CHAPTER 9

OPERATION AND MAINTENANCE

CHAPTER 9 OPERATION AND MAINTENANCE

9.1 General

(1) Purpose

Operation of flood control facilities is defined as the administration, management and performance of activities to keep facilities safe and functioning properly. The operation of flood control measures should be based on an established set of procedures. Maintenance of flood control facilities includes the upkeep of facilities, the evaluation of the performance of facilities, the provision of materials to prevent the deterioration or damage to the facilities, and the repair of damages caused by deterioration, flooding, breakdown, vandalism, or failure.

The purposes of Operation and Maintenance (O&M) programs are described below.

- Ensure that the facilities are operated according to design standards.
- Ensure safe operation of the facilities.
- Ensure the useful life of the facilities.
- Ensure that the established procedures are followed.
- Protect the environment and facilities provided in the flood control works.
- Promote cost efficient operation.
- Meet the legal and social obligation.

(2) Required Activity

The project works are composed of river improvement works together with river structures such as revetment, groin, ground sill, Simongan Gated Weir and so on. There are also appurtenant works such as the raising of Railway Bridge, drainage facilities and river amenity facilities.

When the activities are classified into two categories, operation and maintenance, the project works related to operation will be limited to Simongan Gated Weir, intake gate for Semarang River and Left Bank Irrigation Channel, and drainage facilities with gate, while maintenance will be required for all project works.

(a) Operation

Simongan Gated Weir and intake structures located immediately upstream of

the weir play an important role in water intake for municipal water and river maintenance flow. Simultaneously, Simongan Weir is designed to discharge the design flood. Therefore an effective gate operation is required and the operation rules are proposed for theses structures. For drainage sluice a gate operation is made during flood as well.

(b) Maintenance

Periodical and routine inspection over project works shall be carried out to maintain facilities and to promptly undertake effective and economical countermeasures, if necessary, for deteriorated portions or the whole works. Frequency of inspection varies depending on materials, type and surrounding condition of the work. Such inspection work shall conducted at least before and after flood seasons. Items of inspection, as well as some effective preventive works are prepared.

(3) Structure and Manpower for O&M Organization

The proposed structure and manpower for O&M organization are described in " CHAPTER 10 "

9.2 Operation Plan

In this section, basic operation guidelines are designed and explained for the New Simongan Gated Weir, intake structures, and drainage sluices installed along the flood protection dike/wall. The guideline will be used by contractors selected through tendering for preparation of the detailed and concrete operation and maintenance manual.

9.2.1 Simongan Gated Weir and Intake Gate

Present Operating Practice of Weir and Upstream Intake Gates

Simongan Weir and upstream intake gates are presently managed by District Office of Provincial Public Works (Cabang Dinas) in terms of its gate operation and maintenance of facilities. The following operating rules/practice are applied:

(1) The channel water level is maintained at the same elevation (EL.+5.200) as that of weir crest during non-flooding time. The river water flows over the fixed weir when it increases.

(2) A discharge of 0.5 m^3/s in dry season and 0.7 m^3/s in rainy season are taken from the river through right bank intake gates for Semrang River, while a discharge of 0.1 m^3/s in dry season and 0.15 m^3/s in rainy season for left bank irrigation channel..

(3) The sediment flush gates are fully closed during both flooding and non-flooding time except periodical opening operation for flushing sediment after flooding.

(4) Closing operation of intake gates is commenced when the channel water level rises by 50 cm or more above the weir crest.

Present Operation of PDAM Intake

(1) General Features of Intake Facilities

The existing PDAM water intake structure is located 1.2 km upstream of the weir on the right bank of Garang River. The facilities were constructed in 1960 aiming at supplying municipal water with a maximum intake capacity of 580 l/s. To meet the increasing water demand , the intake capacity was increased to 980 l/s in 1995.

General data regarding intake capacity and facilities are as follows:

Item	Data
Maximum Pumping Capacity	980 liter/s
Normal Intake Discharge (every month)	900 liter/s
Intake Structure	Sluice Gate 2.5 m x 2.5 m and Pumps
Number of Pump	12 pumps
Type of Pump	Centrifugal and Submergible Pump
Operation of Intake	24-hour operation

(2) Existing Operation Practice

In principal, a 24-hour operation for water intake is made throughout a year except the following cases.

(a) Suspension of entire pump operation due to the cleaning of screen and inlet during/after flooding in rainy season.

(b) Suspension of entire pump operation when the river water contains a lot of mud during flood.

(c) Suspension of entire pump operation due to the power cut of PLN electric

power supply.

(d) Suspension of partial pump operation for cleaning filter of pump.

According to the past pump operation record (1994 to 1998), frequency of pump suspension due to flood with a suspension time more than 0.5 hour is shown in Fig. 9.2.1. Broadly speaking, the pump operation is suspended at the rate of 2 to 10 times in one rainy season.

Main Features of Proposed Gates for Simongan Weir and Intake Structure

Simongan Weir gate consists of flood discharge gates and sediment flush gates. The main features of gate and hoist system are given below.

(1) Flood Discharge Gate

(a) Gate Leaf (3 gates)

- Type : Shell Type Steel Roller Gate (Overflow type)
- Dimension : Clear span 18.50 m × Clear height 3.70 m
- Sealing System : Bottom and sides at upstream side of gate

(b) Hoist System (3 gates)

- Type : Rope drum operated by electric motor
- Operation : Local control at Control House and remote control at Operation/Management Office

(c) Gate Guide Frame (3 gates)

- Type : Steel Guide Frame (Bottom and Sides) (including secondary concrete)

(2) Sediment Flush Gate

(a) Gate Leaf (2 gates)

- Type : Plate Girder Type Steel Roller Gate (Under-flow type)
- Dimension : Clear span 5.50 m × Clear height 4.35 m
- Sealing System : Bottom and sides at upstream side of gate

(b) Hoist System (2 gate)

- Type : Rope drum operated by electric motor and manual operation

- Operation : Local control at Control House and remote control at Operation/Management Office

(c) Gate Guide Frame (2 gate)

- Type : Steel Guide Frame (Bottom and Sides)

(3) Right Bank Intake Gate

(a) Gate Leaf (4 gates)

- Type : Steel Slide Gate
- Dimension : Clear span 2.25 m × Clear height 2.00 m
- Sealing System : Top, bottom and sides at downstream side of gate

(b) Hoist System (4 gate)

- Type : Single spindle operated by electric motor and manual operation
- Operation : Local control at Control House and remote control at Operation/Management Office

(c) Gate Guide Frame (4 gate)

- Type : Steel Guide Frame (Bottom, Sides and Top)

(4) Left Bank Intake Gate

(a) Gate Leaf (2 gates)

- Type : Steel Slide Gate
- Dimension : Clear span 2.00 m × Clear height 2.00 m
- Sealing System : Top, bottom and sides at downstream side of gate

(b) Hoist System (2 gate)

- Type : Single spindle operated by electric motor and manual operation
- Operation : Local control at Control Deck and remote control at Operation/Management Office

(c) Gate Guide Frame (2 gate)

- Type : Steel Guide Frame (Bottom, Sides and Top)

The gate hoisting system is basically operated by both electric motor and manual for the

sediment discharge gate and intake gate, while, by electric motor for the flood discharge gate. Power source for electric motor is supplied primarily from PLN commercial electric line. An emergency generator system is equipped just in case the commercial line is cut.

Proposed Operation Rule for New Simongan Gated Weir

The operation rules for New Simongan Gated Weir are made taking the river hydraulics, the present operating practice of the existing weir, and the flood control plan of Garang River into account. In addition, the existing conditions of water intake by PDAM shall be considered as well.

(1) Operation During Non-flooding Time

In implementing O&M works/activities for this Project, the term "Non-flooding time" indicates the dry season of May 1st to October 30th. During non-flooding time, the operation of gated weir is undertaken as follows.

The water level of upstream channel from the weir shall be kept at EL.+5.200 m or more by closing operation of both flood discharge and sediment flush gates. The remaining river discharge, after being taken for PDAM intake, Semarang River and the left bank irrigation channel, overflows the flood discharge gates into the channel of West Floodway.

(2) Operation During Flooding Time

During flooding time (November 1st to April 30th), if the river discharge continues to increase and the water level of the channel reaches a certain level, the river flow shall be controlled by a phased gate operation to maintain the upstream water level at EL.+5.200 m. (The phased gate operation means an operation which is performed in accordance with the change of channel water level.) Furthermore, when the channel water level exceeds the maximum level, all the gates shall be fully opened. The method of gate operation are schematically shown in Fig. 9.2.2, and are described below.

(a) First Stage

No gate operation shall be performed until the overflow depth at the flood discharge gate reaches 50 cm (water level of the channel = EL.+5.700 m). The maximum overflow discharge is estimated at 34 m^3/s.

(b) Second Stage

When the overflow depth at the flood discharge gate exceeds 50 cm, both right and left sediment discharge gates shall be opened with an opening of 30 cm from the floor of concrete slab. This operation shall be continued until the overflow depth reaches 65 cm (water level of the channel = EL.+5.850 m). Conversely, when the channel water level begins falling and reaches the same elevation of gate crest (EL.+5.200 m), the sediment flush gates shall be closed.

The maximum overflow discharge in this stage is estimated at around 70 m^3/s.

(c) Third Stage

The water level of the upstream shall be kept to be at EL. +5.850 m by controlling the center flood discharge gate with a gate opening range of 0 to 70 cm from the gate floor slab.

In case that the channel water level begins falling and reaches EL.+5.700 m, the center flood discharge gate shall be closed. For the subsequent gate operation, "(b) Second Stage" shall be followed.

In this stage, the flow discharge through the gates varies 70 to 120 m^3/s.

(d) Fourth Stage

Furthermore, if the overflow depth exceeds 65 cm, the sediment discharge gates shall be fully opened first, followed by the center flood discharge gate. And finally, the remaining two (2) flood discharges shall be lifted up. This phased gate lifting operation is performed for avoiding a sudden change of river water level. The gates shall be pulled up until the underside elevation of gates reaches EL.+9.000 m.

(e) Closing Operation of Gate

If the river discharge begins decreasing and the water level of the channel at the Weir reaches EL.+2.000 m (water depth is 0.50 m), the gate closing operation shall be commenced. To avoid a sudden change of river water level, gates shall be closed as follows: First, both right and left side flood discharge gates are closed, secondly the center flood discharge gate, finally sediment

discharge gates are closed.

Fig.9.2.3 and Fig. 9.2.4 show the relation between overflow depth and discharge, and the relation between gate opening and underflow discharge, respectively.

(3) Operation for Sediment Flushing

In order to discharge the sediment deposit on the upstream riverbed, sediment flush gates shall be pulled up with a certain gate opening. It is recommended that this gate operation is carried out periodically when the river discharge is affluent. The operation frequency of twice per month is recommended for the maintenance of upstream river channel.

For controlling the gates, the relation between gate opening and underflow discharge shown in Fig. 9.2.5 shall be used.

(4) Frequency of Gate Operation

The table below presents the relation between river discharge and its frequency of occurrence.

Discharge (m^3/s)	Frequency of Occurrence (times per year)		
	By observed data	By estimated data	Average Value
30	18.9	24.6	21.7
40	10.5	14.5	12.5
50	5.2	8.8	7.0
60	3.4	5.3	4.4
70	1.9	3.5	2.7
80	1.5	2.0	1.8
90	1.4	1.4	1.4
100	1.2	1.0	1.1

According to the above table, the frequency of gate operation is estimated as follows;

- First Stage ····· around 7 times / year (No gate operation)
- Second Stage ····· 3 to 7 times / year (Sediment flush gate only)
- Third Stage ····· 1 to 3 times / year (Center flood discharge gate only)
- Fourth Stage ····· once / year (Whole gates)

The frequency of full opening operation of gate is expected to be once per year. With this frequency, gate operation of Simongan Weir will not cause the water intake of

PDAM any inconvenience. Because, if a big flood with a discharge more than 100 m^3/s occurred, the pump operation for PDAM intake would be obviously suspended.

(5) Notification and Warning of Flood Discharge by Gate Operation

When the operation of flood discharge gate is started (the third stage operation), a notification regarding gate operation shall be made to the agencies concerned without delay. At the same time, a warning siren installed at the weir shall be sounded to let the people along/in the downstream river channel know an abrupt flood due to gate operation.

(6) Recommendation

The sharp hydrograph and rapid flood run-off after a heavy rainfall are the characteristics of Garang River. The rising speed of river water is high as well. Therefore, the estimating/forecasting the water level of upstream channel of Simongan Weir becomes important task for the proper operation of gates.

In this detailed design stage, the gate operation rule was tentatively established based on the water level which is supposed to be observed at the weir site. This gate operation rule should be reviewed and upgraded by conducting the supplementary study on forecasting of inflow into the weir including telemetry hydrological gauging network during the construction stage.

In addition, in order to avoid flood damage caused by the gate operation, a flood warning system should be adopted for the downstream reaches from Simongan Weir.

Proposed Operation Rule for Right Bank Intake Gate

(1) Rating Curve of Intake Gate

The discharge from the intake gate is controlled by the gate opening and water level. In the design of intake gate, the flow condition becomes a submerged flow due to the big elevation difference between the water level of Garang River and that of Semarang River. The rating curve of Semarang River channel immediately downstream of the intake structure was estimated by non-uniform flow calculation. When the discharge of Semarang River is 0.5 m^3/s, the water level of outflow side of gate is estimated to be EL.+4.970 m. Using the water level of EL.+5.200 m at the inflow side and the water level at the outflow side, the intake discharge through the

gates is estimated as shown in Fig. 9.2.6.

(2) Operation Rule

The problem on actual operation of intake gates is how to adjust the gate opening to allow intake for Semarang River at a given water level of both inflow and outflow sides.

Assuming that the water level of Garang River is kept at EL.+5.200 m and intake discharges for Semarang River are 0.5 m^3/s in dry season and 0.7 m^3/s in rainy season, the gate opening is obtained from Fig. 9.2.7 as follows.

	Intake Discharge (m^3/s)	Garang River Water level (EL. m)	Semarang River Water level (EL. m)	*1 Gate Opening (m)
Dry season	0.50	EL.+5.200	EL.+4.970	0.16
Rainy season	0.70	EL.+5.200	EL.+5.010	0.24

Note : *1, Among four gates, only one gate is operated.

For the gate operation at the time of large scale flood, all gates shall be totally closed when the overflow depth of flood discharge gate reaches 50 cm (water level = EL.5.700 m).

Basically, intake from Garang River can be done by one gate only. However, to meet the future water demand for flushing Semarang River, which is expected to be increased, the possibility of using the other three gates is high. Apart from this gate operation, the other gates are periodically used for maintenance work and/or repair of the gate.

Proposed Operation Rule for Left Bank Intake Gate

The existing operation practice/rule can be applied to the newly constructed intake gate structure, because the number of gate, dimensions, and the gate floor elevation are determined based on the existing conditions.

Regarding the gate operation, since the intake water volume is as small as 0.15 m^3/s, the water intake should be done by a single gate. For the gate operation, the discharge rating curve is obtained as shown in Fig. 9.2.6. The maximum gate opening is estimated at around 0.03 m for the target discharge of 0.15 m^3/s.

Installation of Temporary Gate for Maintenance Work for Main Gates

During the maintenance work and/or repair for one of the flood discharge gates or one of the sediment flush gates, the temporary gate will be substituted for the said main gate.

The temporary gate is stoplog type with the main member of steel guide post and slide gate. The gate is installed at 3.75 m downstream side from the center of main gate. The steel guide posts are set in the hole in the gate floor concrete and are supported by the bridge slab at the top portion. The main features of temporary gate are described below.

(1) Gate Leaf for Flood Discharge and Sediment Flush Portions

- Type of Gate : Steel guide post and Steel Slide Gate (2 stage gates)
- Dimension : Clear span 18.50 m × Clear height 5.00 m (for Flood Discharge Portion)
  Clear span 5.50 m × Clear height 5.00 m (sediment discharge portion)
  Size of Slide Gate
  2.83 m x 2.50 m x 12 sets and 3.11 m x 2.50 m x 4 sets
- Sealing System : Bottom and sides at upstream side of gate

(2) Gate Guide Frame

- Type : Stop log supported by guide frame of gate pier and central steel guide frames (2 sets) connected with maintenance bridge at top portion.

The procedure of gate maintenance work is as follows:

(1) The temporary gate with a sealing system will be installed firmly.

(2) The target gate (one of the flood discharge gate or sediment flush gate) will be hoisted up to the required height. Then, the river water flows down to the closed temporary gate.

(3) The maintenance work will be done while the target gate is opened.

(4) After the completion of maintenance work, the gate will be fully closed. Then, discharging water enclosed by both target gate and temporary gate, the temporary gate will be taken apart.

The sequence of above gate operation is made in the dry season.

9.2.2 Drainage Facilties

There exist a total of 47 drainage outlets along the river dike and/or river bank. Some of those outlets are equipped with flap gate, but others are not. In this project, new steel flap gates will be installed at the outlet portions of drainage culverts/pipes in case that drainage channels are influenced by backwater from the main river channel. Those facilities are operation-free structures due to their structural function. However, periodical maintenance work is very important to assure long lasting function.

Apart from flap gate, there are also a few existing drainage outlets with a slide gate, and one drainage sluice gate which is proposed to be newly constructed. They will be operated by care takers appointed by the Public Work Division of Semarang City. Gate operation rules for those facilities are described below.

(1) Newly Constructed Drainage Sluiceway

This drainage sluice will be constructed at the site of WF172R+15m of Garang River. The gate and hoist system are described below.

Gate Leaf		
	Type	Steel slide gate
	Dimension	Clear span 1.6 m, Clear height 1.6 m x 2 gates
Hoist System		
	Type	Single spindle
	Operation	Manual operation
	Hoist speed	0.3 m/min (for hoisting up and down)

The design height of gate is 1.6 m and the hoisting speed of spindle is at 0.3 m per minute. The operation time of gate is hence estimated at about 6 minutes for full close which requirs a quick operation. On the other hand, the flood hydrographic in Garang River is sharp and the rising speed of water level for the design flood (100-year return period with Jatibarang Dam) reaches around 3.0 m per hour at the maximum. Therefore, an earlier gate operation is required.

The gate operation rules are given below.

(a) The gate shall be fully opened in usual time.

(b) When the river water level rises and exceeds EL.+11.400 m which is equivalent to the elevation of 1.0 m below ground level, the gate shall be promptly closed by hoisting down the spindle. The index level is supposed to

be marked clearly at gate piers.

(c) After closing the gate, when the water level in the river goes down lower than EL.+11.400 m , the gate shall be opened again by hoisting up the spindle.

(2) Existing Drainage Outlet Structure with Slide Gate

Among the existing drainage outlet structures, the following two structures are equipped with a slide gate. The current gate operation rules should be revised according to the river dimensions determined in the river improvement plan.

	WF.121R+22m	WF.134L+0m
Type of Gate	Steel Slide Gate	Steel Slide Gate
Size of Gate	1.5 m x 1.5 m	1.5 m x 1.5 m
Elevation of Gate Floor	EL.5.700 m	EL.7.000 m
D.H.W.L	EL.8.779 m	EL.10.060 m

The gate operation should be performed as follows.

Gate Operation

	Gate : WF.121R+22m	Gate : WF.134L+0m
Non Flooding Time	Fully opened	Fully opened
Beginning of flood : Closing operation	When water level begins rising and exceeds EL.7.50 m, the gate shall be closed.	When water level begins rising and exceeds EL.8.00 m, the gate shall be closed.
End of flood : Opening operation	When water level begins falling and is lowered below EL.7.50 m, the gate shall be opened.	When water level begins falling and is lowered below EL.8.00 m, the gate shall be opened.
Hoisting Speed	Average 0.3 m per minute	Average 0.3 m per minute
Maintenance	Closing & opening operation	Closing & opening operation

9.3 Maintenance Plan

9.3.1 River Channel and Dike

Periodical Channel Survey

It is necessary to conduct periodically a longitudinal survey and cross sectional survey along the river channel and sea depth sounding in and around the river mouth. These shall be done at least twice a year, before and after each rainy season, based on the following indications.

(1) Longitudinal and Cross Sectional Survey

There exist a number of control points of concrete pile for river survey, which are to be established during construction works for the Project. The elevation of the following points shall be measured at the river sections of the above control points:

- Shoulder of dike / Crown of floodwall
- Toe of dike/floodwall
- Shoulder of low water channel
- Channel bed (about 10 m interval)
- Deepest channel bed

After measurement, designed figures such as high water level, elevation of dike/floodwall and channel bed shall be indicated on the drawing together with the survey results and filed for periodical analysis.

(2) Depth Sounding

To grasp the growth or change of sand bar and sediment condition of the sea including river mouth area, sea and river depth sounding shall be conducted at least twice a year before and after each rainy season.

The sea depth survey at the estuary of West Floodway shall cover about 400 m distance from the river mouth (Section WF. –9) to the sea and about 1,000 m wide along sea shore on both sides. The survey area of 0.4 km^2 shall be divided into a mesh with 200 m intervals, and the measurement of sea bed and sea level shall be done at 55 points at the crossing points of the mesh lines.

Dike and Riverbank

(1) Slopes of Earth Dike and Riverbank

It takes about three years, in general for a dike to become stable and for sod to completely cover the slope of the dike after completion of embankment work. Therefore, special care should be taken during these years.

Maintenance work such as repairing of dike and weeding will be necessary even after the above-said period, because the dike and river bank could be damaged due to weathering and passing of people and animals on the slope of dike and the sod may

also be spoiled by weeds.

Sodding is one of the most suitable means of slope protection. Thus, protection by sodding is an important factor for the maintenance of dike and riverbank. Weeds found in the sodding area shall be dug out, because weeds generally become taller than the sod and likely to kill the sod when they grow. Therefore, weeding twice a year is required because weeds grow so fast.

Scoured section shall be immediately and temporarily repaired by sandbags, etc.. and rehabilitated by permanent means in dry season.

Since the dike crown and the flood plain facing the low water channel are designed as maintenance road as well as walkway, the surface is to be maintained well so as not to cause problems on patrolling activities in the rainy season.

(2) Floodwall

The floodwalls constructed in the downstream of Railway Bridge may be affected by the land subsidence which have been progressing in the central low lying area in Semarang City. Accordingly, there may be a possibility of settlement of the floodwall. Monitoring or observation of the crown elevation, therefore, will be an important task in the O&M work.

(3) Leakage of Water through Dike/Floodwall

Leakage of water through dike embankment is the most serious problem and this is generally caused by the following reasons.

- Different qualities of soil and/or voids because of poor mixing of soil for dike embankment material.
- Permeable layer at the foundation of dike/floodwall.
- New alignment stretch shifted from the old alignment of a river.
- Riparian structure site such as sluice and culvert crossing the dike/floodwall.
- Big water head between the flood water stage and inland ground water level during flood.
- Void caused by small animals such as mouse, mole, etc

In the stretch of lower West Floodway, there may be a possibility of leakage in case

that a flood with a long lapse of time occurs. Therefore, dike and floodwalls in this river section are required to be checked by periodical patrol and a repairing should be made in case a problem is founded.

River Channel

(1) Channel Section

It is necessary to maintain the standard cross sectional form of the channel by excavation or dredging when a decrease of the effective cross sectional area of the channel is found. Weeds, bamboo and other plants grown in the channel not only hamper the smooth flow of stream but also accelerate sedimentation and , as the result, they reduce the flow section of the channel. This is the other reason why weeding is necessary together with the clearing of bamboo and plate. Sediment deposits shall be carefully observed and removed from the channel bed during dry season.

According to the analysis on sediment yield and balance made in Feasibility Study in 1993, it is estimated that after the completion of Jatibarang dam, the sediment deposited in the river channel of downstream from the confluence of Garang and Kreo rivers amount to about 90,000 m^3/year. It is assumed that most sediment be deposited particularly in the area of river mouth and upstream portion of Simongan Weir. Although some of the sediment on the riverbed might be flushed into the sea during flooding, most part of the sediment still remains. Therefore, periodical maintenance dredging is essential.

(a) Target River Stretch for Maintenance Dredging

Taking the river characteristics and impact on river channel by Simongan Weir condition into account, the maintenance dredging should be done focusing on the following portions.

1) The river mouth stretch downstream from North Ring Road Bridge (Stretch-1 : Length = around 1,200 m), and

2) The downstream stretch of Garang River from Simongan Weir up to the proposed Ground Sill (WF124) (Stretch-2 : Length = 1,000 m)

(b) Frequency of Dredging

Assuming that the sediment is deposited annually in the whole area of river stretch-1 with the same rate, the depth of sediment is roughly estimated at 0.3 m. With this thickness of sediment an effective dredging work in the whole stretch can not be performed. For the effective dredging work, thickness of sediment layer should be 0.8 m or more. Therefore, phased dredging with an interval of 2 or 3 years will be a reasonable method.

(2) Waste Disposal and Aquatic Plant

Wastes, whenever found, shall be removed without delay as they spoil the scenic environment of channel, and wastes on the slopes also cause damage to the slopes by nesting of field mice and mole. For the disposal of wastes in the channel, it is desirable that the wastes be brought to a specified garbage incineration plant or a garbage dump where they are incinerated. At areas covered by wastes for a long time, sods die in most cases. To rehabilitate such area, clean soil may have to be placed and mixed with the deteriorated soil and re-sodding has to be done if necessary.

Aquatic plants represented by water hyacinth grow rapidly and thickly in areas where water is available. Such plants, which clog the flow section, shall be removed immediately and treated as described above for waste.

(3) Estuary

Monitoring and management of siltation at the estuary and drainage channels shall be made by collecting data on the growth of riverbed elevation by silting or sand bar.

9.3.2 River Structures

(1) Groundsill

Groundsill is susceptible to scouring at its foot from either up and downstream, bringing sections of riverbed materials resulting in foundation sinking and tumbling. Concrete of groundsill body is also subject to cracking and abrasion by riverbed material.

When the structure is damaged, it must be rehabilitated in the next dry season. On the

other hand, when the foundation of the ground sill is damaged, chemical or cement grouting through the holes drilled in the ground sill by concrete cutter may be recommended to strengthen the foundation. Sheet pilling and/or water proof apron provided at the upstream portion of the groundsill may also be effective depending on the damage.

Other than the countermeasure mentioned above, strict control of sand mining operations is the best protection against damage to the groundsill.

(2) Wet Stone Masonry Type Revetment for the Slope of 1:2 and 1:1.5

This type of revetment is constructed of durable materials, but careful attention is required because the revetment faces the flood flow and it is affected by riverbed variation.

Slope protection shall be maintained well even in a trouble spot, because it is important to prevent initial destruction which, in general, does not require much difficulty for repairing.

Slope foundation shall be taken care of where the foundation is exposed above the riverbed. Additional foot protection shall be set steadily and, especially for sections without foot protection, some reinforcements such as riprap and gabions are required to be provided if local scouring is found and the foundation is caving in.

(3) Gabions

An inspection shall be made in terms of scouring at the toe portion of gabions on channel slope, corrosion of steel wire, stones dropping out from gabions. When such problems are observed, repair and/or reinforcement shall be done as required.

(4) Floodwall and Retaining Wall

Checking on the structure is made in terms of opening and gap of jointing portion, uneven settlement of wall, crack and damage of wall. Repair and/or reinforcement shall be done when the problems are observed. When the settlement of floodwall crown is observed, the floodwall shall be raised up to the design dike crown by using the same material.

(5) Groin

In general, each groin installed upstream of each groin group is susceptible to damage by flood. Local scouring at foot portion as well as logs and drifts which are clogged by the groin are main causes of damage. Whenever local scouring is observed, the portion shall be temporarily strengthened and be rehabilitated during dry season by the construction of a more permanent structure at the same place and/or upstream. Logs and drifts shall be properly removed so that they will not give excessive flow pressure to the groin.

(6) Drainage Facilities

Since the Public Works Office of Semarang City is responsible for the operation of drainage sluice gate, the maintenance work for drainage facilities is to be undertaken by the same office.

The following matters shall be taken into consideration.

(a) Operation of the gate is most important, and the conditions for smooth opening and closing shall be confirmed especially before rainy season. Painting shall be done at least once every six (6) to seven (7) years to protect the gate from rust.

(b) Weeds and sediments are often observed on the bottom of culvert. They shall be removed and checking work has to be done during patrol.

9.3.3 Simongan Weir

(1) Main Weir Body (Weir Pier, Floor Slab and Apron)

Periodical checking regarding uneven settlement of floor slab, inclination and movement of piers shall be made, especially a post-flood checking and a post-earthquake checking are indispensable. In case that the unusual settlement or movement are observed, causes for those phenomena shall be found immediately and proper countermeasures shall be taken as soon as possible. The major parts of the weir are made of concrete, so the checking on cracks and weathering of concrete shall be made as well during periodical check of weir.

Since the floor slab and apron are susceptible to wear and erosion by intensive flood

flowing force, monitoring of wear and erosion of concrete surface is required.

Uplift force is working at the downstream side of weir along the foundation line of weir body or of the downstream apron. Breaking of the water stop may cause piping at construction joints. Piping is one of the most serious problems for the stability of weir body and the problem portion shall be repaired without delay when found. One of the most popular repairing method of piping is grouting.

Continuous monitoring of the condition of sediment deposition in the immediate upstream channel of gate is required for timely flushing the sediment through sediment flush gates.

(2) Approach Wall, Revetment, Concrete Block and Gabion

The joint between apron and concrete block is a transition of roughness structurally and turbulent flow may happen near the joint resulting in settlement and horizontal movement of concrete blocks. Monitoring of scouring around concrete blocks and movement of blocks shall be done periodically and a proper treatment is taken as required. Similarly, the jointing portion between concrete block and gabion shall be checked periodically. Furthermore, riverbeds in immediate downstream and upstream of gabion are prone to scouring, so periodical checking is needed. In case serious local scouring is found, a proper treatment shall be taken to stop further scouring.

The joint between approach wall and revetment can be susceptible to damage during flood. Careful checking on this portion is needed.

(3) Control House

To make the condition of gate operation smooth and reliable under any weather, the control house shall be well maintained.

(4) Maintenance Bridge and Approach Bridge

Refer to the section 9.4.5.

(5) Gate and Hoist

Gate, hoist, electric motor, operation panel and generator system shall be well

maintained through periodical checking/inspection and temporary operation of facilities, so that the gate be securely hoisted up during flood. The detailed and concrete checking/inspection items of gate, hoist, electric motor and operation panel are supposed to be mentioned in the maintenance manual prepared by a contractor selected through tendering. This manual shall be used and followed for the maintenance work.

Sediment deposited in front of the weir and floating trees and garbage trapped at weir can be obstacle to the gate operation. Therefore, they shall be removed during maintenance work.

To prevent corrosion of steel gate and other steel members, periodical painting shall be done. A recommendable interval of painting is as follows:

Gate ····· 7 years
Hoist ····· 10 years
Hand Rail ····· 12 years

Cables and hoist including motor shall be monitored and lubricated to the required parts for safe operation.

The frequency of checking/inspection is determined depending on the importance, operation frequency and technical level of each facility, and environment conditions of facilities. To achieve successful maintenance of gate and hoisting system, the checking/inspection shall be performed in the form of the following three kinds. Items to be checked are enumerated as well.

(a) Monthly checking (Once a month)

Gate : Major parts of gate leaf, Main roller and sub roller, Sheave, Gate guide frame, Sealing parts, Painting condition

Hoist : Wire rope, Electric motor, Reduction gear, Break, Gear and drum, Power transmission, Shaft and bearing, Gate resting device

(b) Annual checking (Once a year)

Gate : Every parts of gate leaf including joint, bolt and nut, Deflector and spoiler, Gate guide frame, Sealing parts, Main roller and sub roller, Sheave, Sealing parts including rubber pad, bolt and nut, Painting

condition

Hoist : Wire rope, Electric motor, Reduction gear, Break, Gear and drum, Power transmission, Shaft and bearing, Gate resting device

(c) Supplementary checking

To supplement the monthly checking this checking shall be carried out once or more times a month. The checking is made focusing on gate leaf, main roller, sheave, gate gird frame and sealing parts.

(6) Operating and Electrical Equipment

Since the operating and electrical equipment are deeply concerned with control and operation of gate and are called for high reliability, a careful and periodical checking on equipment are required. The same checking/inspection method as that of gate and hoist shall be employed, namely, monthly checking, annual checking and supplemental checking. The main points for checking/inspection are as follows.

(a) Checking on appearance of equipment, damage, abnormal sound, generation of heat and so on.

(b) Condition of display lamps.

(c) Confirmation on whether the indicated figures on gauge are normal or not.

(d) Condition of the remote control panel

(7) Intake Structure

(a) Checking/inspection of the facilities shall be done together with that of weir.

(b) Sediment, weeds and floating trees are often observed in front of gates. they shall be removed and checking work has to be done periodically.

(c) The operation of gate is most important, and the conditions for opening and closing shall be confirmed to be smooth, especially before rainy season. Painting shall be done at least every 6 to 7 years to prevent gate and hoist from rust.

(d) Intake Structure as a River Dike

This structure has a function as a river dike when gates are fully closed during

flood. Therefore, the following points shall be well checked or observed.

- Occurrence of opening at joint between box culvert and approach wall of upstream and downstream.
- Piping along the underside ground of box culvert
- Occurrence of crack on the dike crown and void in the ground under the box culvert due to the ground settlement.

In case that troubles mentioned above are found, proper counter measures shall be taken immediately.

9.3.4 River Amenity Facilities

The major facilities are approach steps on the riverbank and dike, gravel paved walkway on the flood plain along the channel bank and boat mooring structures. These facilities are subject to inundation sometimes in the flood season. After flooding, cleaning these facilities is required. In case deposition of sediment, debris, solid wastes, etc. are observed on/around the facilities, those materials shall be removed.

Inspection work for the river amenity facilities shall include detection of deterioration and failure of the target structures. Steps on the river dike/bank slope are prone to erosion by rainwater and flood flow, therefore the observation shall be emphasized on the bedding materials whether or not they are loosened by erosion. Repairing work shall be done as required. Cracks in the steps shall also be immediately corrected.

9.3.5 Bridges

The maintenance work for bridges and their approach roads shall be handed over to and maintained by the respective responsible agencies. However, the substructures and protection works of the bridges and the flow section under the superstructure shall be observed carefully by the proposed O&M organization. The responsible agencies for bridges are as follows:

Name of Bridge	Responsible Agency
North Ring Road Bridge	Directorate General of Road and Highway (Bina Marga)
Railway Bridge	Indonesian Railway Public Corporation
National Road Bridge	Central Java Provincial Public Works Office
New Simongan Bridge	Directorate General. Bina Marga & Semarang City
Toll Road Bridge	Directorate General of Road and Highway (Bina Marga)

The following points shall be considered in the maintenance work.

(1) Checking shall be made if there are cracks or voids in the dike adjacent to the bridge abutments. Early and proper repair on the trouble spot shall be done, in case problems are found.

(2) Observation and/or investigation shall be carried out to find out if a local scouring of the riverbed around the bridge pier arises. If a serious local scouring is found, a proper countermeasure shall be taken to stop the phenomenon.

(3) If any structural troubles are found on the revetments connecting with the bridge abutments, the revetment shall be repaired as soon as possible.

9.3.6 Water Level Gauging Station

(1) Intake Box, Concrete Pipe and Gauging Well

The area around both intake box and gauging well is susceptible to scouring due to the clinging of flowing things such as trees and garbage during flood. Therefore, those things shall be removed when they are found through the periodical inspection.

Sedimentation inside the structures shall be checked by the periodical inspection. In case that the sediment amounts to a certain volume, it shall be removed from the inside the structure of intake box, concrete pile and gauging well.

(2) Gauging House and Equipment

In order to confirm if the sound observation is being made or not, periodical inspection, at least once a month, shall be done. The checking is made focusing on observed data and gauging equipment such as measuring float, data recorder, spare parts and other equipment.

(3) Compiling Collected Data

Observed data shall be collected and compiled at least once a month.

9.3.7 Use of O&M Equipment

Some maintenance equipment are required for implementing an effective O&M works for the river channel and structures, and for enhancing efficiency of the O&M works mentioned in the previous section. To meet the requirements for maintenance, the following equipment are proposed in the Project, and the use of equipment is described in the table below.

Name of Equipment	Use	Number
Patrol Car (4WD, 3,000cc)	Periodical inspection on the Project facilities such as river channel, Simongan Gated Weir, river structures, bridge foundation, sluiceway	1
Backhoe, 0.35m^3	Removal of sediment near riverbank, Removal of deposit, dirt and garbage on the floodplain, Excavation of drainage channel, Repair of dike slope, Repair of riparian structures	1
Bulldozer	- ditto -	1
Truck, 8 t	- ditto -	1
Outboard Motor Boat	Inspection of channel and river mouth, riverbank protection, bridge pier,	1

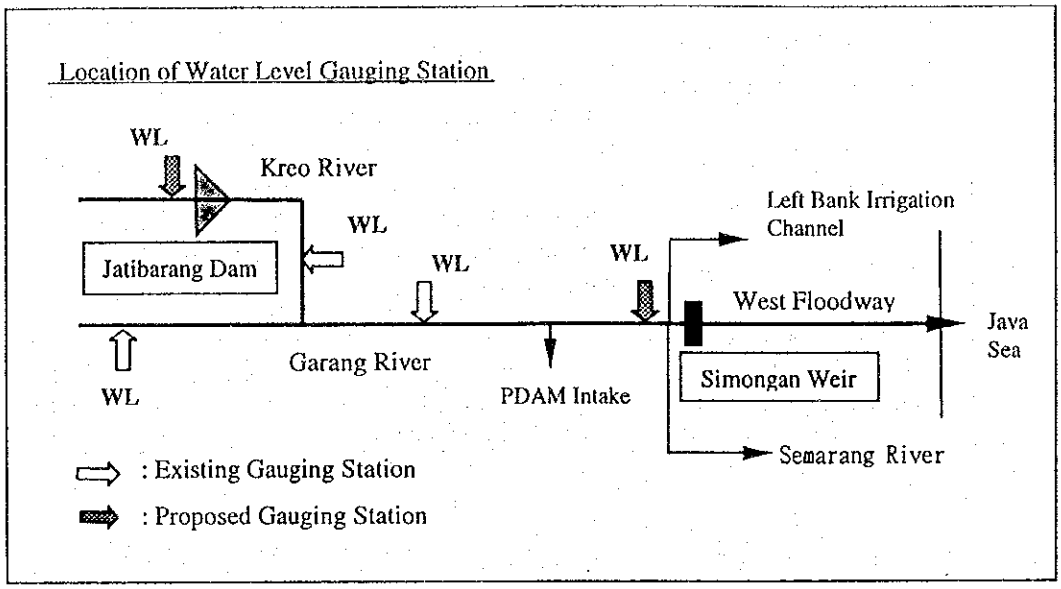
9.4 Management of River Flow and Sand Mining

9.4.1 Flood Observation and Data Transmission System

As far as the flood control of West Floodway/Garang River is concerned, the gate operation of Simongan Weir will be a key issue. Namely, the issue is how timely and precisely the gate operation is performed at the flooding time. The effective gate operation is dependent on the prompt collection of water level data and/or the forecast of water level in the upstream channel in an early stage of flood. To achieve the purpose, the establishment of a system of both flood observation and data transmission is prerequisite. Water level forecasting system could be more helpful for the effective gate operation.

At present, there are three (3) automatic water level gauging stations in Garang River system. They are Panjangan Station located at immediately downstream of the confluence of Garang River and Kreo River, Patemon Station in the upstream of Garang River, and Kalipancur Station in Kreo River. The locations of the said stations are schematically shown in the drawing below. In addition to theses, two (2) more stations are proposed, one (1) at Jatibarang Dam reservoir and the other at Simongan Weir site.

All the data observed at each station should be directly transmitted to the Simongan Weir management/operation office, and should be intensively managed for gate operation. It is recommended that prompt communication system such as telemetering system and water level forecasting system be introduced for timely gate operation, flood fighting activities, etc.



9.4.2 Low Flow Management

A low flow management should be carried out in terms of river discharge and water quality for maintaining normal functions of the river. "A river discharge necessary for maintaining normal function of a river" means the discharge necessary for the following purposes.

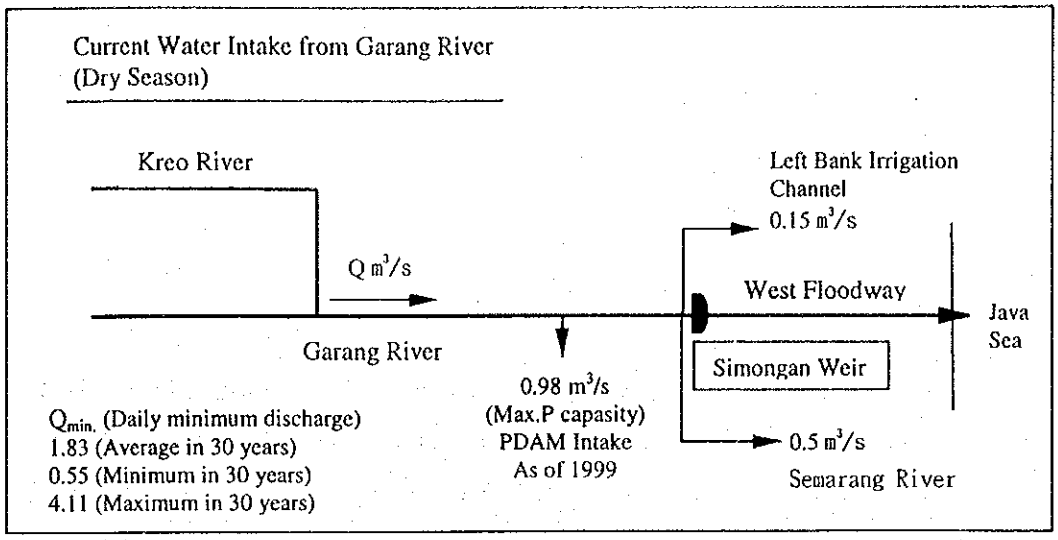
- Assurance of water level for water intake, water-borne transportation and other water utilization,
- Prevention of water contamination by sewerage/drainage,
- Maintenance of river channel (cross sectional form and longitudinal form),
- Prevention of blocking of estuary, and
- Protection of plants and animals in/around river area.

To attain these purposes, a proper management of both river discharge and water quality is required.

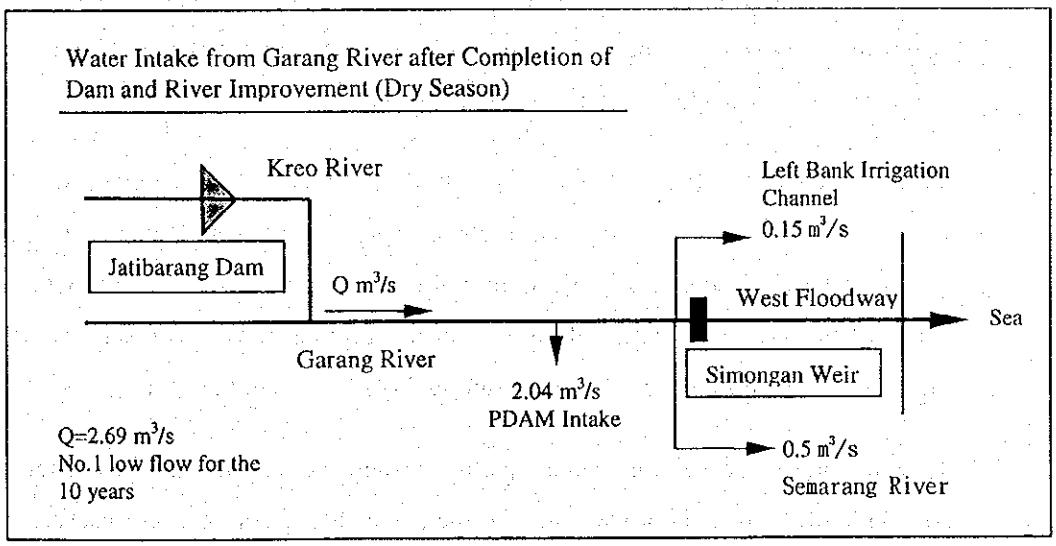
(1) Management of River Flow in West Floodway/Garang River

The following chart shows the amount of water taken from the downstream reaches of Garang River and the daily minimum discharge estimated at the confluence point of Garang and Kreo rivers. A total discharge of 1.63 m^3/s is taken from the river reservoir dammed up by Simongan Weir, and is used as the municipal water and river flushing water. The remaining river water, after being taken for the above water use, flows into West Floodway. Generally speaking, most of the flow water of the lower Garang River is used up in dry season, and almost no water flows into West

Floodway. West Floodway channel, thus, is completely affected by tide.



After the completion of Jatibarang Dam construction, even if the serious draught with a 10-year probability occurs, a minimum flow discharge of 2.69 m^3/s is assured at the confluence point as illustrated below. The newly developed water will satisfy the increase of water intake planned by PDAM. There will be little change in river flow in West Floodway channel.



To conduct an effective flow management of Garang River as planned above, the collection and estimation of the basic data such as river discharge, water quality and intake condition are important, and a proper observation system, and data management and transmission system should be established. Further, an effective measures for flow management are periodical investigations and/or inspections on illegal water intake, discharge of contaminated water, river water quality, and other

actual phenomenon or activities which are affecting the river environment.

As a management of water quantity, the following issues should be tackled.

- Adjustment of Right for water use
- Control of illegal water intake
- Control of water level

(2) Water Quality Management

According to the environmental impact study results, surface water in the upper reaches from Simongan Weir barely meets requirements of Water Quality Standard B which refers to the raw water which needs to be properly treated for drinking. However, it is absolutely necessary to make continuous efforts to improve water quality.

The conservation or improvement of river water quality can be realized with the basic countermeasures such as removal of the sludge deposited on the riverbed, introduction of the flushing water, construction of the water-purification facilities, discharge control of contaminated water, cleaning of the channel and so on. Applicable measures should be selected and put into practice through the coordination between the residents and local government.

There is the Clean River Project (Proyek Kali Bersih : PROKASIH), which is promoted as a nationwide campaign to clean rivers and to create better environment in river basin. Under this project, both Environmental Office of the Semarang Municipality and Environmental Bureau in the Provincial Government have been undertaking monitoring work for the water quality of rivers in the area.

This monitoring work for water quality should be continued even after the completion of river improvement. Further, the legal control on discharge of contaminated water should be employed as the needs arise.

9.4.3 Sand Mining

(1) Present Condition

The sand is deposited on the riverbed in the stretches between the point of about 500

m upstream from PDAM Intake structure and the confluence point of Garang and Kreo rivers. The sand mining sites are extensively distributed in this river stretches. These sand-mining activities in the area are generally done on small scale, and they are legally operated according to the following decree.

(a) If the daily production is more than 100 m^3 and/or mechanical operation is applied, the permit will be issued by the Government or Head of TK I, and

(b) If the production is less than 100 m^3 and/or its operation is dependent on manual laborers, the permit will be issued by the Mayor or Head of Regency.

As can be seen in Fig. 4.1.1 which compares the riverbed profile between 1991 and 1997, some portions of riverbed are extremely lowered due to the excessive sand mining.

(2) Impact on River and Structures

The river structures such as ground sill, groin and riverbank protections are proposed in Garang River. If the sand mining is done with the same way as present one, the proposed structures will be threatened by scouring due to such excessive sand mining in the future time.

(3) Control of Sand Mining

To prevent unusual riverbed fluctuation and to protect river structures, the excessive sand mining should be avoided in the locations mentioned above. Particularly, it should be strictly prohibited to take riverbed materials in the area of 500 m upstream and downstream from the river structures. To achieve the purpose, the decree No. 176/KPTS/A/1987 issued by the Directrate General of Water Resouces Development should be applied.

9.5 River Patrolling

9.5.1 General

(1) Objective of River Patrolling

The objectives of river patrolling are enumerated hereunder.

(a) To inspect and prevent destruction of project facilities such as channels, New

Simongan Weir, river structures, bridge structures, drainage outlet structures and other related structures constructed under the Project

(b) To find the trouble spots and/or obstacles which cause the destruction of the Project facilities.

(c) To grasp the actual conditions such as channel flow, illegal occupation or utilization of the Project facilities, and to monitor river environment including sand mining, water quality and garbage dumping into the river.

(d) To inform the related offices to perform proper countermeasures for the inhabitants along the river and the Project facilities in case of emergency.

(2) Kind of Patrolling

The river patrolling is classified into the following three kinds.

(a) Normal Patrolling

Normal checking on the Project facilities and conditions of river environment, etc. and to find the trouble spots for precaution.

(b) Periodical Patrolling

Periodical checking to maintain the improved channel and structures constructed in the Project securely. Patrolling shall be conducted once a week in dry season, and detailed inspection should be done before every rainy season, which shall be, however, conducted carefully once every day during rainy season.

(c) Emergency Patrolling

In case of emergency such as heavy rainfall, flood, earthquake, land slide and others, the emergency patrolling shall be done and the proper countermeasures shall be taken to the related facilities.

Checking items and frequency for patrolling are indicated in Table 9.5.1.

9.5.2 Implementation

To conduct the patrolling, the following items shall be considered to prepare the implementation program and to perform the patrolling.

(1) Patrolling Schedule

Daily, weekly and monthly implementation schedule for patrolling shall be prepared, and inspection items shall be confirmed before performing daily patrolling.

(2) Composition of Party

Four personal (assistant engineer, foreman, worker and driver) are at least required. In case that some minor repairing works are required during the patrolling, additional staff shall be added in accordance with the work quality and quantity.

(3) Communication System for Patrolling

Patrolling is preferably done by using a patrol car equipped with wireless communication equipment. If wireless is not equipped, communication system with telephone and/or hand receiver shall be considered especially in case of emergency patrolling.

(4) Record and Report

Target route for patrolling, checking items, leaving and returning time and other necessary matters shall be reported before patrolling, and also reported to the Site Manager after finishing. The observation and finding obtained by patrolling shall be summarized and submitted as the monthly report and explained to the Chief of 0&M Management office.

(5) Equipment and Material

The following equipment and materials shall be at least be prepared for patrolling.

(a) Maps, structure drawings and other related administrative materials such as report of occupation of the facilities, construction by private sectors, etc.

(b) Wireless telecommunication equipment such as speaker and receiver.

(c) Observation equipment such as camera, measuring tape and staff.

(d) Equipment for security such as helmet, rope and other signals such as security light in night patrol.

(e) Equipment such as pick, shovel, hammer, wire, rope, grass cutter, and others for usual maintenance.

(f) Patrol car

(6) Patrolling

Checking items, contents and frequency for the patrolling is summarized in Table 9.5.1.

9.5.3 Emergency Patrolling

Emergency patrolling during heavy rainfall or flood is important, therefore careful attention shall be paid during patrolling when heavy rainfall is observed.

For the effective implementation of patrolling in emergency, the following are to be taken care of.

(1) The place and spots to cause troubles in heavy rainfall are to be grasped beforehand based on the data obtained from normal and periodical patrolling.

(2) In case that the emergency such as flood inundation in residential area, damage to the related facilities, electric or telecommunication trouble like a public line cut, tree fall down on the road etc., are found during patrolling, the prompt action to inform the related offices and the emergency measures including evacuation of inhabitants may have to be done. The proper information and the counter measures shall be taken to the inhabitants.

(3) The application of emergency measures such as traffic control and detour are so often required that necessary equipment and materials like signal light, wooden pile, bale for sand bag shall be put in order before patrolling and kept in the patrol car during patrolling.

TABLES

CHAPTER 9

OPERATION AND MAINTENANCE

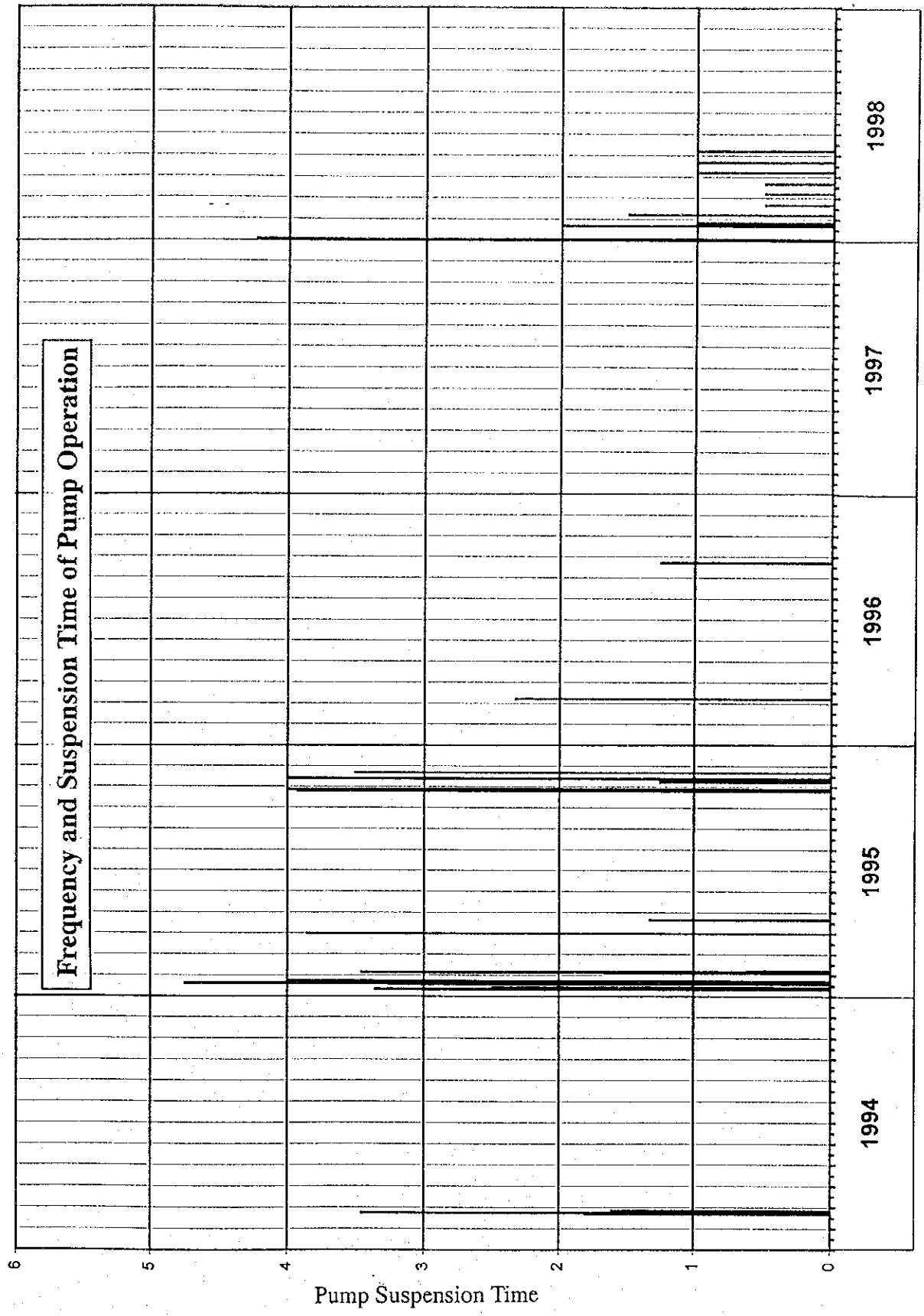
Table 9.5.1 ITEMS FOR INSPECTION WORKS

Inspection	Works of Inspection	Item of Inspection	Frequency of Inspection	
			Usual	Flooding event
Usual or Periodical Inspection	1. River channel	- Sedimentation and scouring condition of riverbed - Flow condition - River mouth condition - Waste disposal and water quality - Illegal occupation of river bank and floodplain	Weekly - ditto - - ditto - - ditto - - ditto -	Daily - ditto - - ditto - - ditto - - ditto -
	2. Dike/Floodwall	- Weed and crack on dike/floodwall surface - Seepage and erosion of dike body - Illegal occupation on dike slope	Weekly - ditto - - ditto -	Daily - ditto - - ditto -
	3. Revetment and Groin	- Crack on slope and foot - Scouring around foot	Weekly - ditto -	Daily - ditto -
	4. Simongan Weir	- Obstacles (tree, garbage, grass) around gate piers - Obstacles on the access roads and maintenance bridge - Defect of concrete structures and building - Sedimentation and scouring of riverbed - Condition of major parts of gate, hoist, other mechanical and electrical equipment - Condition of every parts of gate, hoist, other mechanical and electrical equipment	Weekly - ditto - - ditto - - ditto - Monthly Annually	Daily - ditto - - ditto - - ditto - Monthly Annually
	5. Ground Sill	- Obstacles (tree, grass and solid waste etc.) - Sedimentation on the upstream riverbed - Local seepage and scouring - Crack in apron and side wall	Weekly - ditto - - ditto - - ditto -	Daily - ditto - - ditto - - ditto -
	6. Drainage Sluiseway and outlets	- Sliding condition of gate - Sedimentation and obstacles in the culvert - Crack on concrete	Weekly - ditto - - ditto -	Daily - ditto - - ditto -
	7. Bridge Piers	- Obstacles (tree, grass and solid waste etc.) - Local scouring around the pier	Weekly - ditto -	Daily - ditto -
Emergency Inspection or Activity	- Flow condition of river channel and Inundation condition - Structural condition (Simongan Weir, Drainage sluiceway, outlets, Ground sills etc.) - Gate control for Simongan Weir - Information to related offices - Information to the inhabitants - Temporary counter measure for flood defense		Hourly	

FIGURES

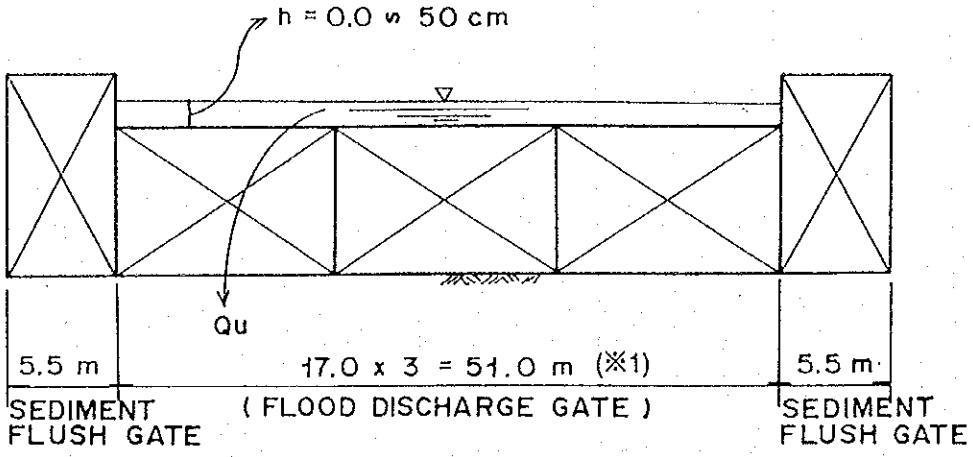
CHAPTER 9

OPERATION AND MAINTENANCE



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 9.2.1 OPERATION RECORD OF PDAM INTAKE PUMP (1994 - 1998)
JAPAN INTERNATIONAL COOPERATION AGENCY	

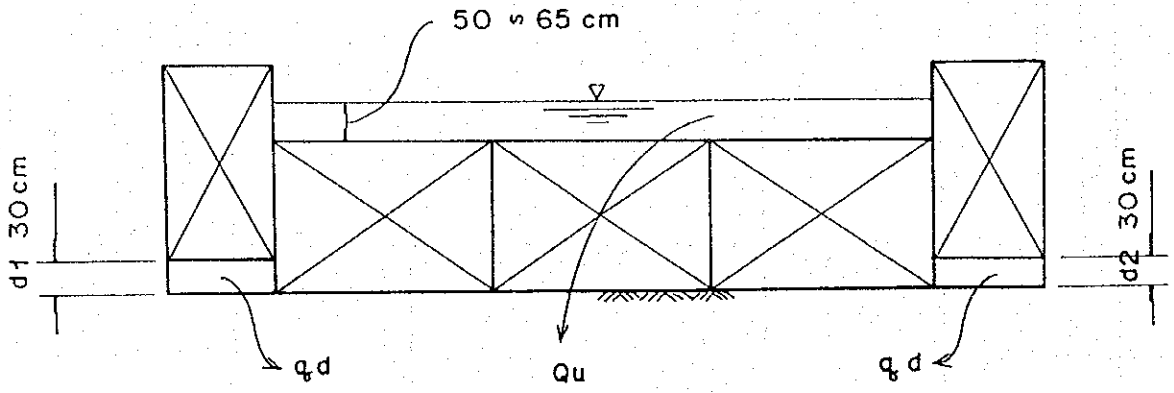
FIRST STAGE



NOTE , ※1 : 17.0m (Efective width of gate = 18.5 - 0.75 × 2)

Q = Qu = 0 ∿ 33.9 m^3/s

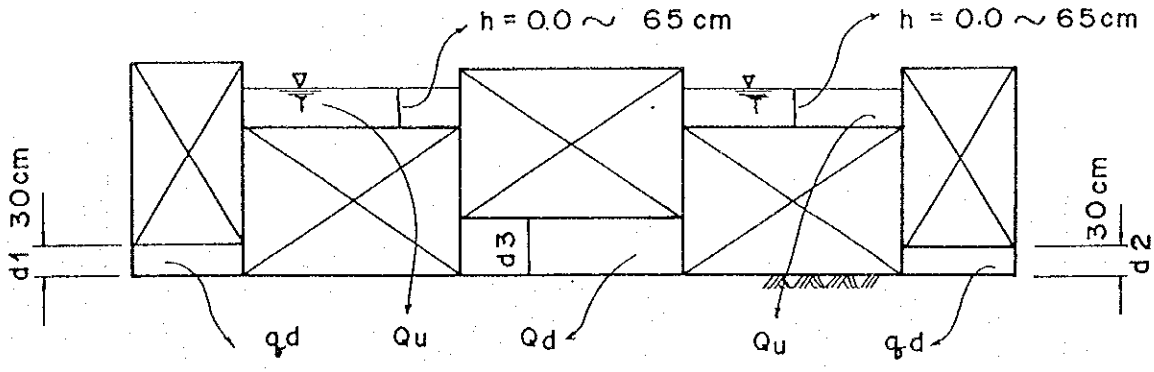
SECOND STAGE



2qd	= 16.6 ∿ 18.1 m^3/s
Qu	= 33.9 ∿ 50.8 m^3/s
TOTAL Q	= 50.5 ∿ 68.9 m^3/s

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig.9.2.2 (1/2) RELATION BETWEEN STATE OF GATE OPERATING SYSTEM AND FLOOD DISCHARGE VOLUME
JAPAN INTERNATIONAL COOPERATION AGENCY	

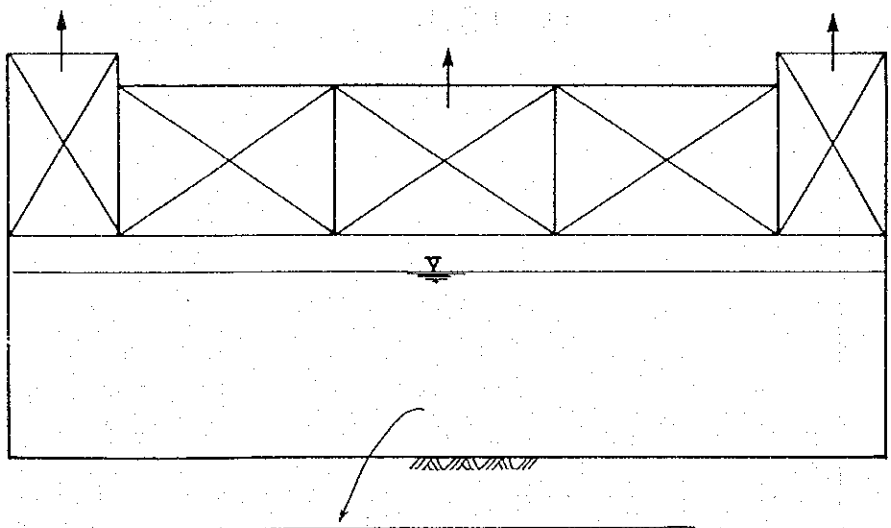
THIRD STAGE



2qd =	16.6	~	18.1 m³/s
2Qu =	50.8	~	33.9 m³/s
Qd =	0	~	63.5 m³/s
TOTAL Q =	67.4	~	115.5 m³/s

d3 = 0.0 ~ 70 cm

FOURTH STAGE



Q = 115.5 ~ 790 m³/s

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 9.2.2 (2/2)
RELATION BETWEEN STATE OF GATE OPERATING SYSTEM AND FLOOD DISCHARGE VOLUME

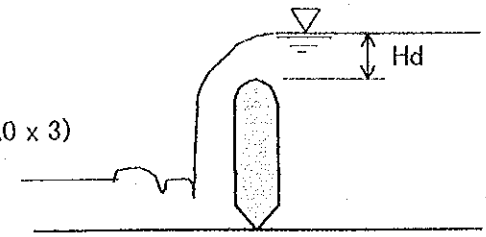
Calculation Formula : $Q = C * B * H^{3/2}$

W = 3.7 m

H_d = H

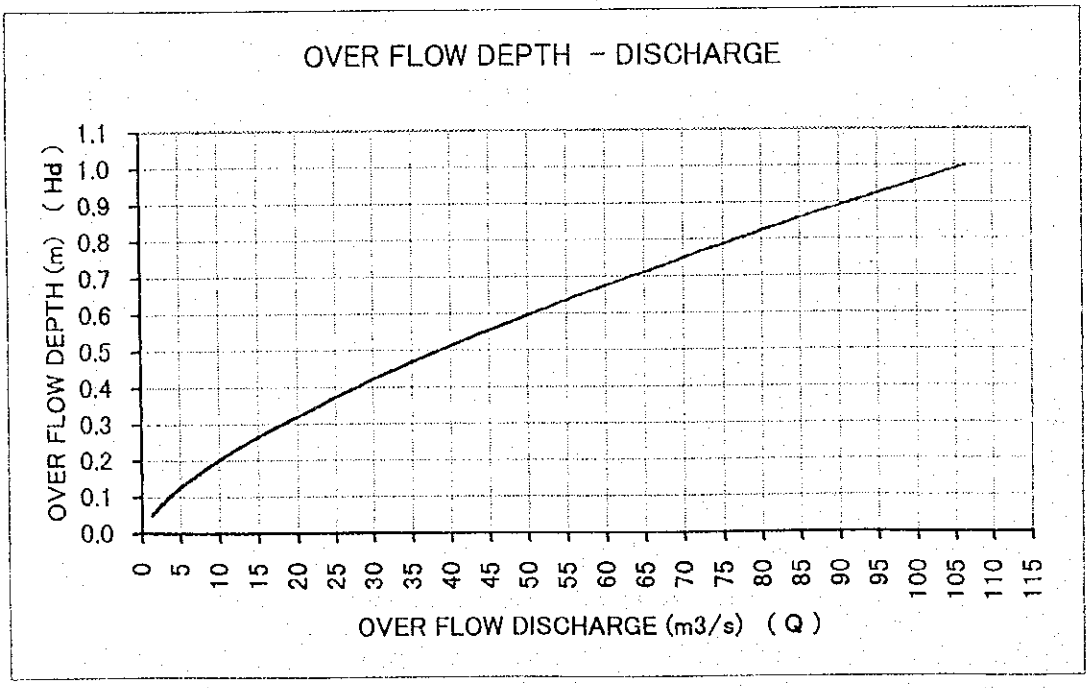
B = 51 m

(Effective Width :17.0 x 3)



Parameters					Case-1		Case-2	
H (m)	H_d (m)	B (m)	C_d	a	C1	Q1 $C1*B*H^{3/2}$ (m^3/s)	C2	Q2 $C2*B*H^{3/2}$ (m3/s)
0.05	0.05	51.00	2.194	0.591	2.194	1.251	1.940	1.106
0.10	0.10	51.00	2.188	0.582	2.188	3.529	1.874	3.023
0.15	0.15	51.00	2.183	0.573	2.183	6.467	1.858	5.504
0.20	0.20	51.00	2.177	0.564	2.177	9.930	1.853	8.455
0.25	0.25	51.00	2.171	0.555	2.171	13.841	1.854	11.820
0.30	0.30	51.00	2.165	0.547	2.165	18.146	1.857	15.564
0.35	0.35	51.00	2.160	0.538	2.160	22.807	1.862	19.659
0.40	0.40	51.00	2.154	0.530	2.154	27.791	1.867	24.088
0.45	0.45	51.00	2.148	0.521	2.148	33.074	1.873	28.834
0.50	0.50	51.00	2.143	0.513	2.143	38.635	1.879	33.885
0.55	0.55	51.00	2.137	0.505	2.137	44.454	1.886	39.231
0.60	0.60	51.00	2.131	0.497	2.131	50.518	1.893	44.863
0.65	0.65	51.00	2.126	0.489	2.126	56.811	1.900	50.773
0.80	0.80	51.00	2.109	0.466	2.109	76.951	1.922	70.121
0.90	0.90	51.00	2.097	0.451	2.097	91.329	1.936	84.320
1.00	1.00	51.00	2.086	0.436	2.086	106.390	1.952	99.527

Note : Case-2 is applied.

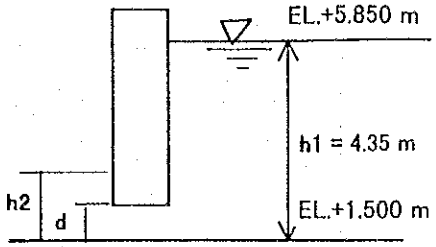


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 9.2.3
OVERFLOW DEPTH - DISCHARGE RELATION OF FLOOD DISCHARGE GATE

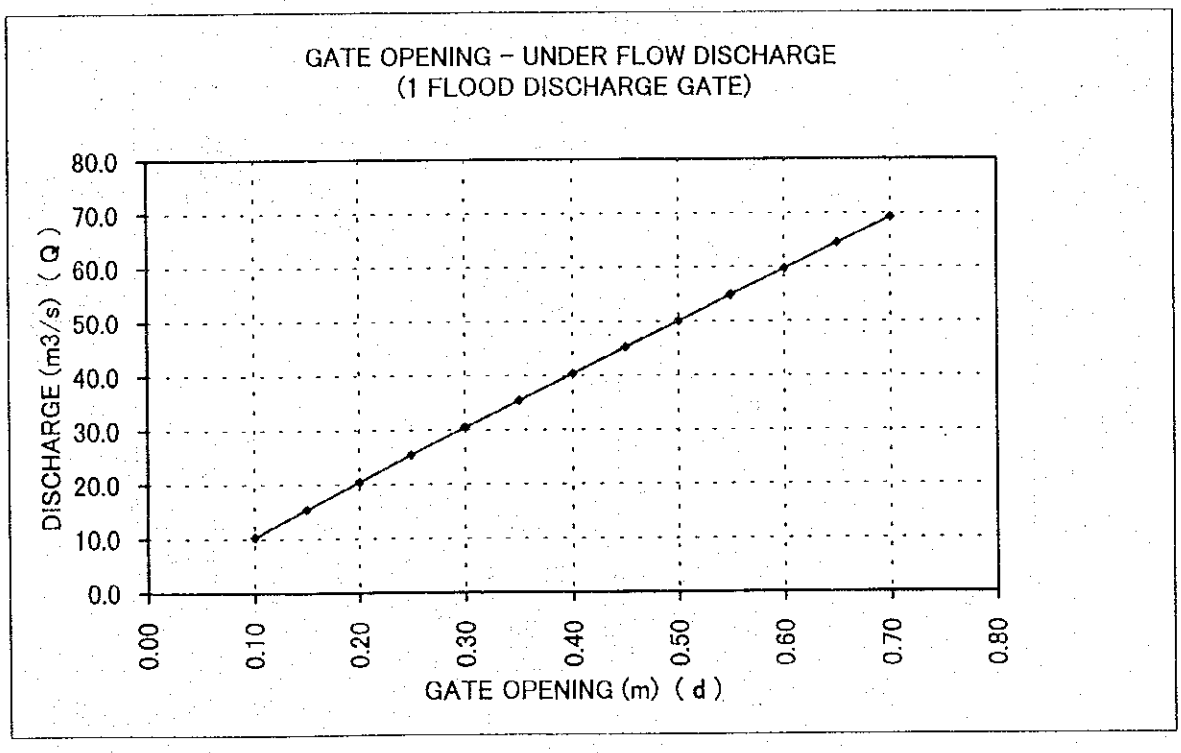
Opening d (m)	Underflow Discharge Q m^3/s			Discharge Coefficient
	Upstream Water Depth : h2 (m)			
	0.00	0.30	0.60	
0.10	10.28	10.28	10.28	0.602
0.15	15.37	15.37	15.37	0.600
0.20	20.42	20.42	20.42	0.598
0.25	25.44	25.44	25.44	0.596
0.30	30.43	30.43	30.43	0.594
0.35	35.38	35.38	35.38	0.592
0.40	40.30	40.30	40.30	0.590
0.45	45.19	45.19	45.19	0.588
0.50	50.05	50.05	50.05	0.586
0.55	54.87	54.87	54.87	0.584
0.60	59.67	59.67	59.67	0.582
0.65	64.43	64.43	64.43	0.580
0.70	69.17	69.17	69.17	0.578



h2 = 0.00 m (Case-1)
0.30 m (Case-2)
0.60 m (Case-3)

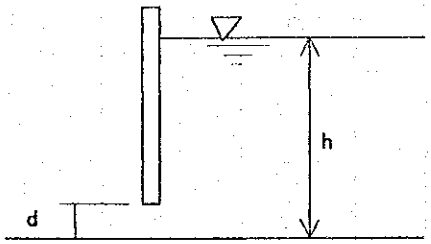
Note :

1. The width of a flood discharge gate is 18.5 m.
2. The upstream water level is controlled to be EL.+5.850 m.
3. The downstream water depth (h2) is assumed to be changed from 0.0 to 0.6 m.
   Calculation formula: refer to "Hydraulic Design Criteria,
   Discharge below vertical slide roller gate"



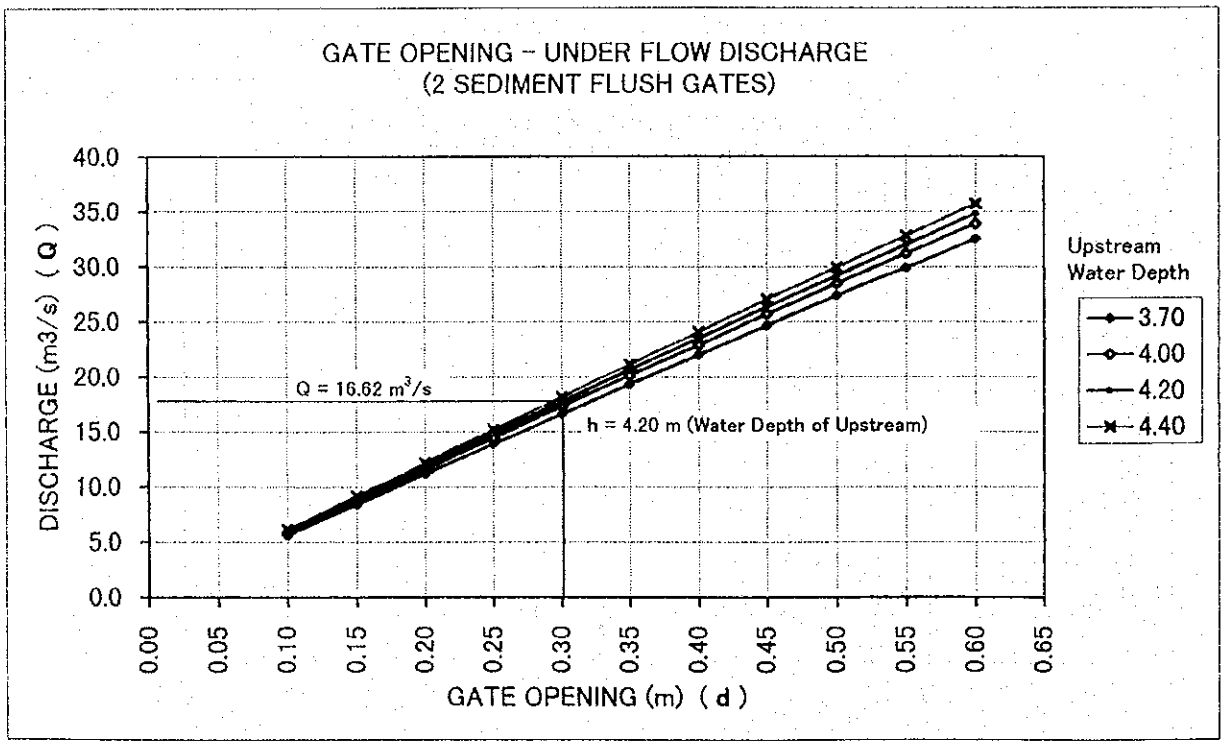
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 9.2.4 RELATION BETWEEN GATE OPENING AND UNDERFLOW DISCHARGE FOR FLOOD DISCHARGE GATE
JAPAN INTERNATIONAL COOPERATION AGENCY	

Opening d (m)	Underflow Discharge Q m^3/s			
	Upstream Water Depth : h (m)			
	3.70	4.00	4.20	4.40
0.10	5.63	5.86	6.01	6.15
0.15	8.41	8.76	8.98	9.19
0.20	11.18	11.63	11.93	12.21
0.25	13.91	14.48	14.86	15.22
0.30	16.62	17.31	17.76	18.20
0.35	19.32	20.13	20.65	21.16
0.40	22.00	22.92	23.52	24.11
0.45	24.65	25.70	26.37	27.03
0.50	27.40	28.46	29.21	29.94
0.55	29.90	31.19	32.02	32.83
0.60	32.51	33.90	34.81	35.70

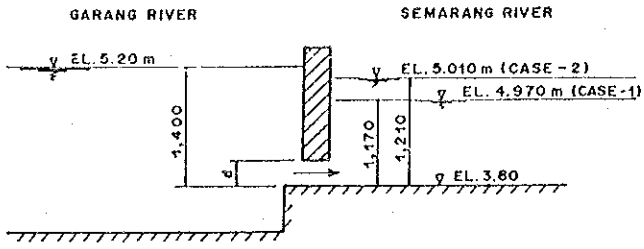


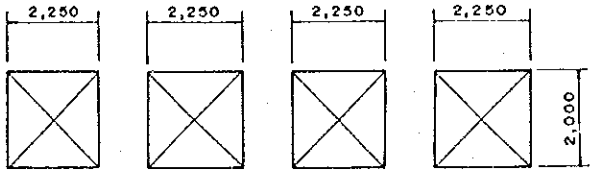
Note :

1. Total width of sediment flush gate is 5.5 x 2 =11.0 m
2. Calculation formula: refer to "Hydraulic Design Criteria, Discharge below vertical slide roller gate"



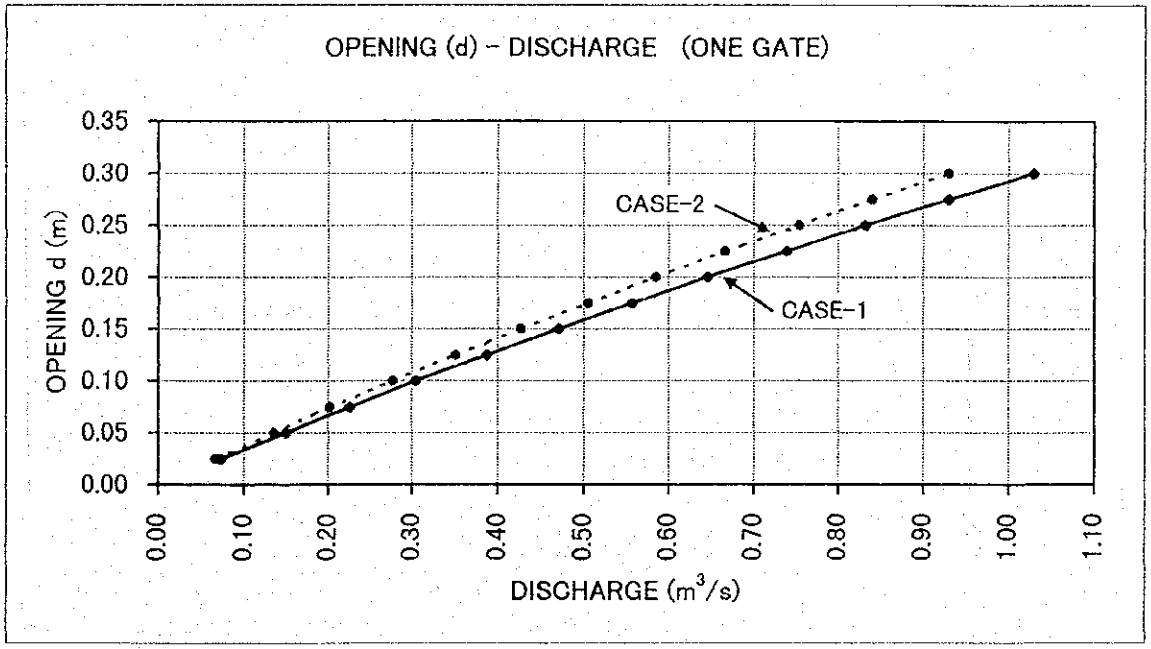
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 9.2.5 RELATION BETWEEN GATE OPENING AND UNDERFLOW DISCHARGE FOR SEDIMENT FLUSH GATE
JAPAN INTERNATIONAL COOPERATION AGENCY	





Width of Gate (m)	Opening Height (m)	Discharge (m^3/s)	
		Case-1 (h = 1.17 m)	Case-2 (h = 1.21 m)
2.250	0.025	0.073	0.067
2.250	0.050	0.149	0.135
2.250	0.075	0.226	0.202
2.250	0.100	0.305	0.277
2.250	0.125	0.387	0.351
2.250	0.150	0.471	0.427
2.250	0.175	0.557	0.505
2.250	0.200	0.646	0.585
2.250	0.225	0.738	0.667
2.250	0.250	0.832	0.753
2.250	0.275	0.930	0.840
2.250	0.300	1.030	0.930

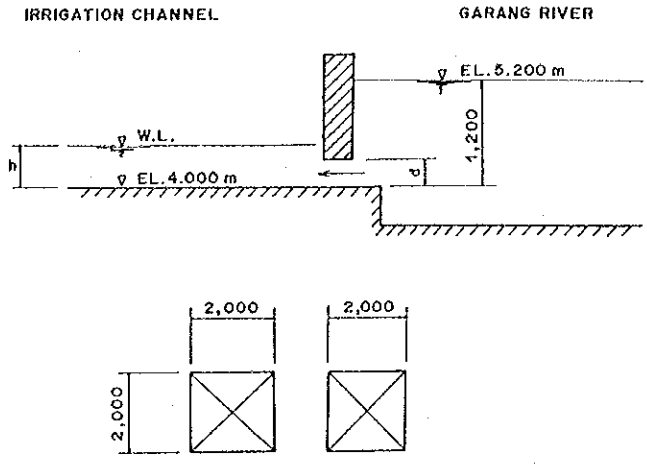
Number of gate : 1
Discharge flow type : Submerged discharge



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

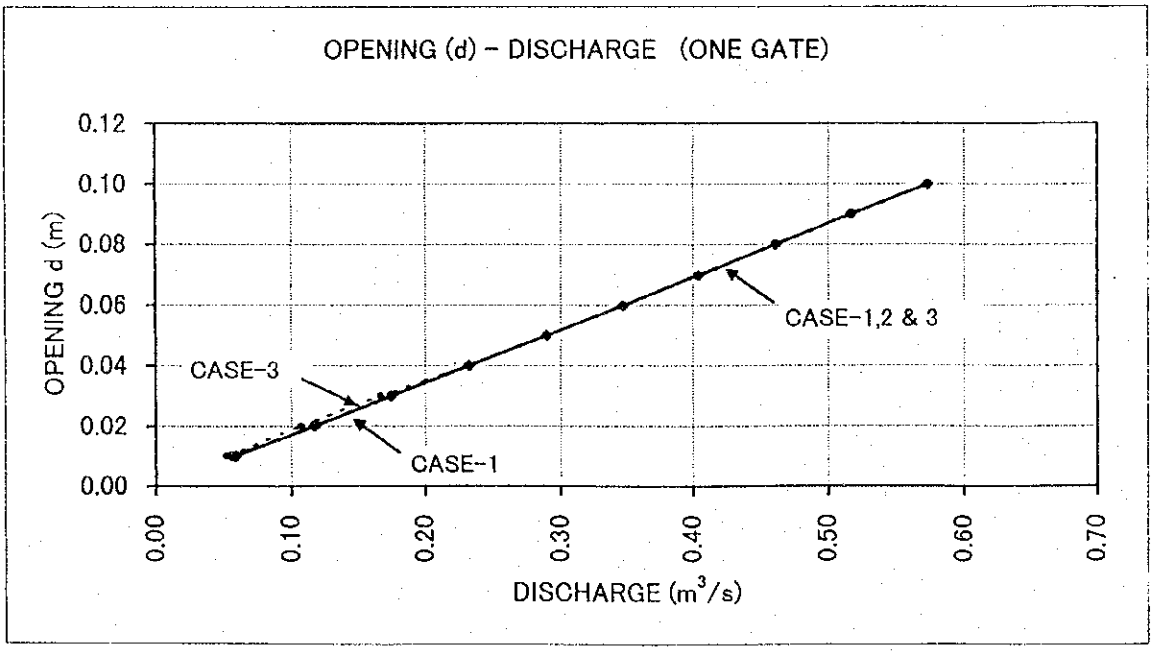
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 9.2.6
DISCHARGE RATING FOR RIGHT INTAKE GATE



Width of Gate (m)	Opening Height (m)	Discharge (m^3/s)		
		Case-1 (h = 0.1 m)	Case-2 (h =0.2 m)	Case-3 (h =0.3 m)
2.000	0.010	0.059	0.056	0.052
2.000	0.020	0.117	0.117	0.107
2.000	0.030	0.175	0.175	0.167
2.000	0.040	0.233	0.233	0.233
2.000	0.050	0.290	0.290	0.290
2.000	0.060	0.347	0.347	0.347
2.000	0.070	0.404	0.404	0.404
2.000	0.080	0.461	0.461	0.461
2.000	0.090	0.517	0.517	0.517
2.000	0.100	0.573	0.573	0.573

Number of gate : 1
Discharge flow type : Submerged discharge and Free discharge



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 9.2.7 DISCHARGE RATING FOR LEFT INTAKE GATE
JAPAN INTERNATIONAL COOPERATION AGENCY	

CHAPTER 10

ORGANIZATION AND INSTITUTION

CHAPTER 10 ORGANIZATION AND INSTITUTION

10.1 Regional Government System in Indonesia

The new Autonomy Law i.e. No. 22 Year 1999 Re REGIONAL ADMINISTRATION was in force on the 7th of May 1999.

The principles of the execution of Regional Administration pursuant to Law Number 22 Year 1999 on Regional Admiistration are as follows:

(1) the implementation of decentralization*, deconcentration* and task attachment principles;

(2) the entire and complete execution of decentralization principles implemented in the Regency and Municipality Regions; and

(3) the attachment principle which can be implemented in the Provincial, Regency, Municipality and Village Regions.

(Note)

Decentralization is the transfer of Administration authority by the Government to the Autonomous Region within the framework of the Unitarian State Republic of Indonesia.

Deconcentration is the delegation of authority from the Government to the Governor as the Government's representative and/or as the (Central) Government's instrument in the Region.

The implementation of extensive regional autonomy is laid down at the Regency Regions and the Municipality Regions, while the Provincial Regional autonomy constitutes a restricted autonomy.

In the framework of the implementation of extensive regional autonomy, the whole authority is basically assumed by the Regency and Municipality Region.

The authority assumed by Provincial Region comprises authority of cross Regency and cross Municipality coordination, other authorities in certain fields of administration, authorities which still cannot be executed by the Regency and the Municipality Regions, as well as those authorities in the field administration which are delegated to the Governor as the representative of the Central Government within the framework of deconcentration.

At the moment when the Law Number 22 Year 1999 was in force, the old Law No. 5 Year 1974 on Principles of Regional Government was declared void, and any Law and Legislation

which contrary to and/or not in accordance with the new Law No. 22/1999 shall be adjusted thereto.

One of the implementing regulations particularly in the field of Water Resources Development, i.e. the Central Java Regional Regulation No. 11 Year 1999 was enacted on the 20th of July 1999.

Details are discussed hereinafter. Italic words show Indonesian terms in this Chapter.

10.1.1 Structure and Powers of Regional Governments

Regional Governments are categorized into two levels, namely, Level 1 and Level II. Level I Regional Governments are composed of Provinces (*Propinsi*) and Level II Regional Governments are Regencies (*Kabupaten*) or Municipalities (*Kotamadya*). Regencies are governments in rural areas and Municipalities are in urban areas. Thus, Semarang Municipality (*Kotamadya Semarang*) is a Level II Regional Government in an urban area.

Regencies/Municipalities are the basic units of regional government system. Matters which affect over one Regency/Municipality are assumed by Provinces while those over one Province are assumed by the Central Government. Ministries of the Central Government have Regional Representative Offices (*KANWIL: Kantor Wilayah*). Regional Representative Offices make technical guidance to or technical coordination with Regional Government Services in the related field. Some Ministries including Education, Religion etc. have them for both Regional Government Level I and II. Ministry of Public Works has them only for Level I.

Regional Parliaments (*DPRD: Dewan Perwakilan Rakyat Daerah*) are established at each Level of Regional Government. Approval by the Regional Parliaments is necessary for making a budget and regional regulation, and for implementing regulations. In addition, each Regional Parliament elects candidate(s) of the regional government's head. Governor (*Gubernur*), the head of Province is appointed by the President, and Regent (*Bupati*), the head of Regency and Mayors (*Walikota*), the head of Municipality are appointed by the Governor.

Structure of regional government offices are similar both for Level I and Level II. Under the head of the regional government, established are Vice Head, such as Vice Governor (*Wakil Gubernur*), Vice Regent (*Wakil Bupati*) and Vice Mayor (*Wakil Walikota*), Secretariat (*Sekretariat Daerah*), Regional Development Planning Board (*BAPPEDA: Badan*

Perencanaan Pembangunan Daerah), Inspectorate (*Inspektorat*) which reports to the head of the regional government, and Services (*Dinas*).

Vice Head assists the Region's Head, coordinates the activities of the Regional Government institutions and is responsible to the Region's Head.

Secretariat supports the Region's Head, collects and analyze information on regional administration.

Services are offices for implementation of government services in respective fields. They execute implementation procedures of services, guidance, planning, licensing and supervision/administration of implementation. The organization of each Service consists of

(a) Head of the Service;

(b) Administration Division;

(c) Sub-services; and

(d) Functional Group.

BAPPEDA draws up a development plan and financial plan, coordinates government services between the Services in dealing with problems on development.

Refer to Fig. 10.1.1 for the structure of the Regional Governments.

Sub-Regional Governments

Under Regencies/Municipalities, there are Sub-Regional Governments. Their characteristics are summarized as follows:

Sub-Regional Governments

Name	Status	Function	Description
Sub-District (*Kecamatan*)	Under Regency / Municipality	Coordinate Village Administrations in its jurisdiction.	Head (*Camat*) is appointed by and reports to Regent/Mayor. No parliament.
Village-administration (*Kelurahan*)	Under Sub-District in Urban Areas	A government office in direct contact with the public.	Head (*Lurah*) is appointed by and reports to Regent/Mayor. No parliament.
Village (*Desa*)	Under Sub-District in Rural Areas	A government office in direct contact with the public. Can make village internal Regulations by the proposal and/or approval of the Village Consultative Assembly (*Musyawarah Desa*).	Head (*Kepala Desa*) is elected directly by the Village residents and appointed by and reports to Regent/Mayor.

The Points of the New Autonomy Law (No. 22/1999)

The points of new Autonomy Law (Law No. 22/1999 on Regional Administration) can be summarized as follows:

(1) Many authorities of the higher level of the Government are assumed by the Regency/Municipality Governments. Matters related in one Regency/Municipality are managed by the Regency/Municipality Government.

(2) Every Region is led by a Region Head as Chief of the Executive Body who is assisted by a Vice Region Head.

(3) The Region Head and Vice Region Head as elected by the Regional Parliament and Stipulated as Head and Vice Head of the Region for a five-year term by the Regional Parliament but they shall be authorized by the President.

(4) The Region Head and Vice Region Head are inaugurated by the President or by other official acting on behalf of the President

(5) The Provincial Region Head is referred to as Governor, who is ex-officio also Representative of the Central Government.

(6) In his capacity of the Central Government's Representative the Governor is subordinated and accountable to the President.

(7) In his capacity of the Region Head, the Governor is accountable to the Provincial Parliament.

(8) The Head of a Regency (*Kabupaten*) is referred to as *Bupati* (Regent).

(9) The Head of Municipality (*Kotamadya*) is referred to as *Wlikota* (Mayor).

(10) In the execution of his task and responsibility as Region Head, the *Bupati/Wlikota* is accountable to the Regency/Municipality Parliament.

10.1.2 Finance of Regional Governments

The execution of Regional Government's tasks and the Regional Parliament shall be financed from and borne by the Regional budget. The execution of the Central Government's tasks in the Region shall be financed from and borne by the Central Government's budget.

The sources of revenue in the implementation of Regional Government's tasks are:

(1) Regional original revenue;

(2) Proportion Funds;

(3) Regional loans; and

(4) Other legal regional revenues.

Sources of Regional original revenue consist of:

(1) Regional tax collection;

(2) Regional retribution collection;

(3) Income of the region owned enterprises, from the management of separated Region's assets; and

(4) Other legal regional original revenue.

The Proportion Funds consists of:

(1) Region's proportion from Land and Building Tax revenue, Land and Building Acquisition Duty and revenues from natural resources;

(2) General Allocation Funds; and

(3) Special Allocation Funds.

Certain percentage of he Proportion Funds are paid to Regional Governments. The proportion between the Central Government and the Regional Government is as follows:

Proportion Funds

Source	Central Government	Regional Government
Land and Building Tax	10%	90%
Land and Building Acquisition Duty	20%	80%
Natural Resources (Forestry, General Mining & Fishery)	20%	80%
Oil Mining	85%	15%
Natural Gas Mining	70%	30%
General Allocation Funds	It is stipulated at least 25% from the domestic revenue stipulated in the State's Budget. 10% of the Fund is allocated to Level I and 90% for Level II.	
Special Allocation Funds	It is transferred from the State Budget to certain Regions to assist financing special needs, observing the availability of funds in the State Budget.	
Reforestation Funds	60%	40% for producing Regions as Special Allocation Funds

Proportions between Level I and Level II will be decided in the new Regional regulations except that of General Allocation Funds.

The total revenue is Rp. 1,325 billion for the Central Java Province and Rp. 117 billion for Semarang Municipality in 1995/1996. The latter amounts to 8.8% of the former. Subsidies amount to 73.6% in the total revenue for Central Java Province while only 30% for Semarang Municipality, which shows a clear contrast in the revenue structure. It means that Semarang Municipality has relatively abundant in its own financial sources.

Issuing bonds by Regional Governments is very limited because it is strongly restricted by the Central Government which is very cautious about budgetary deficit as well as the market is not developed yet for the Regional Government bonds. Loans to Regional Governments are mainly those underwritten by the Central Government. In 1995/1996 budget, Central Java Province borrowed no loans while Semarang Municipality borrowed Rp. 20 billion.

Expenses are divided into two: one is the routine budget and the other is the development budget. The routine budget is allocated to current expenditures and the development budget is spent on the project bases. The total expenditure is Rp. 1,261 billion for the Central Java Province and Rp. 103 billion for Semarang Municipality in 1995/1996. In Central Java Province, the ratio between the routine budget and the development budget is 85.8% to 14.2% while in Semarang Municipality 48.3% to 51.7%. The largest items in the routine budget is salaries (85.6% in the Province and 36.5% in the Municipality). Concerning the

development budget, relatively larger portion is allocated to the transportation sector (19.9% in the Province and 33.5% in the Municipality).

10.2 Present Situations of Organization and Institution for Operation and Maintenance

10.2.1 Related Laws and Regulations

The basic law on rivers in Indonesia is the Government Regulation No. 35/1991. This Regulation is enacted for the implementation regulation of the Law No. 11/1976 on Water Resources Development, under which the Government Regulation No. 22/1982 on Water Management, the Government Regulation No. 23/1982 on Irrigation, the Government Regulation No. 20/1990 on Control of Water Pollution and the Government Regulation No.27/1991 on Swamps are also promulgated.

The background of the enactment of these Regulations is that the increase of water demand due to growth of population and industrial development as well as the deterioration of water quality and decrease of water resources necessitate the implementation of Regulations.

Law No. 11/1974 on Water Resources Development

The State has the responsibility for control, development and management of water resources. Priority is put on water uses for drinking, irrigation and energy in water planning and allocation. Direct beneficiaries are to participate in the operation and maintenance with the Central or Regional Government assuming the operation and maintenance responsibility.

Government Regulation No.22/1982 on Water Management

This Regulation sets up the basis for river basin management including the requirement for a comprehensive water resources plan for each basin which is to be incorporated in a National Water Plan as part of the National Development Plan. Except for domestic use, all water use requires license from the Provincial Government, including groundwater extraction.

Government Regulation No. 35/1991 on River

It declares that rivers have multi-purpose uses and delegates responsibility for their development and management to either Central or Regional Government in accordance with a classification of their economic importance. Construction of river structure with the aim for public welfare and safety shall be made by the Government or a state-owned corporation.

In addition, operation of river and river facilities shall be made by the Government or a state-owned corporation.

10.2.2 Related Authorities

(1) *JRATUNSELUNA* Master Project Office

JRATUNSELUNA stands for the names of five river basins (Jragung, Tuntang, Serang, Lusi and Juana) which the office covers in a part of the Central Java Province. It manages the projects for water resources development falling in the scope of Region Level I within the said river basins including Semarang Project Area. The General Manager of the Master Project Office makes guidance to such projects from the viewpoint of policy matters, under the supervision of the Ministry of Public Works. On the other hand, those projects are also guided by Head of Water Resources Development Unit of the Central Java Province in terms of technical matters. Under the General Manager, there are three implementation units for projects Refer to Fig 10.2.1.

The implementation unit for Irrigation is now abolished because the World Bank loan for the irrigation project has finished. The implementation unit of *PKSDA* (*Proyek Konservasi Sumber Daya Air* or Water Resources Conservation Project) has changed to *PPKSA* (*Proyek Pengembangan dan Konservasi Sumber Air* or Water Sources Development & Conservation Project).

The budget by each project implementation unit is as follows:

Budget by Project Implementation Unit of *JRATUNSELUNA*

Unit: Rp. 1,000

Fiscal Year	Water Resources Management & Flood Control Project		Water Source Development & Conservation Project		Raw Water Supply Project	
	Allocation	Realization	Allocation	Realization	Allocation	Realization
1996/1997	21,128,841	8,234,024	7,161,257	6,956,324	5,210,147	5,205,387
1997/1998	20,903,308	8,080,109	3,137,309	2,986,313	11,042,967	11,039,432
1998/1999	43,384,725	25,713,950	10,742,070	10,669,398	16,413,856	4,454,778

Usually, *JRATUNSELUNA* does O&M services for two years after the construction of facilities. The same implementation unit will take in charge in the O&M stage. The budget allocated for the O&M of facilities is very small. It is not proper to show the budgets of previous years for the purpose of the study of the financial capacity

with the following reasons:

(a) Budget of *JRATUNSELUNA* is made on the project basis. Thus, the actual budget allocated for the facility cannot be estimated until the project is really started.

(b) The budget allocated for the O&M of facilities is very small. The amount of budget was decided with no reasonable calculation.

(c) Presently, the government system in Indonesia is changing drastically, such as restructuring of Ministries, decentralization of power, clean up of corruption, etc. *JRATUNSELUNA* is also planned to change in the near future.

In the construction stage, the implementation unit of *PPKSA* will take the Jatibarang Dam in charge, and the implementation unit of *PPSAPB* (*Proyek Pengembangan Sumber Air dan Pengendalian Banjir* or Water Sources Development and Flood Control) will take the West Floodway/Garang River Improvements in charge. It is presently planned that *PPSAPB* coordinates with Housing Facilities Improvement Project Office (*P2P*) under Directorate General of Human Settlement (*Directorat Jenderal Cipta Karya*) for the construction of Urban Drainage Facilities. No new organization is planned to be established for the Project Facilities.

(2) Water Resources Development Service of Central Java Province (*Dinas PU Pengairan*)

The present organization of the Water Resources Service is in a transition period, awaiting the promulgation and implementation of the new Regional Regulation on the organization and procedures of Central Java Province. The draft of this Regional Regulation has been approved by the Provincial Parliament but has still to wait for the numbering and the promulgation as well as the announcement in the Regional Gazette, which will take some longer time.

In the New Regional Regulation of Central Java Province on the Organization and Procedures for Water Resources Development Service, which is expected to be signed and promulgated by the end of July 1999, the following provisions are stipulated:

Status: Water Resources Development Service is an Implementation Element of the Provincial Government in the field of water resources development, led by a Head of

Service, being subordinated to and responsible to the Governor of the Province;

Tasks are as follows:

(a) Implementation of part of the Provincial Government services in the field of water resources development;

(b) Implementation of supporting tasks for the Provincial Government services in the field of water Resources development transferred to Provincial Government.

Functions are as follows:

(a) Formulation of development plan and management of technical policy, provision of guidance and licensing in the field of water resources development pursuant to the policy stipulated by the Governor;

(b) Implementation of development in the field of water resources development;

(c) Supervision and technical control of water resources development, operation and maintenance of water resources infrastructure and facilities, and activities of water sources' exploitation, monitoring and control;

(d) Guidance toward Water Resources Development Section of Public Works Service in the Regencies/Municipalities in the field of water resources development having technical and functional characteristics based on the policy stipulated by the Minister for Public Works;

(e) Management of Service administration; and

(f) Management of the Water Resources Management Units.

Organization: The Organization of Water Resources Development Service consists of Head of the Service, Administration Division, five Sub-Services, Water Resources Management Units, and Specialist Group. Refer to Fig. 10.2.2.

The budget of the Central Java Flood Disaster Re-construction Project is shown below for the reference of the annual budget for the operation and maintenance by the Service.

Budget of Central Java Flood Disaster Re-construction Project

Unit: Rp. 1,000

1995/1996	1996/1997	1997/1998	1998/1999
985,000	1,515,000	3,060,000	2,135,589

Pursuant to the newly promulgated Central Java Regional Regulation No. 11 Year 1999 on Organization and Procedure of the Public Works Water Resources Development Service of Central Java Province Level I Region, 'Branch Offices (*Cabang Dinas*)' will not exist in the organizational structure of the Service in Level I Region.

Nevertheless, in the Transitional Provision [Art. 66 Central Java Regional Regulation No. 11 Year 1999] it is provided that prior to the establishment of the Public Works Water Resources Development Service in Level II Regions, the handling of part of the Administration affairs in the field of Public Works Water Resources in the Level II Region will be executed by (old style) Branch Office.

Based on the Central Java Regional Regulation No. 8 Year 1988, such (old style) Branch Office is subordinated and accountable directly to the Head of the Water Resources Development Service in Level I Region.

Branch Offices (*Cabang Dinas*)

There were 29 Branch Offices under the Provincial Water Resources Development Service. Their job is now only irrigation. They are under the Public Works Service of Regencies/Municipalities following the implementation of the new Provincial Regulations on Water Resources Development Service.

The scope of working areas of the Branch Offices, which had been referring to the river basin unit beforehand, has been changed to the scope of administrative territory of the Regencies/Municipalities.

River Basin Water Resources Management Units (*Balai Pengelolaan Sumber Daya Air*)

The River Basin Water Resources Management Units have been established, which serves as Technical Implementation Units of Water Resources Development Service of Central Java Province within the region.

There are presently eight Units and later will be combined to seven. Their job is those related to more than one Regency/Municipality. On the other hand, jobs which are related to only one Regency/Municipality are transferred to the Regency/Municipality. For example, the management of Silandak River has been transferred to Semarang Municipality.

The tasks of the River Basin Water Resources Management Units are:

(a) Irrigation beyond one Regency/Municipality;

(b) Raw water supply for multifarious purposes (industry, harbor, clean water, hydro-electric power, water traffic, ponds, etc.);

(c) River;

(d) Reservoir, lake, natural pond (*situ*) and small reservoir (*embung*);

(e) Flood control and drought prevention;

(f) Swamp;

(g) Water pollution control;

(h) Coastal protection; and

(i) Estuary and delta.

To implement the above-mentioned tasks, the Water Resources Management Units have the following functions:

(a) Operation of the service provision to the public in the field of water resources;

(b) Operation, maintenance, repairs and constructions of water resources infra-structures;

(c) Operation water sources conservation ;

(d) Maintenance of surface water sources and water resources facilities; and

(e) Implementation of administrative technical services.

(3) Public Works Service of Semarang Municipality (*Dinas Pekerjaan Umum Kotamadya Semarang*)

Public Works Service of Semarang Municipality is characterized as follows:

Purpose: To enhance the execution of Government and development efficiently in

particular in the field of operation and maintenance of the construction of roads, bridges, and city channels.

Status: an implementation unit of the public works in the Municipality.

Tasks/Duties: Assisting the Head of Public Works Service in the execution of Government services in the field of the construction of roads, bridges, city channels, water supply facilities and buildings.

Functions are itemized as follows:

(a) Coordinates the implementation and maintenance of the construction of roads, bridges, city channels, water supply facilities and buildings owned by the Regional Government in its working area which are financed by the Level II Regional Budget Funds, Subsidy of Level I Budget and Subsidy of the National Budget;

(b) Reporting on the result of the implementation of the works in its working area to the Head of Public Works Service;

(c) Submitting technical considerations to the Head of Public Works Service; and

(d) Implementing other works provided by the Head of the Public Works Service.

The **Organization** of Public Works Service consists of the Head of the Service, Administration Sub-Service, and five Sections. Refer to Fig. 10.2.3.

The budget of the O&M for urban drainage is Rp. 1,062,394,000 in 1998/1999 and Rp. 991,000,000 in 1999/2000, which is categorized as Project Budget.

(4) Other Related Authorities

Other related authorities concerning water resources development are summarized as follows:

Other Related Authorities Concerning Water Resources Development

Abbreviation	Indonesian Name	English Trans.	Main Tasks & Responsibilities
DGWRD (MPW)	Direktorat Jenderal Pengairan	Directorate General of Water Resources Development (M. of Public Works)	Responsible for planning, development and management of water resources in the nation excluding ground water. Responsible for all river works and flood control in rural and urban areas and for drainage works in urban areas.
DPU Cipta Karya	Directorat Jenderal Cipta Karya, Dep. Pekerjaan Umum	Directorate General of Human Settlements (M. of Public Works)	Responsible for planning, development of human settlement in rural and urban areas.
DPE	Departemen Pertambangan dan Energi	Ministry of Mining and Energy	Gives technical advice to provincial government Gives approval of groundwater exploitation Overseas PT PLN activities in coordination with DGWRD which controls water licensing for hydro use.
DISTAMB	Dinas Pertambangan Daerah Propinsi Dati.I Jateng	Provincial Mining Service, Central Java	Determines the allocation and extraction schedules after getting approval of DPE
BAPEDAL	Badan Pengendalian Dampak Lingkungan	Environment Impact Management Agency	To assist the President in managing environmental impacts including prevention of and control over pollution and environmental damage To assist the President in rehabilitating environmental quality.
BAPEDALDA	BAPEDAL Daerah Propinsi Dati.I Jateng	Provincial Agency for Environment Impact Management	Responsible for monitoring inspecting and controlling quality of water, air and soil. Coordinating for environmental damages.
Dinas Penyehatan	Dinas Penyehatan TK I Jawa Tengah	Sanitation Services, Central Java	Responsible for clean water demand in Central Java Province
DDN	Departemen Dalam Negeri	Ministry of Home Affairs	Responsible for implementation of public services in Indonesia
PT PLN	Perseroan Terbatas Perusahaan Listrik Negara	State Electric Power Company	Responsible for power generation, transmission and distribution of electricity Responsible for planning, construction and operation of power supply facilities
PDAM Semarang	Perusahaan Daerah Air Minum	Regional Drinking Water Supply Company (Semarang)	Responsible for providing municipal and industrial water Surface water of the K. Garang is withdrawn for Semarang mainly groundwater is pumped up for other areas than these two.
Dam Safety Unit	Balai Keamanan Bendungan	Dam Safety Unit	Responsible for preventing negative impact of dams in Indonesia

10.3 Proposed Organizations and Cost for Operation and Maintenance

Usually, *JRATUNSELUNA* does O&M services for two years after the construction of facilities. The same implementation unit will take in charge of the O&M services. After

that, O&M responsibilities will be transferred to the Regional Government according to the Regional Regulation on the organization and procedures.

10.3.1 Proposed Organizations

According to the new Regional Regulation on the organization and procedures of Central Java Province, operation and maintenance of the river facilities are carried out by **Jragung-Tuntang West Water Resources Management Unit**, which is under the Head of Water Resources Development Service, Central Java Province. **West Floodway & Garang River Lower Reaches Operation & Maintenance Office** and **Simongan Weir Operation & Maintenance Management Office** are established in the Operational Management Section. Refer to Fig. 10.3.1.

Operation and maintenance staff for the proposed facilities are to be designated from the staff in the existing organizations including those in the Water Resource Development Service and Branch Office, which is transferred to the Level II Regional Government, in order to set up the new system as simple as possible. See the table below:

O&M Staff for West Floodway/Garang River

Assignment of Staff	Number	Original Organization
Section Chief/Eng.	1	Maintenance and Rehabilitation Sub-Section of the Unit (*Balai*)
Assistant Engineer	1	Maintenance and Rehabilitation Sub-Section of the Unit (*Balai*)
Legal Specialist	1/3	Branch Office (*Cabang Dinas*)
Clerk	1	Administration Sub-Division of the Unit (*Balai*)
Accountant	1	Administration Sub-Division of the Unit (*Balai*)
Computer Operator	1	Administration Sub-Division of the Unit (*Balai*)
Janitor	1	Administration Sub-Division of the Unit (*Balai*)
Site Manager	1	Maintenance and Rehabilitation Sub-Section of the Unit (*Balai*)
Mechanic	1	Equipment and Logistic Sub Division of the Service (*Dinas*)
Heavy Equipment Operator	2	Equipment and Logistic Sub Division of the Service (*Dinas*)
Driver	2	Administration Sub-Division of the Unit (*Balai*)
Worker	5	Administration Sub-Division of the Unit (*Balai*)

O&M Staff for Simongan Weir

Assignment of Staff	Number	Original Organization
Chief Civil Engineer	1	Maintenance and Rehabilitation Sub-Section of the Unit (*Balai*)
Electrical/Mechanical Engineer	1	Maintenance and Rehabilitation Sub-Section of the Unit (*Balai*)
Legal Specialist	1/3	Branch Office (*Cabang Dinas*)
Operator	2	Administration Sub-Division of the Unit (*Balai*)
Watchman/Janitor	1	Administration Sub-Division of the Unit (*Balai*)
Driver	1	Administration Sub-Division of the Unit (*Balai*)

A Legal Specialist should be added in the staff list (same as an Assistant Engineer level) for legal matters. The same Legal Specialist works for three offices such as West Floodway & Garang River Lower Reaches Operation & Maintenance Management Office, Simongan Weir Operation & Maintenance Management Office and Jatibarang Dam Operation & Maintenance Management Office. Many staff including legal specialists, however, belong to Branch Offices and they have been transferred to Level II Regional Governments as a result of the implementation of New Regional Autonomy Law. It is possible and there is an example of asking somebody in a Level II Regional Government to work for the job of Water Resources Development Service, Central Java Province.

10.3.2 Budgetary Arrangement

There are several financial sources for the O&M of proposed facilities. These are (1) Provincial budget, (2) subsidy from the Central Government and (3) charge/fee collected from those who make money utilizing the resources bestowed in the river basin.

Firstly, the Provincial Government should consider the possibility of tax increase if the budget is not enough to allocate to the O&M of proposed facilities. Especially, those who are living and/or running business in the area which is released from the periodical flood should bear the part of the cost.

Secondly, a subsidy from the Central Government budget should be considered from the viewpoint of balanced development in the Republic. It is transferred from the State Budget to the Region to assist financing special needs, observing the availability of funds in the State Budget.

Thirdly, increase of charge for sand mining, for example, should be increased with the competence of the river basin management body.

10.3.3 Preparation of Schedule and Budget

Annual Schedule

Annual implementation schedule for maintenance of facilities is prepared taking into consideration of the optimum distribution of both work items and work volume, and the selection of the effective time of work. The schedule is programmed based on the following considerations.

(1) The period and the time are determined carefully considering characteristics of the location of work, traffic condition and the work procedure at the site;

(2) Personnel, equipment and materials to be used are distributed properly and effectively through the year;

(3) Repairing is most important, and early implementation is required; and

(4) The maintenance/repair work is implemented with two procedures, temporary/short term base and long term base.

Based on the above, the example of yearly maintenance activity is drawn up as shown in Table 10.3.1. As the above maintenance works comprise part of the whole operation and maintenance work, further modification or adjustment will be required before the completion of the Project facilities.

Personnel in Charge of O&M for the Project

Personnel/staff stated in Tables 10.3.2 and 10.3.3 is proposed to be assigned to the O&M for the Project. The kind and number of personnel are determined based on the contents of O&M work and its volume.

Budget

This section deals with the annual O&M cost, replacement cost and budgetary arrangement for the Project. These cost, however, should be reviewed during the supervision stage based on the actual contract price and the prevailing Government regulations at that time.

(1) Annual O&M Cost

Annual O&M budget required for O&M works undertaken by the implementation bodies (West Floodway/Garang River Management and Simongan Weir O&M Management) is given by estimating the cost for personnel expense, office

consumables, running cost of maintenance equipment, operation & maintenance work for project facilities, maintenance dredging of river channel, survey and investigations, training of staff and so on.

The estimated budgets are presented in Tables 10.3.4 and 10.3.5, and summarized below.

Required Annual Operation & Maintenance Cost for West Floodway/Garang River

Description	Yearly Cost (Rp)
1. Salary for Staff	96,200,000
2. Office Consumable and Running Cost	59,000,000
3. Materials and Equipment Operation & Maintenance	54,000,000
4. Contractual Maintenance*	200,000,000
5. Training and Seminar	3,000,000
TOTAL	412,200,000

*: Above mentioned contractual maintenance work means estimated cost for maintenance dredging and some of the major repair works which may be carried out under the contract.

Required Annual Operation & Maintenance Cost for Simongan Weir

Description	Yearly Cost (Rp)
1. Salary for Staff	26,400,000
2. Office Maintenance & Running Cost	9,000,000
3. Maintenance Cost for Equipment/Tools	5,384,000
4. Repair Cost of Gate, Hoist, Electrical/Mechanical Equipment, Office Building and Civil Works	40,000,000
TOTAL	80,784,000

(2) Replacement and Other Cost

Since almost all facilities and equipment provided by the Project have the life of more than 30 to 40 years except for some items, replacement is basically not necessary.

Items which are subject to replacement or painting are tabulated below together with quantity and cost.

Replacement and Other Cost

Item	Period of Renewal	Quantity	Cost (Rp)	Annual Cost (Rp)
Simongan Weir				
- Replacement of Watertight Rubber	10 years	250 kg	35,000,000	3,500,000
- Painting of Gate	7 years	2,760 m^2	350,000,000	50,000,000
- Painting of Hoist	10 years	680 m^2	85,000,000	8,500,000
- Painting Other Steel	12 years	50 m^2	5,000,000	420,000
- Use of Temporary gate	5 years	3 + 2 = 6	17,000,000	3,400,000
- Other Spare Parts	15 years		30,000,000	2,000,000
Drainage Sluiceway				
- Replacement of Watertight Rubber	10 years	12 kg	2,000,000	200,000
- Painting of Gate & Hoist	7 years	10 m^2	1,200,000	172,000
- Other Spare Parts	15 year		1,000,000	70,000
Drainage Outlet				
- Replacement of Gate	20 years	20 gates	300,000,000	15,000,000
Heavy Equipment				
Total Annual Cost (Converted)				83,262,000

TABLES

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Table 10.3.1 ANNUAL SCHEDULE FOR MAINTENANCE

Maintenance Works	Apr.	May	Jun	Jul	Aug	Sep.	Oct.	Nov	Dec.	Jan.	Feb.	Mar.
1. River Channel												
1) Short Term (Removal of obstacles, Floating trees, grass, garbage, etc.)	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪ Dry Season	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪ Rainy Season	▪▪▪▪	▪▪▪▪
2) Long Term (Maintenance dredging , Removal of sediment, land fill etc..)		▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒					
2. Dike and Floodwall												
1) Temporary Repair (Slope, weed, crack Smoothing of crown, Filling, etc)	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪
2) Long Term (Replacing of material, Sodding, work, Raising dike/floodwall		▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒					
3. Revetment and Groin												
1) Temporary Repair (Slope, Weed, Crack, Weep hole, Filling, Riprap, etc.)	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪
2) Long Term (Intensive rehabilitation, Replacement of materials, foundations and drain of backfill)		▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒					
4. Simongan Weir												
1) Temporary Repair (Removal of, obstacles, Removal of sediment weeds, and Cleaning of building)	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪
2) Short Term (Repainting of metal structure, Repair and replacement of structures and equipment.)		▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒					
3) Long Term (applied to serious cases in the above short term repair/replacement)		▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒					
5. Ground Sills												
1) Temporary Repair (Removal of obstacle Leveling of the scouring spot)	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪
2) Long Term (Removal of sediment, Intensive rehabilitation)		▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒					
6. Drainage Sluiceway and Outlets												
1) Temporary Repair (Sliding of gate, removal of sediment, weed and grass)	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪
2) Long Term (Intensive rehabilitation, Painting, Replacement)		▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒					
7. Others (River amenity facilities, Water level gauging station)												
1) Temporary Repair (Removal of obstacles, and sediment, Cleaning structures)	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪
2) Long Term (Intensive rehabilitation, Painting, Replacement)		▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒	▒▒▒▒					

LEGEND

▪▪▪▪▪▪▪▪▪▪ : To be implemented periodically.

▒▒▒▒▒▒▒▒▒▒ : To be implemented as required.

Table 10.3.2 STAFF OF THE O&M OFFICE FOR WEST FLOODWAY/GARANG RIVER

Assignment of Staff	Number	Tasks and Responsibility
- Section Chief/Eng.	1	Management and administration, O&M Planning
-Assistant Engineer	1	Assistance to the Section Chief
- Clerk	1	Office staff
- Accountant	1	- ditto -
- Computer Operator	1	- ditto -
- Janitor	1	- ditto -
- Site Manager	1	Site inspection, Supervision of O&M work
- Mechanic	1	Repair of mechanical/electrical equipment
- Heavy Equipment Operator	2	Operation of heavy equipment
- Driver	2	Driving a car
- Worker	5	Maintenance/Repair work at the site
- Seasonal Employee		Maintenance/Repair work at the site
Total	17	

Table 10.3.3 TASK AND RESPONSIBILITIES OF THE STAFF OF SIMONGAN WEIR OPERATION/MANAGEMENT OFFICE

Assignment of Staff	Number	Tasks and Responsibility	Remarks
Chief Civil Engineer	1	- Management and administration - Supervision of O&M works - Instructions to the Operator for periodical inspection, maintenance and repair - Request of budget	Periodical and emergency case (to be assigned for 6 months in a year)
Electrical/Mechanical Engineer	1	- Assistance to Chief/Civil Engineer - Supervision of Operator - Periodical inspection, maintenance and repair of electrical/mechanical equipment	Periodical and emergency case (to be assigned for 6 months in a year)
Operator	2 (2)	- Daily operation of sediment flush gates and intake gates - Operation of flood discharge gates in flooding event - Daily inspection, maintenance and repair of gate and hoist	Permanently stationed 2 persons (for flooding season 2 more persons are assigned to)
Watchman/Janitor	1	- Security guard for the office - Cleaning the office - Care for engineers and operator	Permanently stationed. (to be assigned 12 months in a year)
Driver	1	- Driving a car	Periodical and emergency case (4 months in a year)
Total	6 (8)		

Table 10.3.4 ANNUAL BUDGET REQUIRED FOR WEST FLOODWAY/GARANG RIVER OPERATION AND MAINTENANCE

Description	Unit / Number	Monthly Cost (Rp)	Yearly Cost (Rp)
1. Salary for Staff			
- Section Chief/ Civil Engineer	1	750,000	9,000,000
- Assistant Engineer	1	600,000	7,200,000
- Clerk	1	400,000	4,800,000
- Accountant	1	400,000	4,800,000
- Computer Operator	1	400,000	4,800,000
- Janitor	1	300,000	3,600,000
- Site Manager/Foreman	1	450,000	5,400,000
- Mechanic	1	450,000	5,400,000
- Heavy Equipment Operator	2	400,000	9,600,000
- Driver	2	350,000	8,400,000
- Worker	5	350,000	21,000,000
- Seasonal Employee	L.S.		5,000,000
Subtotal			89,000,000
2. Office Consumable and Running Cost			
- Electricity/Water/Gas	L.S.	500,000	6,000,000
- Communication	L.S.	300,000	3,600,000
- Office Consumable	L.S.	300,000	3,600,000
- Car Running Cost	2	500,000	12,000,000
- Heavy Equipment Running Cost	3	800,000	28,800,000
- Miscellaneous	L.S.		5,000,000
Subtotal			59,000,000
3. Materials and Equipment Operation & Maintenance			
- Construction Material	12	2,000,000	24,000,000
- Fuel and others	12	2,000,000	24,000,000
- Maintenance of Equipment	12	500,000	6,000,000
-			
Subtotal			54,000,000
4. Contractual Maintenance Maintenance Dredging, Repair works and Survey, etc.	L.S.		200,000,000
5. Training and Seminar	L.S.		3,000,000
TOTAL			405,000,000

Table 10.3.5 ANNUAL BUDGET REQUIRED FOR SIMONGAN WEIR OPERATION AND MAINTENANCE

Description		Unit	Yearly Quantity	Unit Cost (Rp)	Yearly Cost (Rp)
1. Salary for Staff					
- Chief/ Civil Engineer	1 x 6 = 6	M/M	6	600,000	3,600,000
- Electrical/Mechanical Eng.	1 x 6 = 6	M/M	6	450,000	2,700,000
- Operator	2 x12 +12 = 36	M/M	36	400,000	14,400,000
- Watchman/Janitor	1 x 12 = 12	M/M	12	300,000	3,600,000
- Driver	1 x 6 = 6	M/M	6	350,000	2,100,000
Subtotal					26,400,000
2. Office Maintenance & Running Cost					
- Computer		month	12	200,000	2,400,000
- Car (with fuel and oil)		month	12	350,000	4,200,000
- Others		month	12	200,000	2,400,000
Subtotal					9,000,000
3. Maintenance Cost for Equipment/Tools					
- Electricity Basic Charge (25 kva)		kva	300	5,000	1,500,000
- Electricity KWH Charge (2kw x 12h/day)		kwh	8640	100	864,000
- Fuel (Generator) (180 ltr/day x 5 days)		ltr	900	800	720,000
- Telephone		L.S.	-	-	800,000
- Stationary		L.S.	-	-	1,000,000
- Others		L.S.	-	-	500,000
Subtotal					5,384,000
4. Repair Cost of Gate, Hoist, Electrical/ Mechanical Equipment, Office building and Civil works					
- Electrical/Mechanical Equipment		L.S.	-	-	20,000,000
- Civil/Architectural Works		L.S.	-	-	20,000,000
Subtotal					40,000,000
TOTAL					80,784,000

FIGURES

CHAPTER 10

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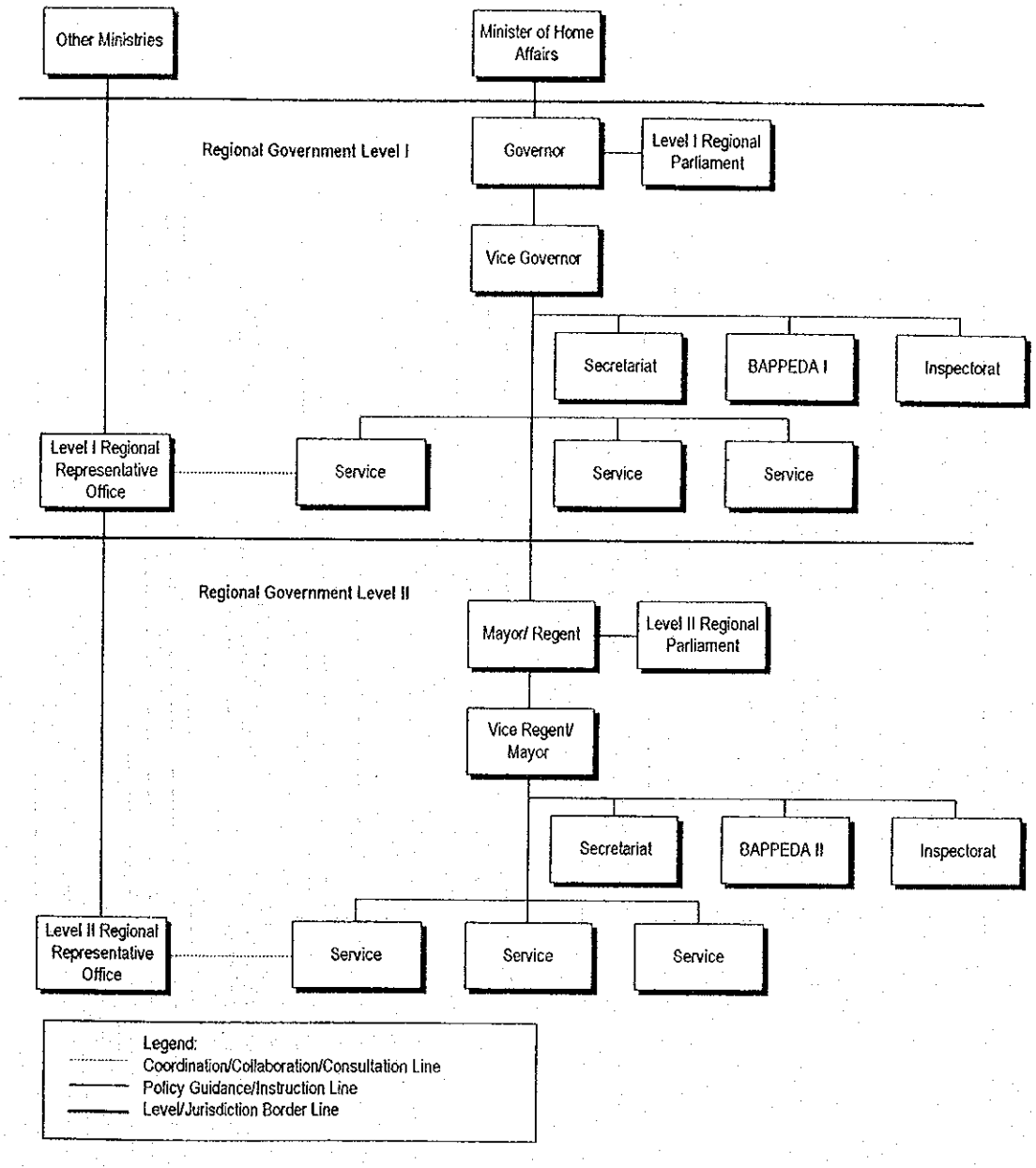
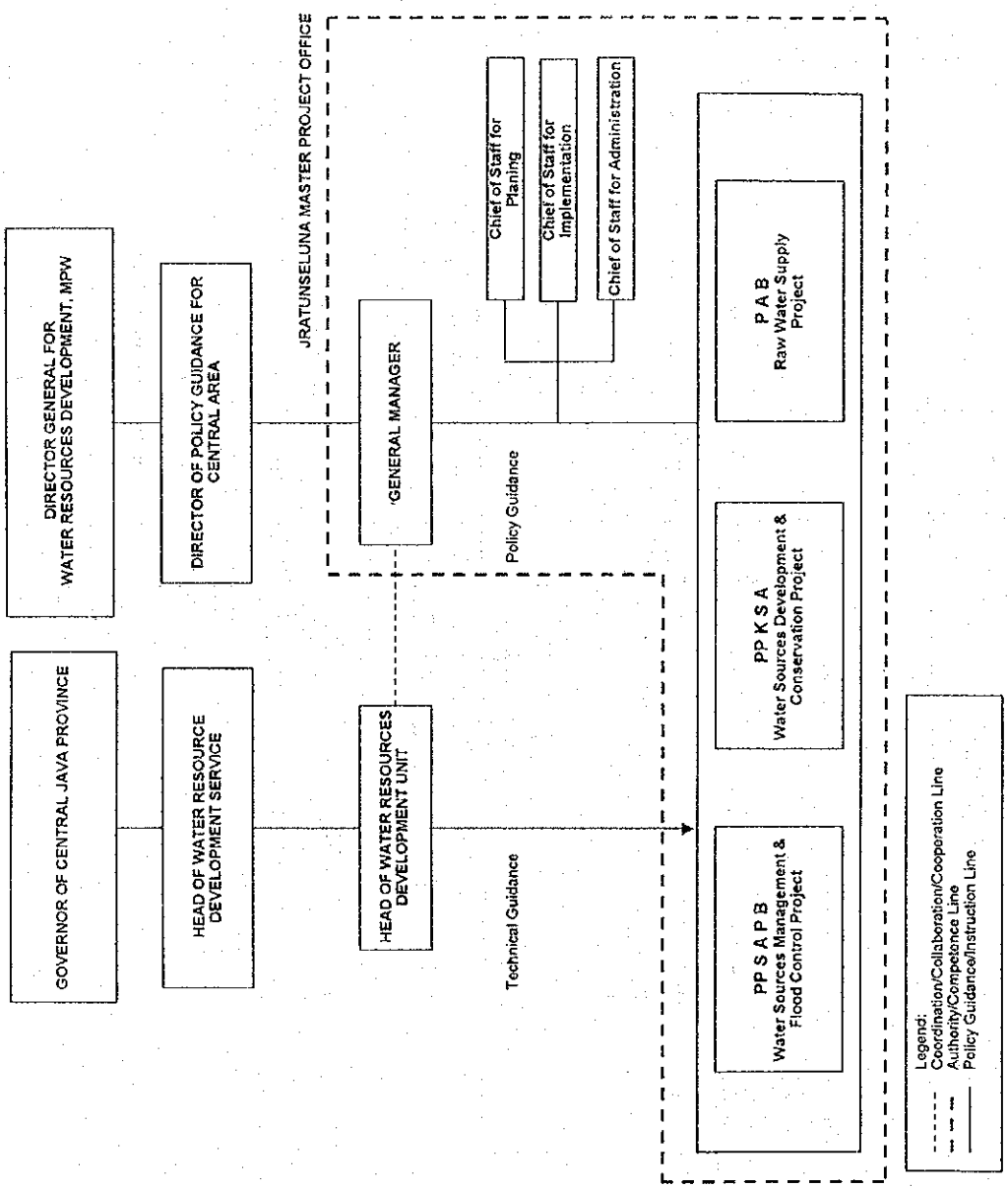
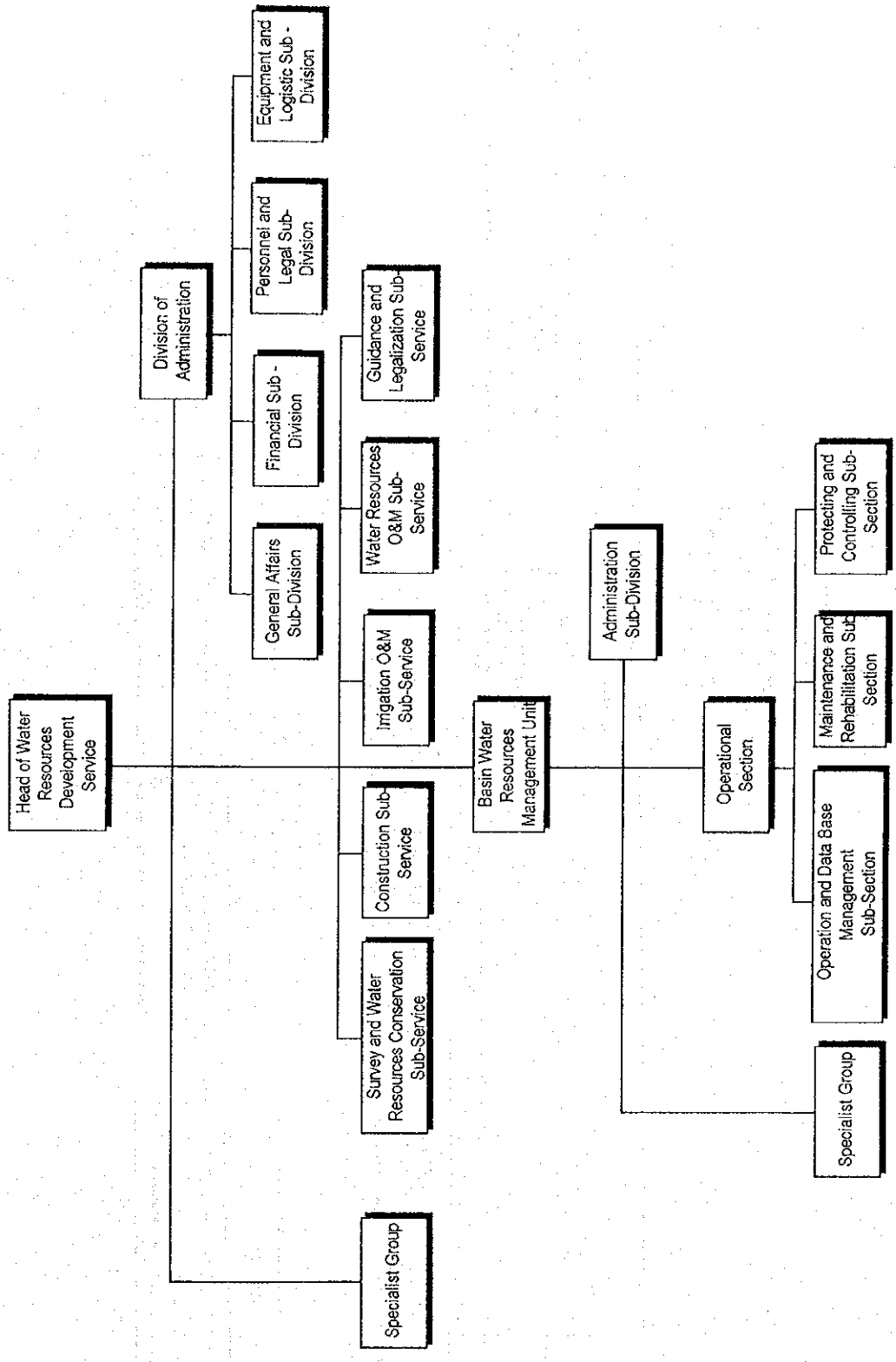


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 10.1.1 THE STRUCTURE OF THE REGIONAL GOVERNMENTS
JAPAN INTERNATIONAL COOPERATION AGENCY	



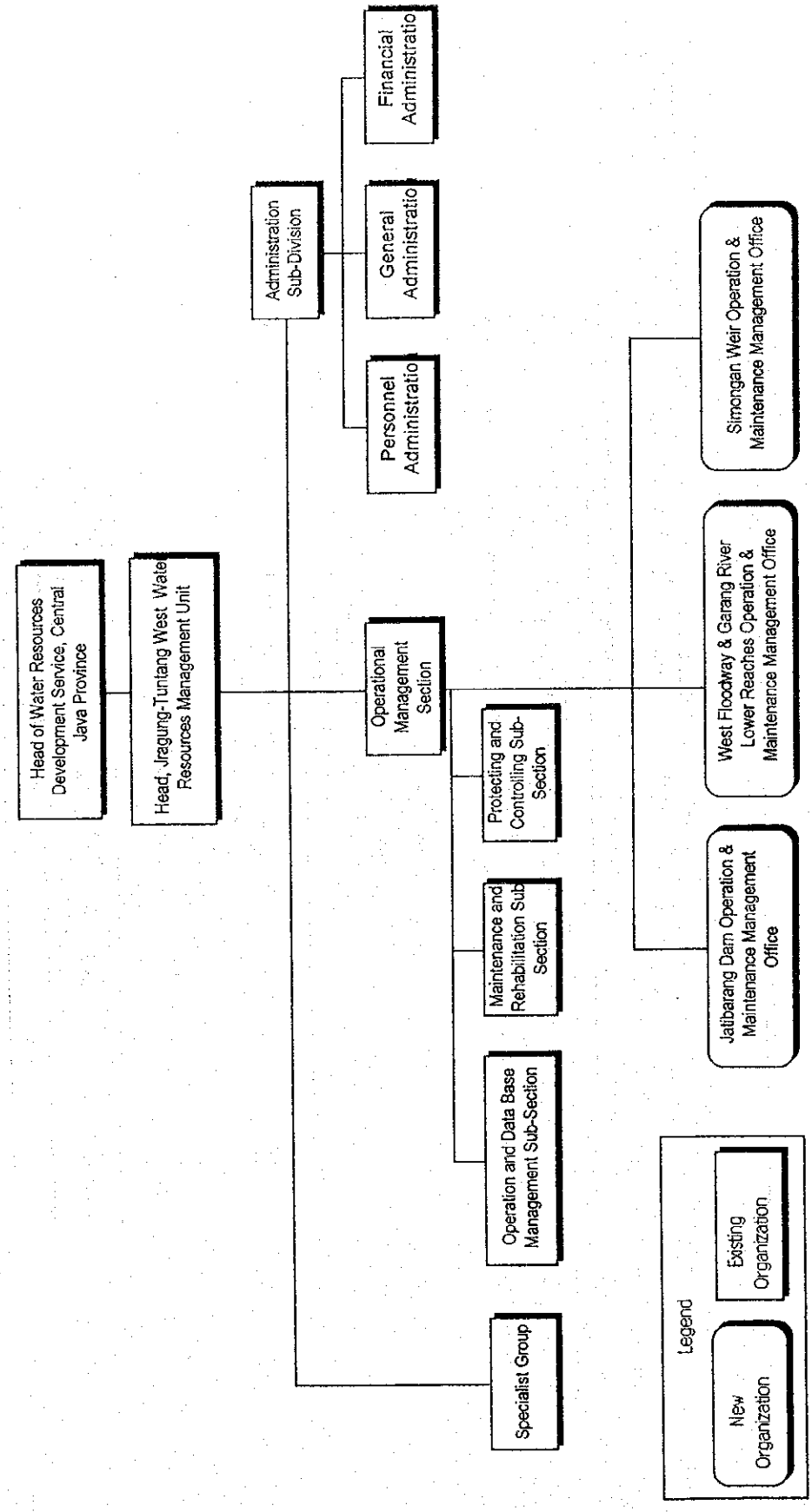
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 10.2.1 ORGANIZATION OF JRATUNSELUNA MASTER PROJECT OFFICE AND IT'S RELATED AUTHORITIES
JAPAN INTERNATIONAL COOPERATION AGENCY	



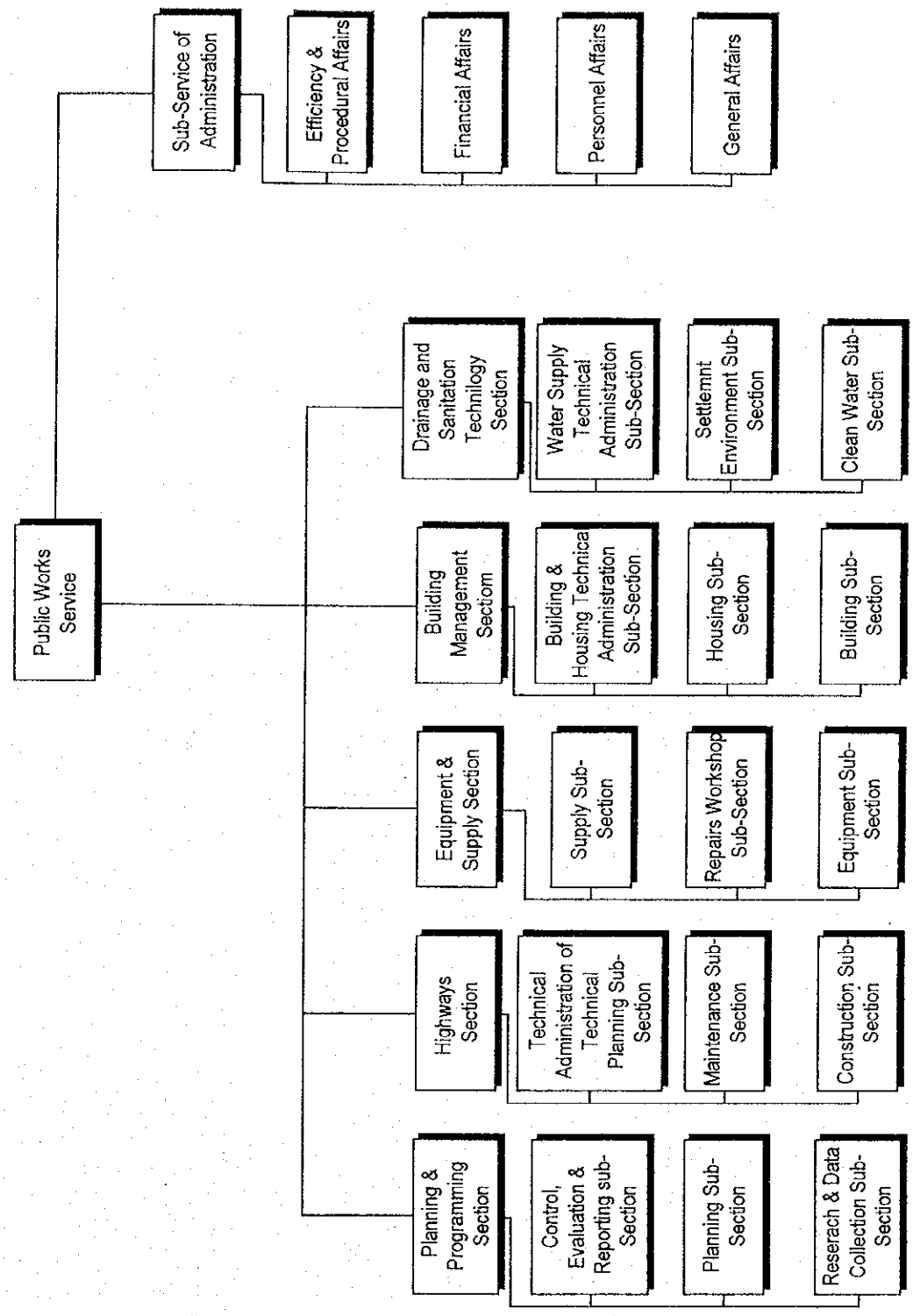
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 10.2.2
WATER RESOURCES DEVELOPMENT SERVICE OF CENTRAL JAVA PROVINCE



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 10.2.3 THE ORGANIZATION OF PUBLIC WORKS SERVICE
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 10.3.1
PROPOSED ORGANIZATIONS