5 CONSTRUCTION PLAN

5.1 General

The study of the construction plan and schedule are carried out for the schemes with principal features as described in Table 5.1 and the required major construction works are summarized as follows:

(1) Cisadane River

- River channel improvement, about 20.0 km long, including dredging of river channel as well as construction and improvement of dikes.

- Construction of related drainage structures.

(2) Ciliwung Floodway

- Construction of a floodway consisting of 2 lanes of tunnels, about 1,000 m each by means of shield tunneling method, inlet structures including a control weir, outlet facilities and river channel protection works.

(3) Western Banjir Canal

- River channel improvement, about 17.4 km long, including dredging of river channel, widening of low water channel, reconstruction of 7 bridges, improvement of utility bridges, strengthening of existing bridge structures, and improvement of related drainage facilities.

- Improvement of the existing Manggarai Barrage including installation of an additional gated sluiceway and an intake channel for drainage canal.

- Construction of related drainage structures at Muara Angke.

It is assumed that the construction works will be mainly conducted under a contract system of which contractor(s) will be selected through international competitive bidding. The following basic considerations are taken for construction planning;

(a) Yearly workable days are estimated at 240 days on the assumption that the construction works will be suspended in Sunday, National holidays and heavy rainy days.

(b) One shift with 8 working hours per day will be applied throughout the year excluding the dredging and tunneling works which will operate by two shifts for the purpose to shorten the construction period.

(c) The construction works for road bridges will be carried out under active operational condition in principle.

(d) The existing rivers and canals have to be maintained of the present flow and drainage functions during the construction period. For this purpose, the construction works will be conducted with dry condition at the respective job-sites. Thus, the partial coffering are provided.

Based on the above condition and assumption, the construction plan and schedule is prepared to give an outline of possible construction sequence and method, and construction schedule.

5.2 Site Condition and Construction Plan

5.2.1 Cisadane River

There are the existing roads on both banks which run parallel with the river course and traffic on these roads is a little, so that they will be useful for the construction works. Furthermore, temporary construction roads will also be provided easily on both river banks, since most of these areas are occupied by grassland or forest.

Excavation for the river banks will be made by backhoes, bulldozers and tractor shovels, and embankment of the levees will be made as usual by using dump truck for hauling, bulldozer for spreading and soil compactor or tire roller for compaction. Dredging will be made by crawler crane with clam shell attachment, or backhoe mounted on pontoon, and/or a small size dredger in the downstream reaches from the existing bridge in Kec. Teluknaga.

Excavated materials which are suitable in quality are to be used for dike embankment. Unsuitable materials or excess materials to the required embankment are to be hauled and dumped in spoil banks and low-lying area near the river channel.

The levee embankment will be carried out mainly during dry season from May to November annually. Available working day for the embankment of levee is estimated at about 240 days annually, considering that of the similar river improvement projects performed in Indonesia.

Total volume to be spoiled from the river channel improvement is estimated at about 80,000 m^3, and it will require about 2.0 ha in total land areas for spoil banks alongside the Cisadane river.

In general, this area has also been developed well and mostly covered by paddy fields. However, there are some depressed lands or swamps here and there on both river banks. These depressed lands are caused by digging sand and gravel materials from the river terrace, and used for fishponds and dumping grounds at present. Some of these dumping grounds will be used for the spoil banks.

5.2.2 Ciliwung Floodway

(1) Control Weir

After the mobilization and preparatory works, the construction of non-gated control weir will be carried out by making cofferdam. The river diversion works will be divided into two stages. The first stage diversion will be carried out in the left side bank, and subsequently the second stage will be performed in the right side.

After the completion of coffering with steel sheet piles, the construction area will be dewatered by using submersible pumps and subsequently foundation excavation will be carried out by using backhoes, breakers, bulldozers with ripper and dump trucks.

The concrete works will be performed by using concrete bucket handled with crawler crane after the foundation excavation.

(2) Floodway Tunnel

(a) Inlet Side of Ciliwung River

A rather wide flat area exists on the right bank near the existing bridge on the main road from city center of Bogor. Therefore, access roads to the inlet portal as well as to the control weir construction site will be provided through this area, though a temporary construction bridge or a causeway will be required across the Ciliwung river.

To construct the inlet portals and control weir, temporary cofferings and river diversion works will be required as usual.

(b) Selection of Tunneling Method

Under the present circumstances, geology in the tunnel is very complicated with spring water and is not good condition for tunneling. Besides, the tunnel is planned to pass through just under the densely populated Bogor city with shallow overburden, so that no dynamite can be used for blasting. It is obliged to adopt a mechanical tunneling method for excavation as well as for concrete lining, though it is rather difficult to use in such complicated geological condition with spring water.

As for the mechanical tunneling methods, a comparative study has been made on the following two machines;

- Partial tunnel face excavation machine (road header)
- Shield tunneling machine (enclosed type)

Open type tunneling method by using a road header has following weak points as compared with an enclosed type shield tunneling machine;

(i) Tunnel face will fall down or washed out by artesian water.
(ii) Since the evacuation of ground water can not be made in the tunnels, a lot of chemical and/or cement groutings will be required for consolidation and stabilization of the tunnel face all over the tunnel length. It will take long construction period and will become uneconomical.

(iii) Bottom of tunnel will be easily disturbed and changed into mud by operating the heavy construction equipment and spring water, because the base rock contains clayey soil.

(iv) Bond between surrounding rock and shotcrete will be poor owing to a lot of spring water. Besides, rock anchor by means of rock bolts will also be inferior.

A lot of houses have been built just above the tunnel route and inhabitants living there have used ground water through wells for domestic purpose. Overburden of the tunnels is very shallow. Therefore, the ground water will easily escape into the tunnels, when the tunnels are excavated by using a road header with open type tunneling method. Thus, the wells will be dried up completely. Besides, the ground surface will be settled and it will cause some disasters against private houses, public facilities, etc.

Taking into consideration with such claims by inhabitants and compensation costs, it is indispensable to adopt the enclosed type shield tunneling method.

(c) Shield Tunneling Method

The tunnel construction will be initiated from portal construction at both inlet and outlet sites, and subsequently tunnel will be excavated by using a shield tunneling machine at first from the inlet side.

During excavation, evacuation of leakage water is quite necessary to prevent contamination of the foundation zone of tunnel.
Immediately after completion of the excavation by the shield machine, initial tunnel lining will be made by using reinforced concrete segments to be produced by a manufacturer in Indonesia.

Working conditions for the initial tunnel lining will be as follows:

- Tunneling by machine : 1,940 m (4.5 m/day)
- Excavation method : Starting base at inlet side; U-turn base at outlet side
- Shield machine : One enclosed type with mud earth pressure equipped with roller cutter for boulders and ribbon screw.

After completion of the initial tunnel lining, second lining with concrete will be carried out by using a steel sliding form and prescrete in the following manner:

- Steel sliding form : ϕ 8.0 m x 9 mL x 2 sets
- Lining thickness : 25 cm.

(d) Outlet Side of Cisadane River

There are an existing roads leading to the right side of river bank and a playground for football just upstream of the outlet portal of tunnel. This road will be utilized for access road and the playground will be used for a temporary construction yard as well as for stock yard of tunnel muck by procuring or renting the land.

(3) Concrete Work

There is no ready mixed concrete plant in and around Bogor city, but an existing private plant is available alongside the JABOTABEK line just intermediate point of Pasar Minggu and Depok. This is a nearest concrete mixing plant to the Ciliwung Floodway in Bogor. Besides, quality and supply capacity of the fresh concrete produced by this plant seem good enough from the results of field investigation. It will take about 40 minutes to the construction site by means of use of the toll roads to Bogor. Therefore, concrete placing for the Ciliwung Floodway can be made easily by using this private mixing plant.

(4) Concrete Aggregates

Among several sand and gravel pits and quarry sites around the project site, there is a rock quarry site near Rumpin available and recommendable for the construction of the Ciliwung Floodway. This quarry has been developed in a large scale by the private company who has 2 existing crushing plants and another additional one which has been operated since September, 1996. Total production capacity of these plants is 575 tons per hour.

It is considered better to purchase rubble stones and concrete aggregates from this quarry site, since quality of material is good and supply capacity is also good enough. P.U. Bogor also recommended this quarry site.

(5) Spoil Banks

Tunnel muck and surplus soil to be spoiled is roughly estimated at about 500,000 m^3 for 2 lanes of tunnels and open-cut excavation. It will require about 10.0 ha of spoil banks near the construction site.

There are a private land presently under reclamation by using spoiled soil on the right bank of the Ciliwung river near the existing road, and a play ground and grassland near the outlet portal of the tunnel. These areas will be used for the temporary stockyards of the tunnel muck by procuring or renting the lands.

A private developer has promoted a large scale land preparation and housing project near the confluence of the Cipaku river with the Cisadane river at about 1 km downstream from the tunnel outlet. A part of this area on the right bank of the Cisadane river will be used for the spoil bank. Besides, the other areas of land preparation and housing development projects planned in the suburbs of Bogor may also be available for the spoil bank.

5.2.3 Western Banjir Canal

(1) River Channel Improvement

Total length of the canal to be improved is about 17.4 km from the Manggarai Barrage to the estuary. Most important matter for this improvement work is how to excavate the canal and how to transport the surplus soil to the designated spoil banks under the present heavy traffic conditions in Jakarta city.

(a) Manggarai Barrage to M. H. Thamrin Bridge

The excavation will be made by means of combination use of a special swamp backhoe and barges or load haul dumps in the canal and the excavated materials are hauled by barges or load haul dumps to some flat areas in the canal during the dry season.

Instead of use of a barge, a temporary haul road is constructed during dry season alongside the right bank to some flat areas by using grovel and weathered rock excavated from the Ciliwung floodway sites. Then, muck excavated for the improvement is transported by small size dump trucks through this temporary haul road. Finally, the temporary haul road is removed by using backhoe and dump trucks.

(b) M. H. Thamrin Bridge to Aipda K. S. Tubun Bridge

The existing road on the right bank and that located downstream of the Karet Barrage on the left bank can be utilized for the haul roads. The cultivated lands and playgrounds will be utilized for construction yard and/or temporary stockpiles for the surplus soil excavated.

Excavation for canal improvement will be made easily by using backhoes and a crawler crane with clam shell. Besides, both banks downstream from the Karet Barrage have already been widened and protected by bamboo nets and bars.

(c) Aipda K. S. Tubun Bridge to Prof. Dr. Latumeten Bridge

The canal in this stretch runs well developed city areas. However, there are some existing roads with a little traffic along the canal on both banks, especially on the right side. Therefore, these roads will be used for the haul roads during construction period.

The improvement works will be made by backhoes, clam shells and dump trucks.

(d) Prof. Dr. Latumeten Bridge to Estuary

The canal improvement will be made by using backhoes and clam shells together with dump trucks as usual for which the existing toll road and new roads under construction will be used as haul roads.

As for an alternative plan, dredging by using a pump dredger may be considered for downstream reaches from the Mandara Permai Bridge to the estuary.

(e) Reconstruction of Existing Bridges

There are 16 bridges on the Western Banjir Canal. Out of these 16 bridges, 7 bridges have some problems with the proposed design water level of the WBC. It is proposed to replace those bridges which names and features are shown in Table 5.1.

(2) Improvement of Existing Manggarai Barrage

It is planned to improve the existing Manggarai Barrage by providing an additional gated sluiceway at the right side of the existing barrage.

The following construction measures are suggested to construct this additional sluiceway;

(a) To discharge river flow to the lower Ciliwung drain and the Western Banjir Canal as much as practical to lower the water level in front of the existing barrage.

(b) To protect and reinforce the railway by under-pinning method using H-steels and rails.

(c) To enclose both construction areas upstream and downstream by using steel sheet piles and/or continuous underground walls.

(d) To demolish a part of existing concrete structures adjoining to the right side of the barrage including a intake gate and pipe culvert.

(e) To construct concrete culvert for the additional sluiceway in the upstream construction area.

(f) To install a gate for sluiceway and construct related concrete structures including reconstruction of the small intake after the sluiceway culvert has been settled in a proper position.

During the construction period, the existing one way road located between the Manggarai Barrage and the JABOTABEK line will be closed, since the upstream construction area is rather small.

(3) Spoil Banks

Volume of excavated materials to be spoiled is estimated at about 1,700,000 m^3 in total, of which about 700,000 m^3 will be rather good soil materials and about 1,000,000 m^3 will be sludge material dredged under the water.

In this case, the following spoil banks will be required;

- For rather good soil materials	:	about 14.0 ha
- For sludge materials	:	about 20.0 ha
Total area required for spoil bank	:	about 34.0 ha

Since the areas located alongside the Western Banjir Canal have been already fully urbanized, there is no suitable spoil banks near the excavation or dredging sites.

There is a land reclamation area now under planning at the water front near the existing thermal power plant owned by PLN in Pluit or some swamps near Waduk Pluit. These areas may be used for the spoil banks for the improvement works of the Western Banjir Canal. Besides, the areas of reclamation and/or land preparation projects planned in the northern coast of Jakarta, and any other housing development projects planned in and around Jakarta city may be available during the construction period.

5.3 Construction Schedule

The construction works of the urgent flood control project (1st stage project) will be stagewised taking account of required big amount of the project costs in the following manner:

1st Phase	:	- Construction of the Ciliwung Floodway
		- River improvement of the Cisadane river and related works
2nd Phase	:	- River improvement of the Western Banjir Canal including improvement of the Manggarai Barrage and related facilities.

The construction period of each phase will be about four years and a half of which the time schedule is presented for the 1st and 2nd phases in Figures 5.1 and 5.2, respectively.

Prior to each construction works, the detailed design works is required for about one and half a year including survey and investigation works necessary for the detailed design and preparation of tender documents required for selection of appropriate contractors.

The selection of contractors will be carried out through the international competitive tenders with prequalifications, and it will take about one year for each phase.

Implementation schedule of the priority project is proposed as shown in Figures 5.3. Whole implementation period of the project will be about 12 years after the completion of on-going feasibility study.

As indicated in Figure 5.3, necessary land acquisition and house resettlement compensation are required before commencement of the respective construction works.

6 NON-STRUCTURAL MEASURES

6.1 General

(1) Flood Risk Map

Low-lying area of DKI Jakarta has been suffering from habitual inundation for many decades. In order to cope with this, the Ministry of Public Works has been implementing various flood control and drainage projects in the area.

But the implementation of the flood control and drainage master plan in the area still needs much fund and time to be completed. And since the area is fundamentally located in the flood plain, even after completion of those flood control and drainage projects in line with the master plan, the area will be still subject to flooding. The causes may be failure of facilities, failure of operation of facilities, limitation of design scale, human activities against flood control and drainage facilities such as garbage dumping to river area or illegal structure construction in river area and others, abnormal high tide, other abnormal natural phenomena, etc.

Due to these reasons, non-structural measures for flood damage mitigation is inevitable in addition to structural measures. Flood risk map in low-lying area of DKI Jakarta is thus prepared as one of such non-structural measures.

(2) Flood Warning System

Since the flood of the Ciliwung river is to be diverted to the Cisadane river, it is necessary to improve the Cisadane river in its downstream reaches where the carrying capacity is not enough for the design discharge. But in addition to the river improvement of the Cisadane river, establishment of flood warning system for the Cisadane river is also required. As observed in the flood in January 1996, the river flow of the Cisadane river in Bogor city was just in a normal situation on the day when the big flood of the Ciliwung river attacked Bogor city and DKI Jakarta. Accordingly a flood warning system for the Cisadane river is indispensable for the projects.

6.2 Flood Risk Map

(1) General

Flood risk map is prepared on the condition that inundation would occur when failure of dike happens and the failure of dike may occur at any place in the objective reaches of the river during a 100-year probable flood of each river.

(2) Objective Area

The objective area of flood risk map covers the low-lying area of downstream basin of the Cengkareng Floodway, the Ciliwung, the Western Banjir Canal, the Cipinang, the Sunter, the

Jatikramat, the Buaran, and the Cakung rivers. The area is about 500 km^2 wide.

(3) Flood Risk Map

The flood risk map shows the maximum simulated inundation area as in Figure 6.1.

6.3 Flood Warning System

6.3.1 Present Situation of River Use

The present situation of river use of the Cisadane river in the reaches downstream of the outlet site of the Ciliwung floodway is as follows:

(1) Just downstream site

The area is in the city of Bogor and the river is used for washing, playing and fishing. In the reaches just upstream of Empang barrage, river is used for inland fishery, sand mining, and water intake by Empang barrage.

(2) In the middle reaches

The area is outside of Bogor city and the Cisadane river forms a very deep valley. The river is used for sand mining at places and partly for upland cropping.

In the reaches just upstream of Pasar Baru Barrage, the area is located in Tangerang city. The river water level is kept high by the Pasar Baru Barrage and the urban area is just close to the river water surface.

(3) In the downstream reaches (to the river-mouth)

In the reaches just downstream of Pasar Baru barrage, river water in dry season is very little since the river water is taken for irrigation purpose by the barrage. Since there exists only one bridge in the reaches, many ferry facilities are found. In the reaches near the estuary, water transportation and sand mining are found.

6.3.2 Flood Propagation

From the outlet site of the Ciliwung floodway to the site of Pasar Baru barrage, the river length is about 85 km. Accordingly the propagation time of flood from the outlet of the Ciliwung floodway to the Pasar Baru barrage site is estimated to be about 8 hours. The Cisadane river in the reaches forms a very deep valley and the flood peak in the upstream reaches decreases so much.

Accordingly, by the diversion of flood of the Ciliwung river to the Cisadane river, the river water level of the Cisadane river will rise rapidly in the reaches just downstream of the outlet site, but it will not rise so rapidly in the middle and downstream reaches of the Cisadane river.

In the middle reaches of the Cisadane river, many tributaries join the Cisadane river. Accordingly for the proper operation of the Pasar Baru barrage, the information on flood not only about the flood from the Ciliwung floodway, but also about floods from the many tributaries are needed.

6.3.3 Basic Concept of Flood Warning System

Basic concept of flood warning system for the Cisadane river is that information on flood diversion from the Ciliwung river to the Cisadane river should be conveyed to the society of the riverine area along the Cisadane river before the flood reaches the objective area. And the monitoring system for flood of the Ciliwung and Cisadane rivers should be established for that purpose.

6.3.4 Flood Warning System

(1) Monitoring Site

The following should be the monitoring sites for flood warning:

1) inlet site of the Ciliwung floodway (Katulampa barrage as supplementary site)
2) outlet site of the Ciliwung floodway
3) Empang barrage
4) Serpong water-level gauging station
5) Pasar Baru barrage
6) Depok
7) Manggarai

(2) Facilities and Functions

1) Inlet site	: radio communication for downstream sites
2) Outlet site	: radio communication for upstream and downstream sites warning to the riverine area by sirens
3) Empang barrage	: radio communication for upstream and downstream sites warning to the riverine area by sirens
4) Serpong site	: telemetering for downstream sites
5) Pasar Baru barrage	: radio communication with upstream sites warning to the riverine area by siren car

(3) Network System

The proposed network system for flood warning and reporting is shown in Figure 6.2.

7 COST ESTIMATE

7.1 General

Project cost is estimated for the following cost items:

(a) Direct construction cost
(b) Land acquisition and house compensation costs
(c) Government administration cost
(d) Engineering service cost
(e) Contingencies
(f) O & M cost

The direct construction cost is further subdivided into preparatory works, main civil works including hydromechanical works and miscellaneous works.

7.2 Condition for Cost Estimate

The basic assumptions and conditions employed for the cost estimate are set forth as follows;

(1) The costs presented are the financial costs at the price level of October, 1995.

(2) The following exchange rates of domestic to foreign currencies are applied;
US$ 1.0 = Rp. 2,281 = JP¥. 100.48
JP¥. 1.0 = Rp. 22.70

(3) The cost required for main civil works is estimated by multiplying work quantity by unit price.

(4) The unit prices applied include costs for materials, plant and equipment including spare parts, operators, technicians, labors and contractor's overhead, profit and local taxes.

(5) The costs for preparatory and miscellaneous works are estimated at 8% and 10%, respectively, of the main civil works including hydromechanical works, except for preparatory works of the shield tunneling work, that is 15 %.

(6) The project cost is divided into foreign and local currency portions in accordance with the following classification;

(a) Foreign Currency Portion (F.C.)

- Depreciation cost of construction equipment including cost for spare parts and maintenance cost.
- Metal works, if any.
- Procurement costs for imported materials and special construction

equipment, if any, and foreign portion of local material.
- Cost for foreign technician for execution of works.
- Engineering service cost for foreign consultants.

(b) Local Currency Portion (L.C.)

- Land acquisition and house compensation costs.
- Labor wages.
- Government administration cost.
- Engineering service cost for local consultants.
- Locally obtained materials such as sand, gravel, timber board, concrete products, steel pipes, small gates, etc.
- Inland transportation cost.

(7) Government administration cost is estimated in local currency portion at 5.0 % of the sum of the direct construction cost(foreign and local currency portions) and land acquisition and house compensation costs.

(8) The engineering service costs during the detailed design stage and construction supervision stage are estimated at 5 % and 10 % of the direct construction cost, respectively.

(9) The physical contingency is estimated at 10 % of the sum of the total cost.

(10) The price contingency applied is 3% for foreign currency portion and 8% for local currency portion.

(11) The foreign currency portion is expressed by Japanese Yen and the local currency portion is expressed by Indonesian Rupiah.

(12) The annual operation and maintenance cost of each scheme is approximated as follows;

- 1 % of the total construction cost for main civil works.
- 2 % of the total installation cost for hydromechanical equipment.

7.3 Financial Cost

The total construction cost is estimated at about 500 billion Rupiah, consisting of about 15.0 billion Japanese Yen and about 159 billion Rupiah, as shown in Table 7.1.

The total project cost, except price contingency, is estimated at about 754.2 billion Rupiah, consisting of about 19.0 billion Japanese Yen of foreign currency portion and about 323.1 billion Rupiah of local currency portion as shown in Table 7.2.

7.4 Annual Disbursement Schedule

Based on the implementation schedule shown in Figure 5.3, the annual disbursement schedule has been prepared as shown in Table 7.3.

Funds required for the implementation of the urgent flood control project (1st stage project) including the price escalation are summarized below:

Foreign currency	:	RP.534,178 million (¥23,532 million)
Local currency	:	Rp.560,966 million
Total equivalent		:Rp.1,095,144 million.

8. PROJECT EVALUATION

8.1 Methodology

(1) Damageable Property

The methodology applied for the economic evaluation of the urgent flood control project (1st stage project) is same as that applied for economic evaluation of the flood control Master Plan. The same general assets and agricultural assets are used for estimation of flood damage.

(2) Review of Indirect Damage

According to information obtained through the interview survey, one of the largest car manufacturing companies had to stop operation of the factory for two weeks during and after the flood in February 1996. They estimate that the loss due to the shutdown of the factory is far bigger than the direct damage to their properties. According to a division manager of an international hotel in Jakarta, the economy of Jakarta was completely standstill during floods, and no hotel guests could go out for business.

In view of these kinds of information, the indirect flood damage has been reviewed by the following manner.

Average annual growth rate of per capita regional income in DKI Jakarta is assumed to be 5.4 % from growth rate of RGDP per capita. By using the growth rate, per capita regional income in 2008 is estimated at Rp.12.3 million when the urgent flood control project (1st stage project) is almost completed. Assuming that 2/3 of whole population in DKI Jakarta is the population of working people, per capita regional income in 2008 for working people is estimated at Rp. 18.4 million .

Assuming that working population in the beneficial area of the Western Banjir Canal (WBC) is 500,000 from the number of shops, offices, factories, warehouses, and public offices in the area, the reduction of per capita regional income due to the suspension of working for two weeks for these people is estimated at Rp. 352 billion.

This amount is more than 60 % of the direct flood damage under the condition of 50-year flood. Therefore 60 % of the direct flood damage is assumed to be the indirect flood damage in the Western Banjir Canal system.

As for the Cisadane river system, 6 % is applied according to the standard developed by Ministry of Construction, Japan, since the most of the area along the downstream reaches of the Cisadane river will assumed to remain as agricultural land.

The beneficial area of the urgent flood control project (1st stage project) is shown in Figure 8.1.

8.2 Flood Reduction Benefit

Based on the probable flood damage by different magnitude of flood, annual mean flood damage is calculated as presented below.

(Unit: Million Rp)

Alternative	Scale	Flood reduction benefit
Cisadane River system (CSD)	25-year	6,420
Western Banjir Canal system (WBC)	100-year	101,672
Total		108,092

These are the flood reduction benefit.

8.3 Economic Project Cost

(1) Project Cost

The financial project cost of the urgent flood control project (1st stage project) has been converted into the economic cost with the same manner as that used for the flood control Master Plan.

The reviewed financial and economic project costs of the urgent flood control project are shown in Table 8.1.

(2) Annual Operation and Maintenance Cost

Annual operation and maintenance costs for flood control facilities are assumed to be 0.5 % of the direct construction cost, and is estimated at Rp.2,384 million per year.

(3) Replacement Cost

Average lifetime of the metal and mechanical works related to the project is assumed to be 25 years after installation. The replacement cost covers cost for replacement of such metal and mechanical facilities after the lifetime during project life, and is estimated at Rp.2,542 million.

8.4 Economic Evaluation

Economic viability of the urgent flood control project (1st stage project) is assessed using three indicators: economic internal rate of return (EIRR), cost-benefit ratio (B/C), and net present value (NPV). The economic viability of the urgent flood control project is summarized below and its annual cash flow is shown in Table 8.2.

River system	Alternative	EIRR	B/C	NPV (Million Rp)
Western Banjir Canal system + Cisadane River system	WBC-1 +CSD-1	13.1 %	1.10	35,281

Note: Discount rate of 12 % is assumed for calculation of B/C and NPV.

Sensitivity of EIRR of the urgent flood control project (1st stage project) has been examined adopting increase in cost and decrease in benefit. The result of the sensitivity analysis is shown below.

Case	EIRR
(a) Base Estimate	: 13.1 %
(b) Construction cost increase of 15 %	: 11.5 %
(c) Benefit decrease of 15 %	: 11.3 %
(d) Combination of (b) and (c) above	: 9.9 %

8.5 Environment Impact Assessment (EIA)

8.5.1 Environmental Items

The major components of the Project, which is described in Chapter 3, are the improvement of Western Banjir Canal and the Cisadane river, and the construction of Ciliwung floodway. According to the Initial Environmental Examination (IEE) in the Master Plan Study, the environmental items for the IEE have been principally selected from common items related river improvement projects.

Among the selected environmental items for the IEE, the following items would be expected to be significant for EIA study through the IEE and general features of the Project.

- Impacts on the precious ecosystem
- Impacts on the historical Assets
- Impacts on air pollution and noise
- Impacts on transportation system
- Impacts on water quality in the rivers
- Impacts on using of ground water
- Impacts on the displaced people

The EIA study area is shown in Figure 8.2

8.5.2 Environmental Impact Assessment

(1) Encroachment of the Precious Ecosystem

In the estuaries of Western Banjir Canal and the Cisadane river, there are small mangrove forests. However, these mangrove forests have been affected by various problems such as coastal erosion, soil erosion, exhaustion of mangrove forest resources and aqua resources. Therefore the density of mangrove has been reduced and types of remaining mangrove are limited, and dominant types are shown below.

English name	Indonesia name	Latin name
Mangrove	Api-api	Avicenia marina
Mangrove	Bakau Merah	Rhizophora mucronata

16 species of birds and 2 species of reptiles to have been protected were identified in and around estuaries of Western Banjir Canal and the Cisadane river (e.g., birds: Phalacrocorax niger, Anhinga melanogaster, Egretta alba, Ardea cinerea, etc. reptiles: Phyton reticulatus, Varanus salvator). Remaining mangrove forests in estuaries of these rivers can be considered as a comfortable habitats of water birds. However, according to the Preliminary Design of Western Banjir Canal and the Cisadane river, there is no alteration of land due to a provision of dyke and excavation work around these mangrove forests. Thus, no serious impacts on the terrestrial flora/fauna will be caused by the Project.

70 types of fishes and 7 types of shrimps were identified in the estuary of the Western Banjir Canal, however, these fish types and shrimp types are rather common in Indonesia, and no endangered types can be found there. Thus, no serious impacts on the aquatic biota will be caused by the Project.

(2) Historical Assets

The Batutulis village near the outlet site of Ciliwung Floodway is famous for its historical site, because this village has been located in the Keraton, Pajajaran Kingdom zone. Many types of historical assets symbolizing prosperity of the Keraton, Pajajaran Kingdom have been discovered around this area. Therefore it is probable that some cultural and historical assets will be found during the construction period. If some excavated objects are found around outlet site during construction period, the historical value of them should be identified in cooperation with Archaeology Service of Education and Cultural Office in Kodya Bogor, and if necessary, the appropriate management such as a drilling the ground to identify the possibility of buried archaeological objects should be conducted by above-mentioned executive agency.

(3) Air Pollution

Considering a construction scale of the river improvement and the similar cases in Japan, Annual mean NO2 concentration normally increases within range from 0.005 to 0.01ppm around the construction sites due to the operation of construction machines such as shovels and bulldozers for excavation works. However, exhausted NO2 gases will be soon dispersed, and this concentration values will become almost same to the background level at the point about 100m apart from the pollution source which is expected to be the maximum level ground point. Thus, no serious impacts on the air quality would be caused by the operation of construction machines.

The dust dispersion caused by the construction vehicles is considered unavoidable to the communities along the construction roads because of the drying up of surface soils especially I the dry season. A periodical water sprinkling of the construction roads should be conducted during the construction period.

(4) Noise

Since several villages and communities are located along Western Banjir Canal, the Cisadane river and around the inlet and outlet facility sites of Ciliwung river, the construction activities such as the operation of construction machines and vehicles would cause negative impacts to the local people due to noise hazard during the construction period. Therefore, prediction of noise level has been conducted at prediction points which are 20m, 50m and 100m in distance from the noise source (the construction sites).

Based on Hand Book concerning Countermeasure for Construction Noise and Vibration of Japan Construction Machine Association (1986), the noise level of construction works for river improvement can be assumed as follows;

Construction works	Noise level dB(A)
Excavation or Embankment work	about 107dB(A)
Shield tunnel work	about 110dB(A)

Based on above mentioned data, the prediction result of noise level at the prediction points is summarized below:

	Noise Level dB(A)		
Construction works	20m point	50m point	100m point
Excavation or Embankment work	73.0	65.0	59.0
Shield tunnel work	76.0	68.0	62.0

The predicted noise levels are almost higher than the noise standard in Indonesia (60dB(A) in the residential area). It should be noted that the actual future noise level during the construction could be less than the predicted noise levels, because the existence of houses, and ground undulation in the Project site will reduce the noise level.

Since there is no noise criteria related to construction works in Indonesia, the criteria in Japan is shown below. The predicted point of 20m from noise source could be assumed to be on the boundary of construction site. The predicted noise level would be low compared with this criteria.

- 85dB(A) : at the boundary of construction site

However, some houses are close to the noise source, in particular residential complex the southern portion of which is facing to the inlet facility site of Ciliwung Floodway has been extended on the right bank of the Ciliwung river, it is recommended that the following countermeasures should be taken in order to reduce the noise level.

- Installing the temporary sound proof panels between the noise source and residential area
- Surrounding the main facilities related to shield tunnel works with proof sound panels

(5) Impairment of the transportation system

In DKI Jakarta, traffic jam caused by high traffic density is a common phenomena. According to the field survey, the present traffic density of the main streets along and across the Western Banjir Canal is about 5,000 vehicles per hour, and it is probable that there will be no more capacity for further increasing traffic density. However, these main streets would be used for the transportation of excavated material to the disposal areas, it could cause some impacts on the traffic capacity during the construction stage. According to the construction plan of the Project, the number of dump truck to be necessary for transportation of excavated material could be estimated at about 24 trucks per hour (refer to Table 8.3).

The traffic volume of transportation trucks is very few compared with the present one, thus, the relatively low magnitude of impacts would be expected, however, taking into the consideration the present traffic conditions, it is recommended that the following efforts should be adopted.

- Pontoons should be used for the alternative transportation of excavated material as much as possible in the Western Banjir Canal.
- transportation activities should be carried out except for rush-hour in the morning and evening

5 road bridges and 2 railway bridges, which are across the Western Banjir Canal, are built on the trunk line streets in DKI Jakarta. It is probable that the allowable load of some bridges are not enough for increasing traffic. As for rebuilding these bridges, it is recommended that the temporary bridges should be built along the present bridges in order to reduce magnitude of impacts on the traffic current.

(6) Water Quality Change

(a) Construction stage

River dredging and excavation works worsen river water quality caused by increasing suspended solids (SS) during the construction period. In the rainy season, its impact on river water quality is not considered due to high SS of the river water, but it could cause some impacts on the river water quality in the dry season.

In the residential areas along Western Banjir Canal, the main water source is municipal water and groundwater of shallow and deep wells, therefore water quality deterioration due to high SS is considered to be no significant problems. However, in the lower reaches of the Cisadane river, surface river water is utilized as water source for bathing and washing, therefore necessary countermeasures such as a limitation of work times and a information to residents about kinds of work should be taken.

The proposed inlet site of Ciliwung Floodway is located on the left bank of the Ciliwung river, the slope of which is very steep. Thus, soil erosion could be caused by construction works such as land cleaning and excavation of the inlet and outlet sites of Ciliwung Floodway, and it could cause some impacts on river water quality due to high SS. Therefore necessary countermeasures such as preparation of sedimentation ponds and temporary facing the steep slope should be taken to reduce the magnitude of impacts.

(b) Project operations

For assessment of water quality change in the middle reaches of the Ciliwung river and Cisadane river, where inlet and outlet of Ciliwung Floodway would be constructed, water quality sampling and analysis was conducted at the selected 2 stations in September 1996. The location of sampling stations and its result is as follows.

Location Item	Ciliwung river Pulau Armin (at the Floodway inlet)	Cisadane river Parung jambu (at the Floodway outlet)
Discharge(m3/s)	2.2	2.4
COD(mg/l)	2.1	21.2
T-N(mg/l)	1.26	3.36
T-P(mg/l)	0.12	0.28

source: ANDAL investigation in September 1996

COD, T-N and T-P concentration of the Ciliwung river is higher than ones of the Cisadane river, thus it is judged that water quality in the Cisadane river is characterized by chemical pollutants caused by domestic and commercial waste water more than one in the Cisadane river.

Besides, according to the discharge table at Ciliwung Floodway inlet which is shown in Fig.4-14 (in Chapter 4 PRELIMINARY DESIGN), the peak discharge in the Ciliwung river, which is less than about 80m3/s, could flow without flowing into the Ciliwung Floodway. Based on the discharge hydrograph of the flood in February 1996 at Katulampa barrage station which is located in upstream of the control weir of Ciliwung Floodway, the daily discharge against the peak discharge of 80m3/s could be estimated at 27.5m3/s. The average of normal discharge at Katulampa barrage could be estimated at about 10m3/s based on daily discharge data from 1980 to 1990, therefore the flowing into Ciliwung floodway would occurs at flooding in the Ciliwung river. Thus, no significant negative impacts are expected on the water quality in the Cisadane river due to the diversion water from the Ciliwung river.

(7) Using of groundwater

In the residential areas under which Ciliwung Floodway would be constructed, the shallow groundwater is utilized as the main water source for domestic water supply. There are about

60 wells of which the depth are ranged from 1.0m to 18.0m, and the elevation of the residential areas ranges from EL. 275.0 m to EL. 300.0 m.

According to the geotechnical investigation (described in Chapter 2), the groundwater flows across the tunnel floodway, because the elevation of tunnel floodway ranges from EL. 257.0 m to EL. 269.0 m, and that of groundwater ranges from EL .258.8 m to EL. 280.4 m. Therefore, the construction work of the tunnel floodway will influence the use of shallow groundwater due to groundwater gushing out during the construction stage. However, adopting a muddy water shield method for construction of tunnel, no groundwater gushing out can be expected. Therefore, no serious impacts on the using groundwater would be caused by the construction of tunnel floodway.

(8) Impact to the Local Communities

A series of socio-economic studies was conducted to assess the impact of the proposed projects to the local communities through changes in population, land use, local economy, income, and other factors.

Resettlement is the most direct and critical socio-economic impact caused by the projects. Despite the efforts to minimize the resettlement, a total of 52.4 hectare of the land will be subjected to land acquisition. The magnitude of the resettlement is estimated as shown below.

Project	area, hectare	main land use	number of household*1	population*2
Ciliwung Flood Tunnel	4.1	housing, agricultural, small scale business	145	725
Cisadane River Improvement	45.3	agricultural	460	2300
Western Banjir Canal	3.0	housing	81	405

note *1 : based on JICA study, 1996
*2 : assuming 5 persons per household

In addition to the reviews of official records, about 10 % of the heads of the families of the potential resettlers were interviewed in order to obtain a better picture of the present socio-economic condition and their needs in relation to the resettlement. The potential resettlers are mainly farmers, fishermen, traders, workers in transportation industry, etc., and they belong to the low to middle income class (average annual household income < Rp 6 million). The proportion of the productive generation (age 15 to 55) is relatively low (about 50 to 60%) due to a large proportion of children. They are mainly concerned about the adequacy of the compensation, form of the compensation, time allowed for resettlement, and the new socio-economic relation with the future host communities. A large part of the potential resettlers is socially and economically bound to the area, and they prefer to move to the neighboring communities if the resettlement is inevitable.

As a part of the overall financial/economical analysis of the projects, the cost for land acquisition/compensation was estimated as sown below on the basis of the estimated values of the assets (See Section 8.3 for details).

Project	household or land	number	compensation per household or hectare	total compensation
Ciliwung Flood Tunnel	household	145	Rp 27 million	Rp 3,915 million
	land	4.1 ha	Rp 2,200 million	Rp 9,020 million
Cisadane River Improvement	household	460	Rp 7 million	Rp 3,220 million
	land	45.3 ha	Rp 1,000 million	Rp 45,300 million
Western Banjir Canal	household	81	Rp 27 million	Rp 2,187 million
	land	3.01 ha	Rp 6,000 million	Rp 18,060 million

The potential resettlers and other affected parties (e.g., illegal residents) are deeply concerned about their future. To facilitate the resettlement process, therefore, a comprehensive public relation/resettlement program needs to be developed in the Detailed Design stage of the project. The program should focus on assisting the resettlers and other affected parties in their efforts to integrate themselves socially and economically into the new host communities. The program shall be based on, but not limited to, the World Bank Operational Directive 4.30 (1990), and has to be developed in the earliest stage of the project preparation.

8.5.3 Environmental Management and Monitoring Plan (EMMP)

Normally, prediction of impacts and evaluation of these magnitude are conducted by Environmental Impact Assessment (EIA). When adverse impacts are predicted, mitigation measures or control methods are also studied as definitely as possible in the EIA. Besides, unexpected environmental problems may occur during and after implementation of the projects. In this case, it is very important to monitor and thereby manage the effectiveness and efficiency of the proposed mitigation measures and control methods. Thus, the Environmental Management and Monitoring Plan (EMMP) is required to cope with these matters.

(1) Environmental Items for EMMP

Considering the period to be continued and magnitude of negative effects of the possible impacts, the 5 items namely 1) Noise, 2) Impairment of the transportation, 3) Water quality (SS), 4) Groundwater and 5) Resettlement are selected for EMMP of the Project (refer to Table 8.4). As for the item of historical assets, when some archaeological objects are found around outlet site of Ciliwung Floodway during construction period, it become very important item, however it is considered appropriate to be managed by Archaeology Service of Education and Cultural Office in Kodya Bogor

(2) Organizational set-up for EMMP

In order to successfully implement the proposed schemes, establishment of a organization under executing body is of paramount importance. An organization consisting of appropriate members from DGWRD, the Local Government and National Land Affairs, and other related agencies shall actually execute the resettlement and compensation activities for the Project. A new unit for EMMP should be established in the Ciliwung -Cisadane River Basin Development Project Office provided by DGWRD. This unit shall handle environmental issues during and after the implementation of the proposed schemes as well as overall management of EMMP.

8.6 Overall Evaluation

Economic internal rate of return (EIRR) of the urgent flood control project (1st stage project) is estimated at 13.1 %.

The project would greatly contribute to the prosperity of social and economic activities and the people's welfare in Jakarta metropolis as the center of the political and socio-economic activities in Indonesia.

The project would cause some environmental negative impacts especially during the construction stage. Accordingly the monitoring organization for the environmental aspect would need to be organized to decrease the impact as much as possible.

9 INSTITUTIONS AND ORGANIZATION

9.1 General Project Implementation

(1) Definite Plan

Based on the provisions stipulated in prevailing, legislation, water resources development must be conducted based on a definite plan. Minister of Public Works have the task and duty to prepare the definite plan which has to be agreed and approved by all parties involved as suggested in Figure 9.1.

(2) Regulatory aspect to proceed for implementation

Based on law No. 11/1974 and operational regulations, many regulations on implementation proceedings have been prepared. But detailed implementation proceedings still must be developed and stipulated in the operational regulations, further to special condition.

9.2 River Improvement Works

(1) Authority and Responsibility

Authority and responsibility of river management are based on Government Regulation No. 35/1991 pertaining river. For executing/carrying out the task of river management, Government (Central and Region) established River Management Agencies.

According to Ministerial Regulation of MPW No. 48/PRT/1990, management of JABOTABEK area is still kept by Minister of Public Works. But the implementation of management day to day is still conducted by Provincial Government.

The Ciliwung-Cisadane River Basin Development Project (CCRBDP) which is established by Director General of Water Resources Decree No. 28/1994, is empowered to implement development/construction within the frame works of water resources development in JABOTABEK area. In the activities of flood control, CCRBDP is empowered to conduct management of flood control for the rivers flowing in the Province Regional Level I DKI Jakarta and West Java.

(2) Structure Crossing the River

There are several permanent bridges crossing the Western Banjir Canal which may disturb the flow of flood.

Because all of the bridges are government property (Ministry of Public Works and Provincial Government DKI Jakarta), the reconstruction/improvement of the bridge will be the responsibility of the Government. Regarding the decision on which agency should be responsible for the reconstruction/improvement and the cost will be provided by the Minister of Public Works in regard to the existing authority and responsibility (Ministerial Regulation of MPW No. 48/PRT/ 1990).

(3) Further Steps

One of the important factors for the implementation of the project is that the implementation of intended provisions must be obeyed as suggested in Figure 9.1.

To be in conformity with the provisions stipulated in the intended legislation, providing policies in implementation to proceed construction can be obtained through Forum of Coordination (provisions in Ministerial Regulation of MPW No. 67/ PRT/1993).

9.3 Tunnel Floodway Works

(1) Preparatory Stages

The level of the tunnel is about 20 m below the surface and located just right down under the city of Bogor. The system of construction will be implemented mostly by horizontal boring, and not disturbing the city. No land acquisition will be needed on surface land above the alignment of the tunnel.

To avoid any unlike circumstances, either as structural constraints related to engineering construction or non structural such as socio-psychological and socio-political constrains, etc., particular efforts and steps should be taken as follows:

1) In conformity with provisions stipulated in the prevailing regulations, especially Government Regulation No. 22/1982 and its operational regulations, a development plan on water resources have to be provided by the Minister of Public Works. (refer to Figure 9.1).

2) Operational regulations, either which should be issued by Central Government (MPW, Minister of Home Affairs, Minister of Environment) or by Provincial Government, have to be settled, covering the structural and non structural aspects.

The development of the said operational regulations, is similar but proportional to the procedures applied for regulatory arrangement of the Guidelines on Dam Safety which is issued by Ministerial Decree of MPW No. 378/KPTS/1987.

(2) Non Structural Aspect

Clear information about the construction of the tunnel has to be presented to the people, by organizing campaign movement, before the construction begins. The campaign contains among others, of explanation on some assurance that the construction of the tunnel may not cause disturbances to the living conditions of the people.

Description of responsibilities of the consultants, the contractors, and the government/MPW as the owner and supervisor, has to be formulated in detailed explanation and issued as guidelines for implementation of the tunnel construction as a Ministerial Instruction of MPW (as reference : Guidelines on Dam Safety, Ministerial Decree of MPW No. 378/KPTS/1987).

(3) The River Management

Before construction of the tunnel, the management system of Ciliwung river and Cisadane river, is in accordance with DPS (Daerah Pengairan Sungai - Catchment Area) pattern or Sub River Basin pattern (The River Basin or River Territory is Ciliwung - Cisadane River Basin).

But at the time the construction of the tunnel is completed, the Ciliwung river and Cisadane river are interconnected to one river system. The river management also has to be modified to one river management system, including the flood control management. The discharge distribution system in the engineering predesign is already designed in one system.

Before the construction of the tunnel, an institution including the river management unit has to be established. This unit is one of the division of Basin Water Resources Management and Development Unit. Conceivable ways for that are : 1) the function of the present Ciliwung-Cisadane River Basin Development Project be upgraded, or 2) the function of the present Jasa Tirta State Corporation be enlarged to cover the Ciliwung-Cisadane river basin.

10 IMPLEMENTATION PLAN

10.1 Phasing of Urgent Flood Control Project (1st Stage Project)

In consideration of the project cost and the on-going flood control projects to be financed with Project Type Sector Loan by OECF which are scheduled to be implemented in 1997 to 2000, it is proposed to implement the urgent flood control project (1st stage project) by phasing as follows:

1st phase	
The Cisadane river	: Channel improvement works for 25-year design scale
The Ciliwung floodway	: Construction of floodway with 2 tunnels (design discharge distribution is 300 m^3/s)
2nd phase	
The Western Banjir Canal	: Channel improvement works for 100-year design discharge

10.2 Time Schedule of Urgent Flood Control Project (1st Stage Project)

The time schedule of implementation of the urgent flood control project (1st stage project) is proposed as follows:

1st phase project
Detailed design : 1997 - 1998   Construction : 2000 - 2003

2nd phase project
Detailed design : 2002 - 2003   Construction : 2004 - 2008

11 2ND STAGE PROJECT

11.1 General

The supplemental works for the master plan level after completion of the urgent flood control project (1st stage project) is called as 2nd stage project. The succeeding supplemental works consist of the followings:

1) river improvement of the Cisadane river for 50-year design scale
   (scheduled year : detailed design 2007 - 2008, construction 2010 - 2011)
2) adjustment works of the Ciliwung Floodway inlet facilities for 600 m^3/s
   (scheduled year : detailed design 2007 - 2008, construction 2010 - 2011)

The 2nd stage project is desirable to be implemented soon after completion of the urgent flood control project (1st stage project).

11.2 Economic Evaluation of Whole Priority Projects

Here project cost, benefit and EIRR for the whole priority projects comprising the urgent flood control project (1st stage project) and the 2nd stage projects are presented below:

1) Whole Project Cost : Rp.1,169,126 million (¥ 51,503 million)
2) Whole Project Benefit : Rp.116,545 million (¥ 5,134 million)/year
3) Whole Project EIRR : 13.2 %

12 RECOMMENDATIONS

In view of the serious direct and indirect damages and confusion due to the big flooding in January and February 1996 in DKI Jakarta, it is proposed that the urgent flood control project (1st stage project) be implemented very soon as an urgent scheme.

The following recommendations are also proposed.

12.1 Flood Control

(1) Restriction of Development along the Western Banjir Canal

River improvement of the Western Banjir Canal has been proved to be indispensable for flood control of DKI Jakarta through the floods in 1996. And it has been also proved that the downstream reaches improvement has an important role for the river improvement of the whole reaches.

However, as can be seen along the downstream reaches of the WBC, it is practically impossible to implement the present Detailed Design of the WBC conducted in 1987 by "West Jakarta Flood Control System Project (III)" as it is because of the on-going big scale residential development projects within the proposed alignment.

Accordingly, it is absolutely necessary to regulate the development strictly within the alignment proposed in the urgent flood control project not to repeat this kind of situation again.

(2) Coordination with KAPUKNAGA

Reclamation of the north coast of the JABOTABEK area including the area near the estuary of the Cisadane river is planned by KAPUKNAGA project. Even though the estuary area is not included for reclamation by the project, downstream reaches of the Cisadane river has a close relationship with the project, since the development of the coastal area is included in the project.

As urgent flood control project, the project includes a plan to construct the embankment along the downstream reaches of the Cisadane river. But the downstream end of the embankment is planned not in consideration of the reclamation plan since the detailed design of the development is not available yet. Accordingly the coordination with KAPUKNAGA project for this aspect will be needed for further step of the project.

(3) Construction of Embankment

For construction of embankment of the Western Banjir Canal, even though the embankment is planned to be provided with revetment works or pavement on the crown in order that the embankment would not collapse totally even overtopping occurs for floods over the design scale, it is still important to pay attention so that no foreign body would not be included in the embankment during the construction stage.

12.2 Implementation Schedule

Since major floods of the Ciliwung river is to be diverted from the Ciliwung river to the Cisadane river, the river improvement works of the Cisadane river should be completed before the completion of construction of the Ciliwung floodway.

12.3 Detailed Design

(1) Geological Investigation for Detailed Design

Construction plan and the cost of the Ciliwung Floodway are studied in the present report. But it is conducted based on the very limited geotechnical investigation results. The boring sites for the tunnel itself in this feasibility stage for the length of about 1 km are only 3 sites and mainly near the inlet and outlet.

For the detailed design of the floodway tunnel, more detailed geotechnical investigation especially along the tunnel route are needed to be conducted. Depending on the geological investigation results along the tunnel route, the construction method itself might be different and then the cost might be a very different one.

(2) Model Test for Detailed Design of Ciliwung Floodway

The Ciliwung floodway is designed without any gated structure to divert floods from the Ciliwung river to the Cisadane river on the preliminary design level. The diversion ratio of flood between the Ciliwung and the Cisadane river has a significant role for the flood control for DKI Jakarta and Tangerang area. For detailed design of the Ciliwung floodway, model test seems to be indispensable including test for diversion rate of flood.

Tables

Table 2.1 GROSS DOMESTIC PRODUCT

Year	At Current Price				At 1983 Constant Price			
	GDP		GDP Per Capita		GDP		GDP Per Capita	
	Amount (Rp. Billion)	Growth Rate	Amount (Rp.)	Growth Rate	Amount (Rp. Billion)	Growth Rate	Amount (Rp.)	Growth Rate
1984	89,885	-	-	-	83,037	-	-	-
1985	96,997	7.9%	581,469	-	85,082	2.5%	491,836	-
1986	102,683	5.9%	576,005	-0.9%	90,081	5.9%	500,837	1.8%
1987	124,817	21.6%	734,866	27.6%	94,518	4.9%	556,478	11.1%
1988	142,020	13.8%	818,962	11.4%	99,936	5.7%	576,282	3.6%
1989	167,185	17.7%	956,817	16.8%	107,437	7.5%	614,872	6.7%
1990	195,597	17.0%	1,097,812	14.7%	115,217	7.2%	646,671	5.2%
1991	227,450	16.3%	1,253,971	14.2%	123,225	7.0%	679,361	5.1%
1992	259,885	14.3%	1,408,657	12.3%	131,185	6.5%	711,063	4.7%
1993	302,018	16.2%	1,609,997	14.3%	139,707	6.5%	744,751	4.7%

Source: Pendapatan National Indonesia 1988 - 1993, Biro Pusat Statistik
Statistik Indonesia 1988, 1990 and 1991

Note: Figures in 1992 and 1993 are preliminary.

Table 3.1 ALTERNATIVE SCHEMES FOR OPTIMUM SCALE OF PROJECT

	Alt. 1	Alt. 2	Alt. 2'	Alt. 3
Design Scale	WBC: 100-year, Cisadane: 50-year	WBC: 100-year, Cisadane: 25-year	WBC: 100-year, Cisadane: 25-year	WBC: 50-year, Cisadane: 10-year
Floodway tunnel (unit	2	1	2	1
Financial Project Cost (Rp.billion)	767 1	672 2	714 2	595 3
EIRR	16.1% 1	18.0% 3	16.4% 2	17.8% 3
Technical Evaluation	(1) Investigation of ground water once, (2) no restriction to existing tunnel and channel, (3) access easy by existing road, (4) inlet weir construction once, (5) temporary works once 3	(1) Investigation of ground water twice, (2)restriction to existing tunnel and channel, (3) access difficult after construction of one tunnel, (4) inlet weir reconstruction needed, (5) temporary works 1	(1) Investigation of ground water once, (2) no restriction to existing tunnel and channel, (3) access easy by existing road, (4) inlet weir construction once, (5) temporary works once 3	(1) Investigation of ground water once, (2) no restriction to existing tunnel and channel, (3) access easy by existing road, (4) inlet weir construction once, (5) temporary works once 1
Environmental Impact	(1) Temporary land use once, (2) affect to ground water once, (3) river water disturbance once, (4) possible impact to historical assets once 3	(1) Temporary land use twice, (2) affect to ground water twice, (3) river water disturbance twice, (4) possible impact to historical assets 1	(1) Temporary land use once, (2) affect to ground water once, (3) river water disturbance once, (4) possible impact to historical assets once 3	(1) Temporary land use twice, (2) affect to ground water twice, (3) river water disturbance twice, (4) possible impact to historical assets 1
Social Impact	(1) Land acquisition once, (2) transportation of heavy equipment once, (3) affect to groundwater once, (4) noise, vibration, resettlement once, (5) benefit big 3	(1) Land acquisition later more difficult, (2) transportation of heavy equipment twice, (3) affect to groundwater twice, (4) noise, vibration, resettlement twice, (5) benefit middle 1	(1) Land acquisition once, (2) transportation of heavy equipment once, (3) affect to groundwater once, (4) noise, vibration, resettlement once, (5) benefit middle 3	(1) Land acquisition later more difficult, (2) transportation of heavy equipment twice, (3) affect to groundwater twice, (4) noise, vibration, resettlement twice, (5) benefit middle 1
Overall Score	11	8	13	9
			Optimum	

Note: Estimated financial project cost is on the Master Plan level.

Table 4.1 PROPOSED LONGITUDINAL PROFILE OF WBC (1/2)

Section No.	Distance	Accumulative Distance	Existing River Bed	Existing Ground Left	Existing Ground Right	Existing Dike Left	Existing Dike Right	Existing Parapet Left	Existing Parapet Right	Bottom of Bridge Girder Bridge	Bottom of Bridge Girder Truss	Name	Design River Bed	Design H.W.L.	Design Dike
	(km)	(km)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)		(m, TTG)	(m, TTG)	(m, TTG)
0.0	0.000	0.000	-2.37	0.98	0.82								-4.75	0.85	1.85
0.3	0.320	0.320	-3.37	1.00	0.79	2.90							-4.66	0.94	1.94
0.5	0.190	0.510	-5.27	0.96	0.71	2.90	1.20						-4.61	0.99	1.99
0.8	0.305	0.815	-4.28	0.73	0.63	2.90	1.41						-4.52	1.08	2.08
1.1	0.290	1.105	-4.54	0.80	0.91	2.90	2.40						-4.44	1.16	2.16
1.4	0.350	1.455	-4.82	0.41	0.87	2.90							-4.35	1.25	2.25
1.9	0.480	1.935	-5.16	1.29	1.29	2.90	1.65			2.64		Mandara Permai	-4.21	1.39	2.39
2.3	0.360	2.295	-3.01	1.30	1.67	2.35	2.19						-4.11	1.49	2.49
2.4	0.150	2.445	-5.53	0.65	1.03	2.40	1.80						-4.07	1.53	2.53
2.7	0.280	2.725	-3.77	0.79	0.83	2.22	3.71			3.53		Tol Airport Cengkareng	-3.99	1.61	2.61
2.9	0.250	2.975	-3.07	0.92	0.63	0.99	0.96						-3.92	1.68	2.68
3.2	0.290	3.265	-4.79	0.49	0.37	1.45	1.80						-3.82	1.78	2.78
3.4	0.220	3.485	-4.65	0.37	1.31	2.00	1.50						-3.74	1.86	2.86
3.7	0.298	3.783	-3.00	2.01	1.70	3.81	2.41						-3.64	1.96	2.96
4.0	0.305	4.088	-4.21	1.30	1.02	3.84	2.85						-3.53	2.07	3.07
4.3	0.265	4.353	-2.94	1.91	2.01	3.95	2.28						-3.43	2.17	3.17
4.6	0.285	4.638	-4.10	0.59	0.23	3.01	1.92						-3.33	2.27	3.27
4.8	0.215	4.853	-3.72	0.46	1.10	3.21	2.92						-3.25	2.35	3.35
5.0	0.145	4.998	-3.67	0.84	0.70	3.24	2.76			2.63		Teluk Gong Raya	-3.20	2.40	3.40
5.1	0.135	5.133	-3.68	1.22	0.29	3.27	2.59						-3.15	2.45	3.45
5.4	0.280	5.413	-4.05	0.62	1.13	3.04	3.09						-3.05	2.55	3.55
5.6	0.227	5.640	-3.00	1.90	1.35	3.73	3.80			3.60		Pangeran Tubagus Angke	-2.97	2.63	3.63
5.7	0.110	5.750	-3.58	3.12	0.84		3.30		3.80				-2.93	2.67	3.67
5.8	0.110	5.860	-3.55	2.68	1.01	4.01	3.25		3.75				-2.89	2.71	3.71
6.1	0.240	6.100	-3.64	3.43	1.29	3.37	3.29		3.70				-2.81	2.79	3.79
6.2	0.125	6.225	-3.22	3.22	1.98	3.30	4.00	3.60	4.30				-2.76	2.84	3.84
6.4	0.235	6.460	-2.90	3.76	1.92	3.45	3.68	4.00	4.20				-2.68	2.92	3.92
6.7	0.235	6.695	-2.89	0.92	1.37	3.42	3.76	3.80	4.28				-2.60	3.00	4.00
6.9	0.280	6.975	-2.81	1.86	1.37	4.26	4.19	4.30	4.80	2.14		Prof. Dr. Latumeten	-2.50	3.10	4.10
7.1	0.175	7.150	-2.19	3.68	1.11	3.87	3.33	4.00	4.00				-2.43	3.17	4.17
7.4	0.295	7.445	-2.11	0.96	1.70	4.19	4.21	4.40	4.60				-2.33	3.27	4.27
7.7	0.225	7.670	-2.13	1.36	1.89	4.15	4.00	4.50	4.50				-2.25	3.35	4.35
7.9	0.205	7.875	-2.20	2.54	2.02	4.23	4.20	4.48	5.00	3.42		Railway (Future)	-2.17	3.43	4.43
8.1	0.240	8.115	-5.37	1.65	1.17	3.85	3.82	4.10	4.30				-2.09	3.51	4.51
8.4	0.305	8.420	-0.70	2.53	2.03	3.78	4.17	4.30	4.60	2.51		Kyai Tapa	-1.98	3.62	4.62
8.6	0.205	8.625	-2.06	1.28	1.82	3.86	4.10	4.30	4.60				-1.91	3.69	4.69
8.9	0.253	8.878	-1.81	2.50	1.92	4.39	4.37	5.00	5.10				-1.82	3.78	4.78
9.2	0.300	9.178	-1.54	2.41	1.98	4.07	3.97	4.70	4.70				-1.71	3.89	4.89
9.4	0.258	9.436	-0.38	2.53	2.75	4.34	4.93	4.90	5.20	9.05		Tomang	-1.62	3.98	4.98
9.7	0.310	9.746	-1.95	1.57	3.52	4.36	5.16	4.70	5.30				-1.51	4.09	5.09
10.0	0.215	9.961	-4.58	3.05	2.81	4.84	4.68	5.30					-1.43	4.17	5.17

Table 4.1 PROPOSED LONGITUDINAL PROFILE OF WBC (2/2)

Section No.	Distance	Accumulative Distance	Existing River Bed	Existing Ground Left	Existing Ground Right	Existing Dike Left	Existing Dike Right	Existing Parapet Left	Existing Parapet Right	Bottom of Bridge Girder Bridge	Bottom of Bridge Girder Truss	Bottom of Bridge Girder Name	Design River Bed	Design H.W.L.	Design Dike
	(km)	(km)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)	(m, TTG)		(m, TTG)	(m, TTG)	(m, TTG)
10.3	0.360	10.321	-1.48	3.29	3.31	4.78	5.49	5.20					-1.30	4.30	5.30
10.6	0.240	10.561	-3.73	3.68	3.33	4.51	5.97	5.20					-1.21	4.39	5.39
10.7	0.135	10.696	-3.84	1.52	3.89	4.62	6.04	5.00					-1.17	4.43	5.43
10.8	0.120	10.816	-1.89	3.44	3.20	4.95	4.63	5.00					-1.12	4.48	5.48
11.0	0.175	10.991	-0.54	3.34	2.73	4.91	5.04	5.30					-1.06	4.54	5.54
11.1	0.140	11.131	-0.78	3.56	2.90	4.90	5.00	5.20					-1.01	4.59	5.59
11.3	0.158	11.289	-0.87	5.16	3.95		4.40	5.20		8.13		Aipda KS Tubun	-0.95	4.65	5.65
11.5	0.170	11.459	-0.50	4.71	5.37	5.34	5.84	5.10					-0.89	4.71	5.71
11.7	0.220	11.679	-0.74	4.31	4.39	4.91	5.14	5.10					-0.82	4.78	5.78
11.9	0.270	11.949	-0.49	3.71	5.09	5.08	5.90	5.27					-0.72	4.88	5.88
12.1	0.175	12.124	-0.44	4.90	4.35	5.30	5.77	5.60					-0.66	4.94	5.94
12.3	0.170	12.294	-0.29	3.64	4.13	4.22	6.21	5.00					-0.60	5.00	6.00
12.4	0.122	12.416	-6.76	6.89	6.60								-0.55	5.05	6.05
12.41	0.015	12.431	-1.39	6.66	6.71					5.26		Karet Barrage	-0.55	5.05	6.05
12.42	0.020	12.451	0.59	7.02	6.16	8.20	8.11						-0.54	5.06	6.06
12.6	0.110	12.561	0.59	7.93	5.15		7.06						-0.50	5.10	6.10
12.9	0.210	12.871	1.38	7.18	7.25	8.18	8.25						-0.33	5.21	6.21
13.1	0.200	13.071	-1.35	7.73	7.98					5.27		KH Mas Mansyur	-0.21	5.28	6.28
13.2	0.180	13.251	-0.53	5.49	5.95	7.57	7.38						-0.10	5.35	6.35
13.4	0.190	13.441	0.68	7.82	5.54	8.46	6.89						0.02	5.42	6.42
13.7	0.220	13.661	0.68	7.35	5.25		7.10						0.16	5.56	6.56
13.9	0.242	13.903	1.53	7.35	5.25		7.18			9.34		MH Thamrin	0.31	5.71	6.71
14.2	0.265	14.168	1.48	4.67	4.24	6.70	7.25						0.48	5.88	6.88
14.4	0.268	14.436	1.62	7.41	5.37		7.47						0.65	6.05	7.05
14.8	0.325	14.761	0.73	6.60	7.57		7.01						0.85	6.25	7.25
14.9	0.185	14.946	0.89	7.40	8.04	7.85	8.26						0.96	6.36	7.36
15.2	0.280	15.226	1.64	9.15	9.70					7.16		Halimun	1.14	6.54	7.14
15.4	0.255	15.481	1.60	10.40	12.51								1.30	6.70	7.30
15.7	0.240	15.721	3.31	11.89	11.57					11.06	7.35	Guntur	1.45	6.85	7.45
16.0	0.280	16.001	1.52	11.06	11.62					11.20	8.17	Latuharhari	1.62	7.02	7.62
16.3	0.275	16.276	2.24	9.21	7.58		8.26						1.80	7.20	7.80
16.6	0.275	16.551	1.99	8.73	8.59								1.97	7.37	7.97
16.8	0.170	16.721	3.27	9.75	11.06								2.07	7.47	8.07
16.9	0.120	16.841	0.02	10.58	11.01								2.15	7.55	8.15
16.91	0.045	16.886	1.08	8.89	9.03								2.18	7.58	8.18
16.92	0.015	16.901	1.48	8.73	8.73					7.57		Manggarai Barrage	2.19	7.59	8.19
16.93	0.010	16.911	1.36	8.85	9.11										
16.94	0.022	16.933	1.90	12.25	9.45										
17.0	0.030	16.963	2.04	10.08	9.38										

Table 4.2 PROPOSED LONGITUDINAL PROFILE OF CISADANE RIVER

Section No	Distance (km)	Accumulative Distance (km)	Existing River Bed (m, TTG)	Existing Ground Left (m, TTG)	Existing Ground Right (m, TTG)	Existing Dike Left (m, TTG)	Existing Dike Right (m, TTG)	Observed Water Level in Dry Season (m, TTG)	Bottom of Bridge Girder (m, TTG)	Design River Bed (m, TTG)	Design HWL (m, TTG)	Design Dike (m, TTG)
0.0	0.000	0.000	-1.07	0.67	0.67			0.40				
0.4	0.400	0.400	-3.79	0.74	1.25			0.42				
0.9	0.465	0.865	-4.10	1.23	1.70			0.70				
1.4	0.545	1.410	-7.22	1.23	1.63			0.50				
1.8	0.417	1.827	-4.48	2.00	1.51			0.50		-4.93	3.71	4.71
2.2	0.400	2.227	-4.73	1.57	1.87			0.50		-4.80	4.04	5.04
2.9	0.650	2.877	-3.97	1.67	2.14			0.20		-4.60	4.58	5.58
3.5	0.610	3.487	-5.50	2.15	3.11	4.94	3.30	0.30		-4.41	5.09	6.09
3.9	0.412	3.899	-4.39	1.78	1.24	4.26	4.10	0.60		-4.28	5.22	6.22
4.3	0.357	4.256	-5.59	2.12	4.06	4.37	4.70	0.10		-4.17	5.33	6.33
4.7	0.397	4.653	-4.13	2.30	2.11	5.30	4.70	0.50		-4.05	5.45	6.45
5.3	0.598	5.251	-5.50	3.26	2.92	3.62	4.77	0.40		-3.86	5.64	6.64
5.9	0.605	5.856	-3.84	3.41	4.69	4.42	5.79	0.42		-3.67	5.83	6.83
6.4	0.505	6.361	-5.87	4.65	4.00	5.64	6.50	0.43	7.00	-3.51	5.99	6.99
6.8	0.415	6.776	-4.34	3.70	3.20	6.77	6.53	0.40		-3.38	6.12	7.12
7.1	0.350	7.126	-8.10	3.70	2.78	6.50	6.10	0.60		-3.27	6.23	7.23
7.7	0.540	7.666	-3.51	4.51	3.53	6.89	5.94	0.50		-3.10	6.40	7.40
8.2	0.498	8.164	-3.53	4.96	4.87	6.65	6.48	0.50		-2.95	6.55	7.55
8.8	0.650	8.814	-5.95	4.89	4.22	7.20	7.60	0.50		-2.75	6.75	7.75
9.2	0.364	9.178	-3.45	5.32	4.86	7.70	7.90	0.80		-2.63	6.87	7.87
9.9	0.726	9.904	-3.61	5.69	4.27	6.70	6.05	0.40		-2.41	7.10	8.10
10.3	0.423	10.327	-3.33	5.66	5.22	8.20	7.95	0.80		-2.27	7.23	8.23
10.8	0.510	10.837	-5.04	4.13	5.89	8.30	8.90	0.80		-2.11	7.39	8.39
11.3	0.492	11.329	-6.16	7.33	5.37		7.80	0.90		-1.96	7.54	8.54
11.8	0.475	11.804	-7.42	5.57	6.75	8.60	9.30	0.90		-1.81	7.85	8.85
12.3	0.505	12.309	-5.74	6.33	5.68	7.82	6.96	0.90		-1.65	8.19	9.19
12.7	0.440	12.749	-1.51	8.14	8.17	8.84	9.07	1.00		-1.52	8.48	9.48
13.1	0.360	13.109	-3.51	8.34	9.23	9.60	9.40	1.20		-1.27	8.73	9.73
13.5	0.350	13.459	-1.08	8.19	8.72	9.57	9.90	0.80		-1.04	8.96	9.96
13.9	0.438	13.897	-1.37	9.20	8.31	10.23	9.96	1.70		-0.75	9.25	10.25
14.4	0.495	14.392	-2.20	9.08	10.22	9.75	11.55	1.70		-0.41	9.59	10.59
14.8	0.446	14.838	-0.09	9.08	8.05	9.75	9.25	2.70		-0.11	9.89	10.89
15.1	0.255	15.093	-2.20	8.37	9.34	10.35	10.30	2.90		0.06	10.06	11.06
15.6	0.520	15.613	-2.90	7.82	9.35	10.51	11.10	2.90		0.41	10.41	11.41
16.2	0.561	16.174	-1.45	9.55	9.45	10.62	11.40	2.90		0.78	10.78	11.78
16.8	0.668	16.842	-0.74	10.79	10.07	11.08	12.49	3.00		1.23	11.23	12.23
17.4	0.570	17.412	-0.08	10.63	13.75	11.64	14.70	4.40				
18.0	0.610	18.022	2.05	11.59	12.32			5.10				
18.5	0.465	18.487	-0.77	11.52	11.89	11.87	12.50	5.20				
19.1	0.582	19.069	1.36	12.30	12.45		12.95	5.30				
19.5	0.435	19.504	-0.13	12.46	11.44		12.04	6.90				
20.1	0.570	20.074	3.62	14.46	14.86			7.70				
20.7	0.662	20.736	5.59	14.49	15.60			7.40				
21.3	0.550	21.286	5.92	17.30	16.34			8.30				
21.32	0.030	21.316	7.30	17.39	16.76			13.20				
21.35	0.030	21.346	6.99	16.55	16.13			13.20				
21.5	0.200	21.546	7.97	15.11	15.29			13.20				
21.8	0.255	21.801	9.49	15.93	15.29			13.20				
22.1	0.329	22.130	8.06	15.31	15.62			13.50				

Table 5.1 PRINCIPAL FEATURES OF CONSTRUCTION WORKS(1 / 2)

	MAJOR WORKS	QUANTITY	
A.	1ST PHASE		
A - 1	CISADANE RIVER		
1.	River Channel Improvement		
	Excavation, common	825,000	m^3
	Embankment in dike	913,000	m^3
	Concrete in structures	2,520	m^3
2.	Drainage Facilities Improvement		
	Concrete in structures	570	m^3
	Flap gate, ϕ 800 mm	4	nos.
	Flap gate, ϕ 1,000 mm	5	nos.
A - 2	CILIWUNG FLOODWAY		
1.	Floodway Construction		
	Excavation, common	196,700	m^3
	Excavation, weathered rock	78,500	m^3
	Excavation, rock	8,500	m^3
	Embankment for cofferdam	17,600	m^3
	Embankment in dike	15,000	m^3
	Concrete in structures	11,130	m^3
	Shield tunneling excavation	136,600	m^3
	1st lining by segment	1,610	rings
	2nd lining by concrete	15,100	m^3
	Consolidation grouting, 11,400 m	120	ton
	PC concrete pile, ϕ 500 mm	12,630	m
	Steel sheet pile, w=300 mm	9,200	m
	Suspension bridge, 1.5 mW x 40 mL	1	no.

Table 5.1 PRINCIPAL FEATURES OF CONSTRUCTION WORKS(2 / 2)

	MAJOR WORKS	QUANTITY	
B.	**2ND PHASE**		
B - 1	WESTERN BANJIR CANAL		
1.	River Channel Improvement		
	Excavation, common	1,357,100	m^3
	Demolition of existing structure	26,920	m^3
	Embankment in dike	110,600	m^3
	Concrete in structures	12,990	m^3
	Utility bridges improvement	19	nos.
	Reconstruction of bridges	7	nos.
	Latumeten bridge ; 28mW x 60mL		
	Kyai Tapa bridge ; 23mW x 50mL		
	Teluk Gong Raya br. ; 7mW x 50mL		
	Dr.Semeru Railway br.; 1 track x 42mL		
	Railway br. on Karet Barrage ; 1 track		
	K.H.Mas Mansyur ; 12mW x 37mL		
	Road br. on Manggarai Barrage ; 1 lane		
	Strengthening of existing bridge structures	9	nos.
	Flap gate, ϕ 700 mm	4	nos.
	Flap gate, ϕ 800 mm	6	nos.
	Gate, 1.5 m x 2.5 m	2	nos.
	Gate, 2.0 m x 2.5 m	2	nos.
2.	Manggarai Barrage Improvement		
	Excavation, common	10,200	m^3
	Embankment for structures	4,500	m^3
	Concrete in structures	6,020	m^3
	PC concrete pile, ϕ 500 mm	1,920	m
	Steel sheet pile, w=300 mm	1,500	m
	Gate, 1.6 m x 1.6 m	1	no
	Gate, 5.5 m x 8.5 m	1	no
3.	Drainage Structures at Muara Angke		
	Excavation, common	120	m^3
	Concrete in structures	165	m^3
	PC concrete pile, ϕ 500 mm	170	m
	Steel sheet pile, w=300 mm	170	m
	Gate, 1.2 m x 3.0 m	1	no
	Gate, 1.5 m x 2.5 m	2	nos.

Table 7.1 SUMMARY OF CONSTRUCTION COST

(Unit : Thousand)

	Description	Foreign Currency (Japanese Yen)	Local Currency (Rupiah)	Total Equivalent (Rupiah)
A.	1ST PHASE			
I.	CISADANE RIVER			
1.1	River Channel Improvement	1,108,152	13,578,926	38,733,980
1.2	Related Structures	10,879	346,023	592,970
	Sub-total of A-I	1,119,031	13,924,950	39,326,950
II.	CILIWUNG FLOODWAY	11,437,817	109,653,701	369,292,149
	Sub-total of A-II	11,437,817	109,653,701	369,292,149
	TOTAL OF 1st PHASE	12,556,848	123,578,650	408,619,099
B.	2ND PHASE			
I.	WESTERN BANJIR CANAL			
1.1	River Channel Improvement	2,306,606	32,049,715	84,409,663
1.2	Manggarai Barrage	139,053	3,174,025	6,330,520
1.3	Related Structures	7,821	307,568	485,103
	TOTAL OF 2nd PHASE	2,453,479	35,531,309	91,225,286
	GRAND TOTAL	15,010,327	159,109,959	499,844,385

Note : Exchange rate : US$ 1.0 = Rp. 2,281 = JPY. 100.48
JPY. 1.0 = Rp. 22.70

Table 7.2 TOTAL PROJECT COST

(Unit : Million)

Description	Foreign Currency (Japanese Yen)	Local Currency (Rupiah)	Total Equivalent (Rupiah)
1 Direct Construction Cost	15,010	159,110	499,844
2 Land Acquisition and House Compensation Cost	0	81,702	81,702
3 Sub-total of (1+2)	15,010	240,812	581,546
4 Engineering Services Cost (15 % of 1.)	2,252	23,867	74,977
5 Government Administration Cost (5 % of 3.(F+L))	0	29,077	29,077
6 Sub-total of (3+4+5)	17,262	293,756	685,601
7 Physical Contingency (10 % of 6.)	1,726	29,376	68,560
8 Sub-total of (6+7)	18,988	323,132	754,161
9 Price Contingency	4,544	237,834	340,983
TOTAL (8+9)	23,532	560,966	1,095,144

Note : Exchange rate : US$ 1.0 = Rp. 2,281 = JPY. 100.48
JPY. 1.0 = Rp. 22.70

Table 7.3 DISBURSEMENT SCHEDULE OF PROJECT COST

(Unit : Million)

Description	1997/98		1998/99		1999/2000		2000/01		2001/02		2002/03		2003/04		2004/05		2005/06		2006/07		2007/08		2008/09		Total	
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
1. Direct Construction Cost							1,882	18,485	3,708	36,291	3,712	36,395	2,572	25,568	805	8,602	632	9,282	633	9,297	603	8,719	463	6,471	15,010	159,110
(1st Phase)							1,882	18,485	3,708	36,291	3,712	36,395	2,572	25,568	683	6,840									12,557	123,579
(2nd Phase)															122	1,762	632	9,282	633	9,297	603	8,719	463	6,471	2,453	35,531
2. Land Acquisition and House Compensation Cost						20,000		20,000		21,455				10,000		10,247										81,702
(1st Phase)						20,000		20,000		21,455																61,455
(2nd Phase)														10,000		10,247										20,247
3. Sub-total of (1+2)						20,000	1,882	38,485	3,708	57,746	3,712	36,395	2,572	35,568	805	18,849	632	9,282	633	9,297	603	8,719	463	6,471	15,010	240,812
(1st Phase)						20,000	1,882	38,485	3,708	57,746	3,712	36,395	2,572	25,568	683	6,840									12,557	185,034
(2nd Phase)														10,000	122	12,009	632	9,282	633	9,297	603	8,719	463	6,471	2,453	55,778
4. Government Administration Cost		588		588		3,721		3,721		3,721		3,861		3,861		4,780		1,059		1,059		1,059		1,059		29,077
5. Engineering Servise Cost	314	3,089	314	3,089	209	2,060	209	2,060	209	2,060	271	2,948	271	2,948	258	2,770	49	711	49	711	49	711	49	711	2,252	23,867
6. Sub-total of (3+4+5)	314	3,677	314	3,677	209	25,781	2,091	44,266	3,917	63,527	3,983	43,204	2,843	42,377	1,063	26,400	681	11,052	682	11,067	652	10,489	512	8,241	17,262	293,755
7. Physical Contingency	31	368	31	368	21	2,578	209	4,427	392	6,353	398	4,320	284	4,238	106	2,640	68	1,105	68	1,107	65	1,049	51	824	1,726	29,376
8. Total of (6+7)	345	4,045	345	4,045	230	28,359	2,300	48,693	4,309	69,880	4,381	47,524	3,127	46,614	1,170	29,040	749	12,157	750	12,173	717	11,537	563	9,065	18,988	323,131
9. Price Contingency	21	673	32	1,050	29	10,223	366	22,853	836	41,011	1,007	33,924	834	39,666	356	29,011	258	14,089	288	16,210	276	15,364	240	13,762	4,544	237,834
10. Grand Total of (8+9)	366	4,718	377	5,095	259	38,582	2,667	71,546	5,145	110,890	5,388	81,448	3,961	86,280	1,526	58,050	1,007	26,245	1,039	28,383	993	26,901	803	22,826	23,531	560,965

Notes ; F.C. = Foreign Currency in Japanese Yen
L.C. = Local Currency in Indonesian Rupiah

US$ 1.0 = Rp. 2,281 = JPY. 100.48
JPY. 1.0 = Rp. 22.70

Price Contingency : 3 % per annum
8 % per annum

Table 8.1 PROJECT COST

Urgent Flood Control Project (the 1st Stage Project) Exchange rate: ¥1= Rp.22.70

Cost Item	F.C. (Million Yen)		L.C. (Million Rp)		Total financial cost (Million Rp)	Total economic cost (Million Rp)
	Financial cost	Economic cost	Financial cost	Economic cost		
1. Direct Construction Cost	15,010	14,559	159,110	146,382	499,844	476,872
(1) 1st Phase	12,557	12,180	123,579	113,693	408,619	390,180
1) Cisadane River	1,119	1,085	13,925	12,811	39,327	37,441
2) Ciliwung Floodway	11,438	11,095	109,654	100,882	369,292	352,739
(2) 2nd Phase	2,453	2,379	35,531	32,689	91,225	86,692
1) Western Banjir Canal	2,453	2,379	35,531	32,689	91,225	86,692
2. Land Acquisition and House Compensation	0	0	81,702	25,064	81,702	25,064
(1) 1st Phase	0	0	61,455	22,426	61,455	22,426
(2) 2nd Phase	0	0	20,247	2,638	20,247	2,638
3. Sub-total (1+2)	15,010	14,559	240,812	171,446	581,546	501,936
4. Engineering Services Cost (15 % of 1.)	2,252	2,252	23,867	23,867	74,977	74,977
5. Government Administration Cost (5 % of 3.)	0	0	29,077	25,097	29,077	25,097
6. Sub-total (3+4+5)	17,262	16,811	293,756	220,410	685,601	602,010
7. Physical Contingency (10 % of 6.)	1,726	1,681	29,376	22,041	68,560	60,201
8. Sub-total (6+7)	18,988	18,492	323,132	242,451	754,161	662,211
9. Price Contingency	4,544	0	237,834	0	340,983	0
10. Total (8+9)	23,532	18,492	560,966	242,451	1,095,144	662,211

Table 8.2 BENEFIT/COST ANALYSIS

Urgent Flood Control Project
(The 1st Stage Project) 662,211 Unit: Million Rp

Year in order	Year	Benefit	Cost				Net Cash Flow
			Construction	O/M	Replacement	Total	
1	1997/98	0	11,675	0		11,675	-11,675
2	1998/99	0	11,675	0		11,675	-11,675
3	1999/00	0	19,996	0		19,996	-19,996
4	2000/01	0	83,814	0		83,814	-83,814
5	2001/02	3,058	146,259	401		146,660	-143,602
6	2002/03	4,845	139,378	799		140,177	-135,332
7	2003/04	6,632	103,288	1,199		104,487	-97,855
8	2004/05	72,530	44,168	1,600		45,768	26,762
9	2005/06	89,176	27,522	1,967		29,489	59,687
10	2006/07	93,932	27,561	2,072		29,633	64,299
11	2007/08	98,580	27,561	2,174		29,735	68,845
12	2008/09	103,336	19,314	2,279		21,593	81,743
13	2009/10	108,092		2,384		2,384	105,708
14	2010/11	108,092		2,384		2,384	105,708
15	2011/12	108,092		2,384		2,384	105,708
16	2012/13	108,092		2,384		2,384	105,708
17	2013/14	108,092		2,384		2,384	105,708
18	2014/15	108,092		2,384		2,384	105,708
19	2015/16	108,092		2,384		2,384	105,708
20	2016/17	108,092		2,384		2,384	105,708
21	2017/18	108,092		2,384		2,384	105,708
22	2018/19	108,092		2,384		2,384	105,708
23	2019/20	108,092		2,384		2,384	105,708
24	2020/21	108,092		2,384		2,384	105,708
25	2021/22	108,092		2,384		2,384	105,708
26	2022/23	108,092		2,384		2,384	105,708
27	2023/24	108,092		2,384		2,384	105,708
28	2024/25	108,092		2,384		2,384	105,708
29	2025/26	108,092		2,384		2,384	105,708
30	2026/27	108,092		2,384		2,384	105,708
31	2027/28	108,092		2,384		2,384	105,708
32	2028/29	108,092		2,384		2,384	105,708
33	2029/30	108,092		2,384		2,384	105,708
34	2030/31	108,092		2,384		2,384	105,708
35	2031/32	108,092		2,384		2,384	105,708
36	2032/33	108,092		2,384	2,542	4,926	103,166
37	2033/34	108,092		2,384		2,384	105,708
38	2034/35	108,092		2,384		2,384	105,708
39	2035/36	108,092		2,384		2,384	105,708
40	2036/37	108,092		2,384		2,384	105,708
41	2037/38	108,092		2,384		2,384	105,708
42	2038/39	108,092		2,384		2,384	105,708
43	2039/40	108,092		2,384		2,384	105,708
44	2040/41	108,092		2,384		2,384	105,708
45	2041/42	108,092		2,384		2,384	105,708
46	2042/43	108,092		2,384		2,384	105,708
47	2043/44	108,092		2,384		2,384	105,708
48	2044/45	108,092		2,384		2,384	105,708
49	2045/46	108,092		2,384		2,384	105,708
50	2046/47	108,092		2,384		2,384	105,708

IRR = 13.1%
B/C = 1.10 (at discount rate: 12 %)
NPV = 35,281 (at discount rate: 12 %)

Table 8.3 TRFFIC VOLUME OF CONSTRUCTION TRUCK

Construction site	Excavation (m3)	Work days (days)	Excavation per day (m3/day)	Truck volume per day (trucks/day)	Truck volume per hour (trucks/hour)
Ciliwung Floodway	420,300	1,200	351	59	8
W.B.C	1,367,420	1,200	1,140	190	24
Cisadane river	825,000	1,200	688	115	15

Note: Construction term ; 4 years, Work days per year ; 300 days,
Work hours per day ; 8 hours, Capacity per truk ; 6 m3

Table 8.4 SCREENING OF ENVIRONMENTAL ITEMS FOR EMMP

Item	Evaluation			Recommended EMMP for the Project
	Period	Mag'tude	Nece'ty	
A.Ecosystem	C	C	X	No EMMP is required
B.Historical assets	A	B	O	EMMP is needed
C.Air & noise	A	A	O	EMMP is needed concerning noise
D.Transportation	A	A	O	EMMP is needed
E.Water quality				
1)SS	A	B	O	EMMP is needed
2)Soil erosion	B	C	X	No EMMP is required, but sedimantation ponds and early facing are necessary in construction site of the inlet and outlet of floodway
3)Diversion	C	C	X	No EMMP is required
F.Ground water	A	B	O	EMMP is needed
G.Resettlement	A	A	O	EMMP is needed

Note : A: high/long B: medium C: low/short
O: EMMP is needed X: EMMP is not needed