annual growth rate is assumed to decrease to 3 percent for a further 10 years, and to 2 percent for the final ten years of the Project. It is assumed that as a result of Project interventions, the amount of uncollected solid waste in the Project areas will be reduced by 30 percent to 105,000 t by 2003.

8. Direct benefits from the sediment trapping component of the Project are estimated to be the reduction in annual sediment removal costs as a result of the operation of the four sediment removal ponds and traps to be constructed or improved by the Project. The four ponds and traps will trap 130,000 m<sup>3</sup> of sediment annually, or about 21 percent of the 630,000 m<sup>3</sup> to be trapped by the overall Klang River environmental improvement and flood mitigation program. The resultant reduction in sediment removal costs, or direct benefit is valued at \$0.6 million annually, with a gradual decrease in these savings over the life of the Project based on the assumption that soil erosion and sediment in the river systems will decrease slightly over time in the absence of any Project interventions. The sale of sand removed from the traps and ponds is assumed to be about \$0.2 million yearly, with a similar slight decrease in value over the life of the Project as is assumed for sediment removal costs.

9. A direct benefit of the Project is attributed to the tributary river corridor improvement component. The direct benefits consist of reduction in flood damage to residential houses, industrial enterprises, commercial enterprises, retail enterprises, schools, places of worship, agricultural crops, land, and public utilities, such as roads. Direct benefits are also derived from savings in total operating costs for vehicles diverted as a result of flooding, and as a result of time lost due to traffic delays. These economic benefits are valued at \$3.6 million in 2003, increasing by 4 percent annually to year 10 to reflect the increase in such costs to the economy as it continues to grow, and increasing by 3 percent annually from years 20 to 30. Independent direct economic benefits of the flood mitigation activities also are derived in terms of increased land values in the flood-prone areas, which will immediately increase because of the attractiveness for development once flood immunity is provided. These incremental property benefits are assumed to affect 50 percent of the flood-prone area, at a rate of 500 ha (20 percent) of the property per year for five years beginning in 2001, with an incremental value of about \$130 per ha, for an annual increment of \$0.07 million.

10. Benefits from the flood forecasting and warning system component are also attributed to savings in vehicle operating costs and time lost as a result of traffic diversion, and avoidance of 40 percent of the expected annual property damage caused by tributary flooding. These economic benefits are valued at \$2.6 million in 2003.

11. Among the above Project benefits, the benefits derived from expected annual damage reduction benefits and reduced traffic disruption are dependent on frequency analysis for losses to the flood, so that the expectation value of flood losses or annual average losses can be evaluated. However, records of flood losses in relation to flooding severity, including date, duration, and depth in the Project area, are generally not well documented, so frequency analysis of flood losses is difficult, regardless of the availability of flood frequency data. To overcome the difficulties of data scarcity, it is assumed that the frequency of flood losses corresponds to the frequency of flood occurrence, and the flood loss frequency curve can be obtained through a flood routing simulation model. The methodology adopted for the flood loss frequency analysis is indicated in para. 12.

12. Given two known average recurrence interval (ARI) of floods, namely ARI 10 year and ARI 100 year, a simulation model can be used to simulate the inundation situation under ARI 10 (10 percent) and ARI 100 (1 percent) floods in the without Project case. Duration, depth, and area of inundation can be obtained from the result of the simulation, and objects being inundated can be identified from the latest aerial photos. Losses due to floods of ARI 10 and 100 intensity under without Project conditions can be estimated from the result of modeling in association with the aerial photos. This was done during the Project Preparation Technical Assistance studies. As the Project is designed to provide immunity from ARI 100

floods, losses due to ARI 100 floods are expected to be negligible in the with Project situation. Therefore, integration of losses and the probability distribution curve between ARI 10 (10 percent) and ARI 100 (1 percent) will be the expectation value of losses or average savings of losses from floods after Project completion. The savings of losses due to the interruption of traffic or other stochastic characterized losses are also calculated by the same method. The expected annual values for property damage and the costs of traffic disruption are derived from the model.

## 2. Indirect Benefits

13. Of the many indirect benefits from the Project, four are quantified. Indirect benefits from the integrated river basin management component derived from the improvement in land values as a result of soil erosion and rainfall runoff control are estimated for 30 percent (the critical erosion-prone lands) of the total Basin area at a value of \$130 per ha. These benefits are assumed to gradually accrue to 20 percent of the critical lands per year, beginning in year 5 of the Project, and continuing for a further four years.

14. Intangible benefits are attributed to the solid waste management component in terms of improved community health as a result of solid waste removal, primarily in squatter areas; markedly improved aesthetic value; and civic pride. These significant indirect benefits are valued at 50 percent of the value of the estimated direct benefits of the solid waste component.

15. Indirect benefits from the preservation of the MWSS are estimated for its tourism and recreational value, and from carbon sequestration. Although the tourism value of the MWSS is yet to be utilized, given its proximity to the capital city and major urban centers, it is assumed that 15,000 tourists per year, or about 40 persons per day will visit the site starting in 2001, spending \$10 that is directly attributable to the tourism and recreational value of the MWSS. These benefits are assumed to grow by 4 percent annually until 10 years after the commencement of the Project. The annual growth rate is assumed to decrease to 3 percent for a further 10 years, and to 2 percent for the final ten years of the Project. It is assumed that without the Project, 300 ha of the MWSS will disappear yearly, starting in 1997. It is further assumed that 11 t per ha of carbon are sequestered annually, with a value of \$12.76 per t from 1991 to 2000, \$14.04 per t from 2001 to 2010, and \$14.47 thereafter,<sup>1</sup> leading to benefits of \$0.25 million in 2003.

16. A number of other significant indirect benefits are generated by the Project, but are not quantified in the economic analysis. These include beautification and improved amenity of the rivers, the river corridors, and the Klang River Basin generally, including recreational and visual improvements. The water pollution control, fish life rehabilitation, public education programs, and the diffusion effect of the soil erosion demonstration projects of the integrated river basin management component will also contribute benefits in terms of improved river amenity and catchment improvement. Nonquantifiable benefits, such as child safety and improved health conditions as a result of reductions in waterborne diseases, will also be benefits that accrue from other components of the Project.

<sup>1</sup>

The values are based on estimates provided in the Bank's workbook on *Economic Evaluation of Environmental Projects*, 1996.

### 3. Nonuse Values

17. The MWSS and its associated forest reserve also have significant ecological value, especially since they represent the last remnants of lowland swamp forest in western peninsular Malaysia. The open grassland and weed area provides a valuable adjunct and buffer for the maintenance of the MWSS ecosystem. The long-term survival of vegetation in the area depends on the maintenance of the existing hydrological balance of the MWSS. The rapid land development in the Klang River Basin, and in the area of the MWSS itself, especially land filling, threatens the ecological integrity of the area. The integrated river basin management component will ensure that the MWSS area is protected from such developments and the irreversible loss of the MWSS. Recent studies in Malaysia have quantified the use and nonuse values of wetlands, including functions such as acting as carbon sinks, and for flood retardation; their uses as habitats for fish, and wildlife; and their biodiversity attributes. However, calculating the value of retaining an option to future uncertain alternative uses of the MWSS is difficult, and given data limitations, the option value, although assumed to be substantial, has been very conservatively estimated at \$15/ha per year.

### 4. Economic Prices, Project Economic Life, and Exchange Rates

18. The economic costs include all capital costs, including resettlement costs and recurrent costs, and are based on average 1996 market prices. The financial (local market) costs of Project inputs and benefits are converted to economic values using the following conversion factors calculated in a recent study.<sup>1</sup> No specific conversion factor for labor is calculated, since labor is an intermediate good in the Project inputs, and its shadow value is therefore incorporated into the specific conversion factors.

Standard conversion factor	-	0.90
Construction	-	0.96
Petroleum products	-	0.94
Nonelectric machinery	-	0.98
Electric machinery	-	0.81
Motor vehicles	-	0.78
Real estate and dwellings	-	0.89
Other services	-	0.86

19. The economic life of the Project is assumed to be 30 years, as the Project impacts are long term in nature. International values are converted into domestic values using the official exchange rate of RM2.495 = \$1, which was the rate prevailing during appraisal of the Project.

### 5. Economic Internal Rate of Return and Sensitivity Analysis

20. A substantial portion of the Project benefits are not evaluated, therefore the EIRR calculation underestimates the benefits of the Project, and should be considered as a conservative estimate of the rate of return. The Project EIRR is estimated at about 14.9 percent. The Project will have reasonable returns on investment that exceed 12 percent per annum, particularly considering the benefits from indirect use and nonuse values of the

<sup>1</sup> Tan Tok Shiong. 1994. *Shadow Prices for Malaysia with an Extended Semi Input-Output Method*. Ph.D. thesis, Bradford University.

Project that are not estimated in the analysis. Despite the exclusion of these unquantified benefits, the Project is considered to be economically viable.

21. A sensitivity analysis was undertaken to test the effect of likely variations in the estimated costs and benefits of the Project by assuming (i) a 10 percent increase in total Project costs, (ii) a decrease in benefits of 10 percent, and (iii) the combined effect of a 10 percent cost increase and a 10 percent decrease in benefits. The results indicate that the EIRR's sensitivity to changes in incremental benefits or incremental capital and recurrent costs is low. A 10 percent increase in costs will only reduce the base case EIRR from 14.9 percent to 13.4 percent, and a 10 percent decline in benefits will only reduce the EIRR to 13.3 percent. The more severe, but nonetheless possible scenario, a combination of a 10 percent increase in costs and a 10 percent decrease in benefits, results in an EIRR of 12.0 percent, which is still relatively robust, given the severity of this assumption.

22. Switching values of the EIRR have been calculated and indicate that incremental costs could rise by 22.4 percent before the EIRR falls to 12 percent, indicating that the Project can withstand a reasonable increase in costs while remaining economically viable. The incremental benefits can also decrease by a reasonable amount of 18.3 percent before a 12 percent EIRR is reached. The sensitivity analysis indicates therefore, that the Project's viability is more sensitive to reductions in assumed benefit levels than it is to cost increases, and that the Project can tolerate relatively large, unfavorable changes to its benefits and costs, and still remain viable. In any case, the benefits, while realistic, have been conservatively estimated in the analysis, with several indirect use and nonuse benefits not quantified.

**Table 1: Estimated Benefits due to the Project  
Including Estimated Enhancements<sup>1</sup>**

Benefits Categories	On-site Benefits	Off-site Benefits	Total Estimated Value (\$) in 2003
<b>Integrated River Basin Management</b> <ul style="list-style-type: none"> <li>• Soil erosion reduced</li> <li>• Land value improvement</li> <li>• Aesthetic values</li> <li>• Improved river quality</li> </ul>	<ul style="list-style-type: none"> <li>• 1,290 km<sup>2</sup> assuming \$130/ha incremental value for 30% of the land</li> <li>• Sediment reduced from 2.3 million tons to 1.5 million tons</li> <li>• Aesthetic value</li> </ul>	<ul style="list-style-type: none"> <li>• Clean water (water pollution reduced by 50% by 2003)</li> <li>• Reduction in sediment removal costs</li> </ul>	<ul style="list-style-type: none"> <li>• 1.0 million</li> </ul>
<b>Solid Waste Management</b> <ul style="list-style-type: none"> <li>• Reduced cost of rubbish collection</li> <li>• Improved health</li> <li>• Aesthetic values</li> <li>• Civic values</li> </ul>	<ul style="list-style-type: none"> <li>• Improved health</li> <li>• Uncollected solid waste reduced by 30%</li> <li>• Aesthetic values</li> <li>• Civic values</li> </ul>	<ul style="list-style-type: none"> <li>• Clean air</li> <li>• Clean water</li> <li>• Reduced cost of collecting rubbish from the rivers</li> </ul>	<ul style="list-style-type: none"> <li>• 1.2 million due to reduced costs and 1.2 million from indirect benefits</li> </ul>
<b>Sediment Trapping</b> <ul style="list-style-type: none"> <li>• Sand sales</li> <li>• Cost savings from avoided dredging</li> <li>• Improved river quality</li> </ul>	<ul style="list-style-type: none"> <li>• Sand sales: \$ 0.2 million/yr. (130,000m<sup>3</sup> per yr.)</li> </ul>	<ul style="list-style-type: none"> <li>• Cost savings: \$ 0.6 million/yr.</li> <li>• Clean water</li> </ul>	<ul style="list-style-type: none"> <li>• 0.2 million</li> <li>• 0.6 million</li> </ul>
<b>Tributary River Corridor Improvement</b> <ul style="list-style-type: none"> <li>• Land value improvement</li> <li>• Aesthetic values</li> <li>• Avoided damages and disruption</li> <li>• Recreational values</li> <li>• Reduction in riverbank erosion</li> </ul>	<ul style="list-style-type: none"> <li>• 2,500 ha assuming \$130/ha incremental land value</li> <li>• Aesthetic values</li> <li>• Recreational values</li> </ul>	<ul style="list-style-type: none"> <li>• Avoided damages: about \$6 million in 2003</li> <li>• Clean water</li> </ul>	<ul style="list-style-type: none"> <li>• 0.7 million land value</li> <li>• 3.6 million land value</li> </ul>
<b>Flood Forecasting and Warning System</b> <ul style="list-style-type: none"> <li>• Avoided damages and disruption</li> </ul>	<ul style="list-style-type: none"> <li>• Avoided damages</li> </ul>	<ul style="list-style-type: none"> <li>• Avoided damages</li> </ul>	<ul style="list-style-type: none"> <li>• 2.6 million</li> </ul>
<b>Rasau Swamp Protection (1,800 ha)</b> <ul style="list-style-type: none"> <li>• Flood retardation</li> <li>• Carbon sequestration</li> <li>• Tourism</li> <li>• Biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Carbon sequestration assuming 11 mt/ha/yr. for 1,800 ha at \$12.76/mt initially</li> <li>• Tourism: 15,000 persons/yr. each spending \$10</li> <li>• Biodiversity: \$15/ha/yr.</li> </ul>	<ul style="list-style-type: none"> <li>• Flood retardation: \$0.3 million/yr.</li> <li>• Carbon sequestration</li> </ul>	<ul style="list-style-type: none"> <li>• 0.3 million flood retardation</li> <li>• 0.25 million carbon sequestration</li> <li>• 0.16 million tourism</li> <li>• 0.03 million biodiversity</li> </ul>
<b>Soil Erosion Demonstration Projects</b> <ul style="list-style-type: none"> <li>• Land value improvement of the demonstration areas</li> </ul>	<ul style="list-style-type: none"> <li>• Land value improvement</li> </ul>	<ul style="list-style-type: none"> <li>• Diffusion effect</li> </ul>	<ul style="list-style-type: none"> <li>• Value is minimal due to smallness of areas involved</li> </ul>
<b>Education/Public Participation</b> <ul style="list-style-type: none"> <li>• Solid waste reduced</li> <li>• Health benefits</li> <li>• Aesthetic values</li> <li>• Soil erosion reduced</li> <li>• Water pollution reduced</li> </ul>	<ul style="list-style-type: none"> <li>• Solid waste reduced</li> <li>• Health benefits</li> <li>• Aesthetic values</li> <li>• Soil erosion reduced</li> </ul>	<ul style="list-style-type: none"> <li>• Solid waste reduced</li> <li>• Health benefits</li> <li>• Aesthetic values</li> <li>• Soil erosion reduced</li> <li>• Clean water</li> </ul>	<ul style="list-style-type: none"> <li>• Value quantified in above categories</li> </ul>
<b>Improvement of Health</b> <ul style="list-style-type: none"> <li>• Increased productivity</li> </ul>		<ul style="list-style-type: none"> <li>• Improved human welfare</li> </ul>	<ul style="list-style-type: none"> <li>• Value not quantified</li> </ul>
<b>Beautification</b> <ul style="list-style-type: none"> <li>• Land value improvement</li> <li>• Increased tourism</li> </ul>		<ul style="list-style-type: none"> <li>• Land value improvement</li> <li>• Increased tourism</li> </ul>	<ul style="list-style-type: none"> <li>• Value not quantified</li> </ul>
<b>Increased Fish Production</b> <ul style="list-style-type: none"> <li>• River and wetland</li> <li>• Offshore</li> </ul>		<ul style="list-style-type: none"> <li>• River and wetland fish life increased by 20% by 2003</li> <li>• Offshore</li> </ul>	<ul style="list-style-type: none"> <li>• Value not quantified</li> </ul>

<sup>1</sup> See Table 2 for details of the assumed benefits.

Table 2 : Economic Viability Analysis - Constant 1996 Prices  
(RM million)

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	30
<b>Project Benefits</b>																
IRBM: Land value increase	-	-	-	-	-	2.5	2.5	2.5	2.5	2.5	-	-	-	-	-	-
Solid Waste: Collection cost savings	-	1.8	2.5	2.6	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.6	3.7	3.8	4.0	7.2
Solid Waste: Indirect benefits	-	1.8	2.5	2.6	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.6	3.7	3.8	4.0	7.2
Sediment Trapping: Cost savings	-	-	0.5	1.1	1.6	1.6	1.8	1.6	1.6	1.5	1.5	1.4	1.3	1.3	1.2	0.6
Sediment Trapping: Sand sales	-	-	0.2	0.4	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.2
Tributary Rivers: Damage avoided	-	-	4.2	5.9	8.4	8.8	9.1	9.5	9.9	10.3	10.7	11.0	11.3	11.7	12.0	17.1
Tributary Rivers: Land value increase	-	-	-	-	0.2	0.2	0.2	0.2	0.2	-	-	-	-	-	-	-
Flood Forecasting: Damage avoided	-	-	4.2	5.7	6.0	6.2	6.4	6.7	7.0	7.3	7.5	7.8	8.0	8.2	8.5	12.1
MWSS: Tourism	-	-	-	-	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.8
MWSS: Biodiversity	-	-	-	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MWSS: Carbon Sequestration	-	0.1	0.2	0.3	0.4	0.5	0.8	0.8	0.8	0.6	0.6	0.6	0.6	0.6	0.7	0.7
Total	-	3.6	14.3	18.7	23.0	26.5	27.6	28.5	29.3	29.8	28.2	29.0	29.7	30.5	31.5	46.0
<b>Project Costs</b>																
Integrated River Basin Management	5.8	6.7	6.2	4.7	3.6	3.2	-	-	-	-	-	-	-	-	-	-
Solid Waste Management	2.7	6.5	5.2	2.4	2.4	0.6	-	-	-	-	-	-	-	-	-	-
Sediment Trapping	0.3	1.1	3.9	2.9	-	-	-	-	-	-	-	-	-	-	-	-
Tributary River Channel Improvement	6.5	32.0	42.7	34.6	19.2	5.4	-	-	-	-	-	-	-	-	-	-
Flood Forecasting & Warning System	2.6	1.3	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-
Operation and Maintenance	-	-	-	-	-	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	18.0	47.7	58.1	44.5	25.2	9.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Economic Cash Flow	-18.0	-44.1	-43.9	-25.8	-2.1	17.4	27.1	28.0	28.9	29.4	27.8	28.5	29.3	30.1	31.0	45.6

Economic Internal Rate of Return: 14.9%  
Net Present Value: 65.7  
Net Present Value of Environmental Benefits as Percent of Total Benefits: 60%



**Table 3: Sensitivity Analysis of EIRR  
(percent)**

<b>Variation</b>	<b>EIRR</b>
<b>A. Base Case</b>	14.9
<b>B. Sensitivity Tests</b>	
Costs increase by 10 percent	13.4
Benefits decrease by 10 percent	13.3
Costs increase by 10 percent and benefits decrease by 10 percent	12.0
<b>C. Switching Values<sup>a</sup></b>	
Project costs increase	22.4
Project benefits decrease	18.3

<sup>a</sup> Percentage by which variable tested can increase or fall to produce an EIRR of 12 percent (the opportunity cost of capital).