

The alternative plan for deepening the river channel will include excavation of the riverbed, construction of groundsill and reconstruction of Simongan Weir as its major work items. The excavation will be made principally on the downstream of about 1.2 km in length where the proposed riverbed level will be set at EL. 2.5 m to 1.5 m below the existing riverbed level (refer to Fig. V.5.5). Groundsill with a head of 1.5 m will be constructed at the upward end of the excavation section, and the riverbed level upstream of the groundsill will be maintained to almost the same level as the present riverbed.

The bottom elevation of Simongan Weir is lowered by the excavation work from EL. 4.0 m to EL. 1.5 m, and the fixed weir will be reconstructed into a fully movable gate weir with the following structural features:

|                       |   |           |
|-----------------------|---|-----------|
| Gate Crest Elevation  | : | El. 5.6 m |
| Gate Bottom Elevation | : | El. 1.5 m |
| Entire Weir Width     | : | 80.8 m    |

(4) Alternative 2B (Embankment of Garang River)

River improvement of Garang River is now being implemented principally by means of embankment. In due consideration of the lower construction cost, continuation of the ongoing embankment works is selected as one of the alternative river improvement plans.

The alternative plan will include the necessary reinforcement works for the completed embankment portion and the reconstruction of Simongan Weir. Since major excavation work is not included in this plan, the existing riverbed level is

maintained as it is, and the bottom elevation of the reconstructed Simongan Weir is set at EL. 4.0 m which is the same as the present elevation. The fixed weir is therefore assumed as the appropriate structural type of the reconstructed weir considering that the design high water level is hardly lowered, if ever the structural type is changed from the present fixed weir to the fully movable gate (refer to Fig. V.5.5). The fixed weir type will also have the advantages of easier operation/maintenance and lower construction cost than the movable gate type. The following are adopted as the major structural features of the reconstructed fixed weir which are the same as the present:

|                        |   |           |
|------------------------|---|-----------|
| Fixed Weir Crest Elev. | : | El. 5.6 m |
| Weir Bottom Elev.      | : | El. 4.0 m |
| Fixed Weir Width       | : | 63.8 m    |
| Movable Gate Width     | : | 13.0 m    |

#### 5.4 Optimum Plan

##### Optimum Plan for West Floodway

The principal river improvement measure of Alternative 1B is the embankment work which will elevate the existing dike crown level and require reconstruction of the existing three (3) bridges. Furthermore, since the design high water level of Alternative 1B tends to be fairly higher than the hinterland ground level, a particular facility to check the reverse flow is required at the outlet point of the drainage channel connected to the floodway. As a result, Alternative 1B takes a remarkably higher project cost compared with Alternative 1A (Excavation Plan) as estimated below (refer to SECTOR XII, PROJECT COST ESTIMATE):

|                      |   |                              |
|----------------------|---|------------------------------|
| Alt. 1A (Excavation) | : | 11,158 x 10 <sup>6</sup> Rp. |
| Alt. 1B (Embankment) | : | 20,876 x 10 <sup>6</sup> Rp. |

In addition to the above disadvantage on project cost, Alternative 1B has another disadvantage in such that the design high water is set higher than that of Alternative 1A, with a higher flood damage potential.

In due consideration of these disadvantages, Alternative 1B is not considered, and instead, Alternative 1A is preferred as the optimum river improvement plan for West Floodway. The longitudinal profile, typical cross-sections and alignment proposed for the optimum plan are as shown in Table V.5.1, Figs. V.5.6 and V.5.7.

#### Optimum Plan for Garang River

The project cost of Alternative 2B is lower than that of Alternative 2A. However, the difference in cost is limited to 2,600 million Rp. which corresponds to only 8% of the entire project cost for Alternative 2B estimated as follows (refer to SECTOR XII, PROJECT COST ESTIMATE):

|                      |   |                              |
|----------------------|---|------------------------------|
| Alt. 2A (Excavation) | : | 33,891 x 10 <sup>6</sup> Rp. |
| Alt. 2B (Embankment) | : | 31,307 x 10 <sup>6</sup> Rp. |

The design high water level of Alternative 2B tends to be much higher than the hinterland ground level. Accordingly, when an extraordinary flood over the design flood of 25-year return period occurs, the dike may be destroyed by channel overflow and the excessive flood discharge will surge out into the hinterland leading to a disastrous flood damage as experienced in the 1990 flood. On the other hand, Alternative 2A could lower the design high water level and minimize

the potential for flood damage caused by channel overflow.

In due consideration of these disadvantages/advantages, Alternative 2A is preferred as the optimum river improvement plan for Garang River. The longitudinal profile, typical cross-sections and alignment proposed for the optimum plan are as shown in Table V.5.2, Fig. V.5.6 and Fig. V.5.8.

## TABLES



Table V.2.1 (1/2) FLOOD AREA-DEPTH-DURATION  
IN JANUARY 1990 FLOOD

| River                      | Location of Flood  |            |                         | Max.<br>Flood<br>Area<br>(ha) | Max.<br>Flood<br>Depth<br>(m) | Flood<br>Dura-<br>tion<br>(hr) |
|----------------------------|--------------------|------------|-------------------------|-------------------------------|-------------------------------|--------------------------------|
|                            | Kelurahan/<br>Desa | Kecamatan  | Kotamadya/<br>Kabupaten |                               |                               |                                |
| Blorong                    | Sudipayung         | Pegandon   | Kendal                  | 37.0                          | 0.5                           | 24.0                           |
|                            | Dempelrejo         | Pegandon   | Kendal                  | 35.0                          | 0.5                           | 24.0                           |
|                            | Candiroto          | Kendal     | Kendal                  | 72.0                          | 0.5                           | 27.0                           |
|                            | Trompo             | Kendal     | Kendal                  | 21.0                          | 0.4                           | 27.0                           |
|                            | Kebondalem         | Kendal     | Kendal                  | 98.0                          | 0.5                           | 30.0                           |
|                            | Ketapang           | Kendal     | Kendal                  | 14.0                          | 0.5                           | 32.0                           |
|                            | Banyutowo          | Kendal     | Kendal                  | 186.0                         | 0.5                           | 30.0                           |
|                            | Karangsari         | Kendal     | Kendal                  | 123.0                         | 0.5                           | 24.0                           |
| West<br>Floodway           | Bongsari           | S. Barat   | Semarang                | 10.0                          | 2.0                           | 2.5                            |
|                            | Panjang            | S. Barat   | Semarang                | 20.0                          | 3.0                           | 3.0                            |
|                            | N. Simongan        | S. Barat   | Semarang                | 30.0                          | 3.0                           | 3.0                            |
|                            | Kroboan            | S. Barat   | Semarang                | 40.0                          | 3.0                           | 3.0                            |
|                            | Cabean             | S. Barat   | Semarang                | 20.0                          | 3.0                           | 3.0                            |
|                            | Tambkrejo          | S. Barat   | Semarang                | 25.0                          | 3.0                           | 3.0                            |
| Garang                     | Karangkumpul       | S. Selatan | Semarang                | 0.3                           | 1.3                           | 3.0                            |
|                            | S. Pasar           | S. Selatan | Semarang                | 1500.0                        | 2.3                           | 2.5                            |
|                            | Pegandon           | S. Selatan | Semarang                | 20.0                          | 2.8                           | 3.5                            |
|                            | Sampang            | S. Selatan | Semarang                | 2.0                           | 3.0                           | 4.5                            |
|                            | Karang Kumpul      | S. Selatan | Semarang                | 2.0                           | 2.0                           | 4.5                            |
| East<br>Floodway           | Gayamsari          | S. Timur   | Semarang                | 7.5                           | 0.8                           | 9.0                            |
|                            | P. Kidul           | S. Timur   | Semarang                | 8.0                           | No Record                     | No Record                      |
|                            | Gemah              | S. Timur   | Semarang                | 8.0                           | -ditto-                       | -ditto-                        |
|                            | Senoane Guwo       | S. Timur   | Semarang                | 5.0                           | -ditto-                       | -ditto-                        |
|                            | Gayamsari          | S. Timur   | Semarang                | 3.0                           | -ditto-                       | -ditto-                        |
|                            | Lamoer Tengah      | S. Timur   | Semarang                | 2.0                           | -ditto-                       | -ditto-                        |
|                            | Sambirejo          | Genuk      | Semarang                | 6.0                           | -ditto-                       | -ditto-                        |
|                            | Bangetayu          | Genuk      | Semarang                | 12.0                          | -ditto-                       | -ditto-                        |
| East<br>Floodway/<br>Babon | Tambakrejo         | Genuk      | Semarang                | No Record                     | 1.2                           | 5.0                            |
|                            | Muktiharjo         | Genuk      | Semarang                | -ditto-                       | 1.2                           | 21.0                           |
| Babon                      | Sambirejo          | Genuk      | Semarang                | -ditto-                       | 0.8                           | 21.0                           |
|                            | Trimulyo           | Genuk      | Semarang                | -ditto-                       | 1.0                           | 19.0                           |
|                            | Banjardowo         | Genuk      | Semarang                | -ditto-                       | 1.0                           | 19.0                           |
|                            | Karangroto         | Genuk      | Semarang                | -ditto-                       | 0.0                           | 18.0                           |
|                            | Gebangsari         | Genuk      | Semarang                | -ditto-                       | 1.0                           | 18.0                           |
|                            | Tlogosari          | Genuk      | Semarang                | -ditto-                       | 0.4                           | 19.0                           |
|                            | Tlogomulyo         | Genuk      | Semarang                | -ditto-                       | 0.3                           | 9.0                            |
|                            | Kudu               | Genuk      | Semarang                | -ditto-                       | 0.3                           | 7.0                            |

Note: The flood area-depth-duration for Bringin and Silandak Rivers could not be tabulated, since there does not exist any flood damage record.

Table V.2.1 (2/2) FLOOD AREA-DEPTH-DURATION  
IN JANUARY 1990 FLOOD

| River                            | Location of Flood  |           |                      | Flood Area (ha) | Flood Depth (m) | Flood Duration (hr) |
|----------------------------------|--------------------|-----------|----------------------|-----------------|-----------------|---------------------|
|                                  | Kelurahan/ Desa    | Kecamatan | Kotamadya/ Kabupaten |                 |                 |                     |
| Babon                            | Sebungharjo        | Genuk     | Semarang             | -ditto-         | 0.3             | 12.0                |
|                                  | Bangetayu          | Genuk     | Semarang             | -ditto-         | 0.4             | 13.0                |
|                                  | Penggaron          | Genuk     | Semarang             | -ditto-         | 0.4             | 8.0                 |
|                                  | Penggaron          | Genuk     | Semarang             | 15.0            | 0.4             | 4.0                 |
|                                  | Piamongansari      | Genuk     | Semarang             | 35.0            | 0.6             | 5.0                 |
|                                  | Karangroto         | Genuk     | Semarang             | 55.0            | 0.6             | 5.0                 |
|                                  | Jamus              | Mranggen  | Demak                | 50.0            | 0.4             | 5.0                 |
|                                  | Wringinjajar Manur | Mranggen  | Demak                | 10.0            | 0.5             | 5.0                 |
|                                  |                    |           |                      | 25.0            | 0.6             | 5.0                 |
| Drainage Channel/ Storm Rainfall | Mangkang Kulon     | S. Tugu   | Semarang             | 9.0             | 0.8             | 7.0                 |
|                                  | Randu Garut        | S. Tugu   | Semarang             | 5.0             | 0.8             | 5.0                 |
|                                  | Lamper Kidul       | S. Timur  | Semarang             | 1.5             | 0.5             | 8.0                 |
|                                  | Lamper Lor         | S. Timur  | Semarang             | 4.5             | 1.2             | 13.0                |
|                                  | Bandanharjo        | S. Utra   | Semarang             | 50.0            | 0.7             | 13.0                |
|                                  | Mlatiharjo         | S. Utra   | Semarang             | 8.0             | 0.6             | 14.0                |
|                                  | Purwodinate        | S. Utra   | Semarang             | 24.0            | 0.5             | 14.0                |
|                                  | Ketonagung         | S. Utra   | Semarang             | 4.0             | 0.5             | 14.0                |
|                                  | Tamanharjo         | S. Utra   | Semarang             | 42.0            | 0.4             | 14.0                |
|                                  | Bugangan           | S. Utra   | Semarang             | 50.0            | 0.5             | 14.0                |
|                                  | Magersari          | S. Barat  | Semarang             | 40.0            | 3.0             | 3.0                 |
|                                  | Karangayu          | S. Barat  | Semarang             | 50.0            | 0.3             | 3.0                 |
|                                  | T. Komplek         | S. Barat  | Semarang             | 15.0            | 0.3             | 3.0                 |
|                                  | Demangan           | S. Barat  | Semarang             | 15.0            | 0.3             | 2.5                 |



Table V.2.2 (1/2) LATEST RIVER IMPROVEMENT WORKS

| Description                | Blorong River                         | Bringin River                         | Silandak River                         | Garang River                          |
|----------------------------|---------------------------------------|---------------------------------------|--|---------------------------------------|
| 1. Catchment Area          | 157.0 km <sup>2</sup>                 | 32.1 km <sup>2</sup>                  | 8.5 km <sup>2</sup>                    | 204.0 km <sup>2</sup>                 |
| 2. Protected River Stretch |                                       |                                       |  |                                       |
| (1) Length                 | 15.0 km                               | 5.5 km                                | 2.9 km                                 | 4.3 km                                |
| (2) Downstream Point       | River Mouth                           | River Mouth                           | River Mouth                            | Simongan                              |
| (3) Upstream Point         | Pengilon Weir                         | Concrete Bridge                       | Junction of Sianker River              | Junction of Kreo River                |
| 3. Design Scale            |                                       |                                       |  |                                       |
| (1) Design Return Period   | 20-year                               | 5-year                                | 50-year                                | 100-year                              |
| (2) Design Discharge       | 435.0 m <sup>3</sup> /s               | 195.0                                 | 91.5 m <sup>3</sup> /s                 | 1,100.0 m <sup>3</sup> /s             |
| (3) Specific Discharge     | 2.8 m <sup>3</sup> /s/km <sup>2</sup> | 6.1 m <sup>3</sup> /s/km <sup>2</sup> | 10.8 m <sup>3</sup> /s/km <sup>2</sup> | 5.4 m <sup>3</sup> /s/km <sup>2</sup> |
| 4. Flood Control Measures  |                                       |                                       |  |                                       |
| (1) Embankment             | Adopted                               | Adopted                               | Not adopted                            | Adopted                               |
| (2) Widening/Dredging      | Adopted                               | Adopted                               | Not adopted                            | Adopted                               |
| (3) Short Cut              | Adopted                               | Not adopted                           | Adopted                                | Not adopted                           |
| (4) Floodway               | Not adopted                           | Not adopted                           | Adopted                                | Not adopted                           |
| (5) Others                 | Not adopted                           | Not adopted                           | Not adopted                            | Not adopted                           |
| 5. Completion/Target Year  | 1985<br>(Designed)                    | 1991<br>(Designed)                    | 1991<br>(Completed)                    | 1992<br>(On-going)                    |
| 6. Implemented/Proposed by | See Note 1                            | See Note 2                            | See Note 3                             | See Note 4                            |

Note 1 : West Semarang Irrigation Project, Drainage and River Improvement

Note 2 : Central Jawa River Improvement and Maintenance Project

Note 3 : Central Jawa River Improvement and Maintenance Project

Note 4 : Central Jawa River Improvement and Maintenance Project

Table V.2.2 (2/2) LATEST RIVER IMPROVEMENT WORKS

| Description                | East Floodway                          | Babon River                           | Babon River                           |
|----------------------------|--|---------------------------------------|---------------------------------------|
| 1. Catchment Area          | 29.7 km <sup>2</sup>                   | 77.0 km <sup>2</sup>                  | 77.0 km <sup>2</sup>                  |
| 2. Protected River Stretch |  |                                       |                                       |
| (1) Length                 | 12.0 km                                | 17.4 km                               | 17.4 km                               |
| (2) Downstream Point       | River Mouth                            | River Mouth                           | River Mouth                           |
| (3) Upstream Point         | Pucang Gading Weir                     | Pucang Gading Weir                    | Pucang Gading Weir                    |
| 3. Design Scale            |  |                                       |                                       |
| (1) Design Return Period   | 25-year                                | 5-year                                | 25-year                               |
| (2) Design Discharge       | 333.0 m <sup>3</sup> /s                | 320.0 m <sup>3</sup> /s               | 460.0 m <sup>3</sup> /s               |
| (3) Specific Discharge     | 11.2 m <sup>3</sup> /s/km <sup>2</sup> | 4.2 m <sup>3</sup> /s/km <sup>2</sup> | 6.0 m <sup>3</sup> /s/km <sup>2</sup> |
| 4. Flood Control Measures  |  |                                       |                                       |
| (1) Embankment             | Not adopted                            | Adopted                               | Not adopted                           |
| (2) Widening/Dredging      | Not adopted                            | Adopted                               | Not adopted                           |
| (3) Short Cut              | Not adopted                            | Not adopted                           | Not adopted                           |
| (4) Floodway               | Not adopted                            | Not adopted                           | Adopted                               |
| (5) Others                 | See Note 1                             | Not adopted                           | Not adopted                           |
| 5. Completion/Target Year  | 2000<br>(Designed)                     | 1991<br>(Completed)                   | 2000<br>(Designed)                    |
| 6. Implemented/Proposed by | See Note 2                             | See Note 3                            | See Note 4                            |

Note 1 : The present diversion structure from Babon River to East Floodway is proposed to be closed not to divert the flood discharge from upper reaches of Babon River into the Floodway, and thereby the present flow capacity of the Floodway could accommodate the flood scale of 25-year return period.

Note 2 : Jratunseluna Project

Note 3 : Central Jawa River Improvement and Maintenance Project

Note 4 : Jratunseluna Project

Table V.3.1 DESIGN SCALE OF FLOOD CONTROL WORKS  
ADOPTED IN INDONESIA

| No.   | Name of River | Province          | Catch-<br>Ment<br>Area<br>(km <sup>2</sup> ) | Design<br>Flood<br>(m <sup>3</sup> /s) | Return<br>Period<br>(Year) | Remarks     |
|---|---------------|-------------------|--|--|----------------------------|-------------|
| <u>Rivers located within the limits of Study Area</u> |               |                   |  |  |                            |             |
| 1.  | Blorong       | Central Jawa      | 157.0  | 435                                    | 20                         | Completed   |
| 2.  | Silandak      | Central Jawa      | 8.5  | 92                                     | 50                         | Completed   |
| 3.  | Babon         | Central Jawa      | 77.0   | 320                                    | 5                          | Completed   |
|   |               |                   |  | 460                                    | 25                         | On-going    |
| 4.  | East Floodway | Central Jawa      | 29.7   | 333                                    | 25                         | On-going    |
| <u>Rivers located beyond the limits of Study Area</u> |               |                   |  |  |                            |             |
| 5.  | Cimanuk       | West Jawa         | 3,006.0                                      | 1,440                                  | 25                         |             |
| 6.  | Serang        | Central Jawa      | 937.0  | 900                                    | 25                         |             |
| 7.  | Citandui      | West Jawa         | 3,680.0                                      | 1,900                                  | 25                         |             |
| 8.  | Ular          | North Sumatra     | 1,080.0                                      | 800                                    | 30                         |             |
| 9.  | Pemali        | Central Jawa      | 1,228.0                                      | 1,300                                  | 25                         |             |
| 10.   | Cipanas       | West Jawa         | 220.0  | 385                                    | 25                         |             |
| 11.   | Solo          | Central/East Jawa | 3,320.0                                      | 1,500                                  | 10                         | Urgent Plan |
|   |               |                   |  | 2,000                                  | 40                         |             |
| 12.   | Madiun        | East Jawa         | 2,400.0                                      | 1,100                                  | 10                         | Urgent Plan |
|   |               |                   |  | 2,300                                  | 40                         |             |
| 13.   | Wanpu         | North Sumatra     | 3,840.0                                      | 1,320                                  | 20                         |             |
| 14.   | Arakundo      | Aceh              | 5,495.0                                      | 2,100                                  | 50                         |             |
| 15.   | Krung Aceh    | Aceh              | 1,775.0                                      | 1,960                                  | 50                         |             |
| 16.   | Brantas       | East Jawa         | 10,000.0                                     | 1,350                                  | 10                         | Urgent Plan |
|   |               |                   |  | 1,500                                  | 50                         |             |
| 17.   | Bah Bolon     | North Sumatra     | 2,776.0                                      | 1,200                                  | 20                         |             |
| 18.   | Walanae       | South Sulawesi    | 3,190.0                                      | 2,900                                  | 20                         |             |
| 19.   | Bila          | South Sulawesi    | 1,368.0                                      | 1,900                                  | 20                         |             |
| 20.   | Jeneberang    | South Sulawesi    | 729.0  | 3,700                                  | 50                         |             |
| 21.   | Ciujung       | North Banten      | 1,850.0                                      | 1,100                                  | 10                         | Urgent Plan |
|   |               |                   |  | 1,600                                  | 50                         |             |
| 22.   | Kuranji       | West Sumatra      | 213.0  | 870                                    | 25                         | Urgent Plan |
|   |               |                   |  | 1,000                                  | 50                         |             |
| 23.   | Air Dingin    | West Sumatra      | 131.0  | 600                                    | 25                         | Urgent Plan |
|   |               |                   |  | 700                                    | 50                         |             |
| 24.   | Marmoyo       | East Jawa         | 290.0  | 230                                    | 20                         |             |
| 25.   | Surabaya      | East Jawa         | 631.0  | 370                                    | 50                         |             |

Table V.3.2 DESIGN SCALE ADOPTED TO FLOOD CONTROL MASTER PLAN

| Objective River | Status*<br>of<br>Land<br>Use<br>in<br>2015 | Recurrence<br>Probability of<br>Present Channel<br>Overflow | Design Scale Adopted<br>to the Latest Flood<br>Control Project |                  | Design Scale<br>for<br>Master Plan |
|-----------------|--|---|--|------------------|------------------------------------|
|                 |  | Return<br>Period<br>(year)                                  | Return<br>Period<br>(year)                                     | Work<br>Progress | Return<br>Period<br>(year)         |
| Blorong River   | C  | less than 2   | 20   | Designed         | 20                                 |
| Bringin River   | B  | 1.01 - 2  | 5  | Proposed         | 50                                 |
| Silandak River  | A  | 1.01 - 20   | 50   | Completed        | 100                                |
| Garang River    | A  | 5 - 100   | 100  | On-going         | 100                                |
| West Floodway   | A  | 10 - 25   | -  | -                | 100                                |
| East Floodway   | A  | 1.01 - 100  | 25   | Designed         | 100                                |
| Babon River     | B  | Less than 2   | 25   | Designed         | 50                                 |

Note: \*; Status A: The possible flood area is fully developed as the urban area.

Status B: A considerable part of the possible flood area is developed as the industrial area.

Status C: The possible flood area is mostly remained as the present paddy field and/or fishing pond.

Table V.3.3 (1/2) TYPICAL CROSS SECTIONS ASSUMED FOR MASTER PLAN STUDY

| Name of River            | Section      |            | River Bed Slope | Design Flood Discharge (m <sup>3</sup> /s) | Type of Cross Section | Low Water Channel |         | High Water Channel |         | Free-board (m) |
|--------------------------|--------------|------------|-----------------|--|-----------------------|-------------------|---------|--------------------|---------|----------------|
|                          | St. No.      | Length (m) |                 |  |                       | BL (m)            | HL (m)  | BH (m)             | HH (m)  |                |
| Blorong River            | 0.0 - 6.5 k  | 6,500      | 1/7,800         | 60.0                                       | Single                | 28                | 3.2     | -                  | -       | 0.6            |
|                          |              | 6,500      |                 | 100.0                                      | Single                | 32                | 3.2     | -                  | -       | 0.6            |
|                          |              | 6,500      |                 | 200.0                                      | Single                | 61                | 3.7     | -                  | -       | 0.8            |
|                          |              | 6,500      |                 | 300.0                                      | Single                | 76                | 4.3     | -                  | -       | 0.8            |
|                          |              | 6,500      |                 | 400.0                                      | Single                | 98                | 4.3     | -                  | -       | 0.8            |
|                          |              | 6,500      |                 | 500.0                                      | Single                | 120               | 4.3     | -                  | -       | 1.0            |
|                          | 6,500        | 630.0      | Single          | 150  | 4.3                   | -                 | -       | 1.0                |         |                |
|                          | 6.5 - 15.0 k | 7,500      | 1/1,270         | 60.0                                       | -                     | -                 | -       | -                  | -       | -              |
|                          |              | 7,500      |                 | 100.0                                      | -                     | -                 | -       | -                  | -       | -              |
|                          |              | 7,500      |                 | 200.0                                      | Compound              | 61                | 3.7     | -                  | -       | 0.8            |
|                          |              | 7,500      |                 | 300.0                                      | Compound              | 57                | 3.0     | 70                 | 2.2     | 0.8            |
|                          |              | 7,500      |                 | 400.0                                      | Compound              | 57                | 3.0     | 76                 | 2.1     | 0.8            |
|                          |              | 7,500      |                 | 500.0                                      | Compound              | 57                | 3.0     | 85                 | 2.3     | 1.0            |
|                          | 7,500        | 630.0      | Compound        | 57   | 3.0                   | 136               | 2.5     | 1.0                |         |                |
| Bringin                  | 0.0 - 4.5 k  | 4,782      | 1/1,900         | 120.0                                      | Single                | 58                | 2.0     | -                  | -       | 0.6            |
|                          |              |            |                 | 220.0                                      | Compound              | 58                | 2.2     | 85                 | 2.7     | 0.8            |
|                          |              |            |                 | 270.0                                      | Compound              | 58                | 2.2     | 159                | 2.7     | 0.8            |
|                          |              |            |                 | 320.0                                      | Compound              | 58                | 2.2     | 230                | 2.7     | 0.8            |
|                          | 4.5 - 5.0 k  | 258        | 1/360           | 120.0                                      | Single                | 26                | 3.0     | -                  | -       | 0.6            |
|                          |              |            |                 | 220.0                                      | Compound              | 30                | 3.0     | 37                 | 2.0     | 0.8            |
|                          |              |            |                 | 270.0                                      | Compound              | 30                | 3.0     | 48                 | 2.0     | 0.8            |
|                          |              |            |                 | 320.0                                      | Compound              | 30                | 3.0     | 68                 | 2.0     | 0.8            |
| Silandak                 | 0.0 - 2.8 k  | 2,800      | 1/1,680         | 130.0                                      | Single                | 48                | 2.5     | -                  | -       | 0.6            |
|                          | 2.8 - 5.3 k  | 2,510      | 1/390           | 130.0                                      | Single                | 22                | 2.8     | -                  | -       | 0.6            |
| West Floodway/<br>Garang | 0.0 - 0.5 k  | 500        | 1/2,630         | 630.0                                      | Single                | 166-277           | 2.6     | -                  | -       | 1.0            |
|                          |              |            |                 | 770.0                                      | Single                | 180-337           | 2.6     | -                  | -       | 1.0            |
|                          |              |            |                 | 850.0                                      | Single                | 210-372           | 2.6     | -                  | -       | 1.0            |
|                          |              |            |                 | 900.0                                      | Single                | 230-393           | 2.6     | -                  | -       | 1.0            |
|                          |              |            |                 | 980.0                                      | Single                | 263-427           | 2.6     | -                  | -       | 1.0            |
|                          | 0.5 - 2.6 k  | 2,100      | 1/2,630         | 630.0                                      | Compound              | 120               | 1.3     | 17                 | 2.6-3.2 | 1.0            |
|                          |              |            |                 | 770.0                                      | Compound              | 120               | 1.3     | 45                 | 2.6-3.3 | 1.0            |
|                          |              |            |                 | 850.0                                      | Compound              | 120               | 1.3     | 67                 | 2.6-3.3 | 1.0            |
|                          |              |            |                 | 900.0                                      | Compound              | 120               | 1.3     | 84                 | 2.6-3.3 | 1.0            |
|                          |              |            |                 | 980.0                                      | Compound              | 120               | 1.3     | 111                | 2.6-3.3 | 1.0            |
|                          | 2.6 - 3.3 k  | 700        | 1/2,630         | 630.0                                      | Compound              | 60-112            | 1.3-1.9 | 17                 | 2.8-3.3 | 1.0            |
|                          |              |            |                 | 770.0                                      | Compound              | 60-112            | 1.3-1.9 | 30-43              | 2.9-3.3 | 1.0            |
|                          |              |            |                 | 850.0                                      | Compound              | 60-112            | 1.3-1.9 | 38-63              | 2.9-3.3 | 1.0            |
|                          |              |            |                 | 900.0                                      | Compound              | 60-112            | 1.3-1.9 | 46-79              | 2.9-3.3 | 1.0            |
|                          |              |            |                 | 980.0                                      | Compound              | 60-112            | 1.3-1.9 | 60-104             | 2.9-3.3 | 1.0            |
|                          | 3.3 - 5.3 k  | 2,000      | 1/2,630         | 630.0                                      | Compound              | 60                | 2.0     | 16                 | 2.9-3.8 | 1.0            |
|                          |              |            |                 | 770.0                                      | Compound              | 60                | 2.0     | 30                 | 2.9-4.1 | 1.0            |
|                          |              |            |                 | 850.0                                      | Compound              | 60                | 2.0     | 36                 | 2.9-4.3 | 1.0            |
|                          |              |            |                 | 900.0                                      | Compound              | 60                | 2.0     | 44                 | 2.9-4.3 | 1.0            |
|                          |              |            |                 | 980.0                                      | Compound              | 60                | 2.0     | 56                 | 2.9-4.3 | 1.0            |
|                          | 5.3 - 5.8 k  | 500        | 1/1,250         | 630.0                                      | Single                | 67                | 4.7     | -                  | -       | 1.0            |
|                          |              |            |                 | 770.0                                      | Single                | 80                | 5.0     | -                  | -       | 1.0            |
|                          |              |            |                 | 850.0                                      | Single                | 89                | 5.2     | -                  | -       | 1.0            |
|                          |              |            |                 | 900.0                                      | Single                | 94                | 5.4     | -                  | -       | 1.0            |
|                          |              |            |                 | 980.0                                      | Single                | 102               | 5.6     | -                  | -       | 1.0            |
|                          | 5.8 - 9.5 k  | 3,700      | 1/1,250         | 630.0                                      | Compound              | 60                | 3.5     | 13                 | 4.7     | 1.0            |
|                          |              |            |                 | 770.0                                      | Compound              | 60                | 3.5     | 36                 | 5.1     | 1.0            |
|                          |              |            |                 | 850.0                                      | Compound              | 60                | 3.5     | 44                 | 5.2     | 1.0            |
| 900.0                    |              |            |                 | Compound                                   | 60                    | 3.5               | 60      | 5.4                | 1.0     |                |
| 980.0                    |              |            |                 | Compound                                   | 60                    | 3.5               | 84      | 5.5                | 1.0     |                |

Note: BL = Upper width of low water channel  
 HL = Depth of low water channel  
 BH = Total width of high water channels on left and right bank  
 HH = Depth of high water channel

Table V.3.3 (2/2) TYPICAL CROSS SECTIONS ASSUMED FOR MASTER PLAN STUDY

| Name of River | Section      |            | River Bed Slope | Design Flood Discharge (m <sup>3</sup> /s) | Type of Cross Section | Low Water Channel |         | High Water Channel |         | Free-board (m) |
|---------------|--------------|------------|-----------------|--|-----------------------|-------------------|---------|--------------------|---------|----------------|
|               | St. No.      | Length (m) |                 |  |                       | BL (m)            | HL (m)  | BH (m)             | HH (m)  |                |
| East Floodway | 0.0 - 2.2 k  | 2,200      | 1/7,800         | 330.0                                      | Compound              | 72-150            | 1.6-2.5 | 8-47               | 1.8     | 0.8            |
|               | 2.2 - 6.4 k  | 4,200      | 1/7,800         | 330.0                                      | Single                | 80                | 3.6-4.4 | -                  | -       | 0.8            |
|               | 6.4 - 7.6 k  | 1,200      | 1/1,250         | 330.0                                      | Compound              | 30                | 2.6     | 14                 | 2.3-2.9 | 0.8            |
|               | 7.6 - 12.0 k | 4,400      | 1/1,250         | 330.0                                      | Compound              | 25                | 2.3     | 10                 | 4.5-4.9 | 0.8            |
| Babon         | 0.0 - 3.2 k  | 3,200      | 1/8,080         | 150.0                                      | Single                | 45-53             | 1.4-3.4 | -                  | -       | 0.6            |
|               |              |            |                 | 200.0                                      | Single                | 60-68             | 1.4-3.4 | -                  | -       | 0.8            |
|               |              |            |                 | 300.0                                      | Single                | 91-99             | 1.4-3.3 | -                  | -       | 0.8            |
|               |              |            |                 | 430.0                                      | Single                | 129-136           | 1.4-3.3 | -                  | -       | 0.8            |
|               | 3.2 - 5.8 k  | 2,600      | 1/8,080         | 150.0                                      | Single                | 33-53             | 3.4-3.9 | -                  | -       | 0.6            |
|               |              |            |                 | 200.0                                      | Single                | 40-68             | 3.4-3.9 | -                  | -       | 0.8            |
|               |              |            |                 | 300.0                                      | Single                | 58-99             | 3.3-3.8 | -                  | -       | 0.8            |
|               |              |            |                 | 430.0                                      | Single                | 79-136            | 3.3-3.8 | -                  | -       | 0.8            |
|               | 5.8 - 17.4 k | 11,600     | 1/780           | 150.0                                      | Single                | 29-33             | 3.6-4.5 | -                  | -       | 0.6            |
|               |              |            |                 | 200.0                                      | Single                | 33                | 4.2-4.7 | -                  | -       | 0.8            |
|               |              |            |                 | 300.0                                      | Compound              | 31                | 3.8     | 5                  | 1.2-1.7 | 0.8            |
|               |              |            |                 | 430.0                                      | Compound              | 31                | 3.8     | 11                 | 2.0-2.4 | 0.8            |

Note: BL = Upper width of low water channel  
 HL = Depth of low water channel  
 BH = Total width of high water channels on left and right bank  
 HH = Depth of high water channel

Table V.3.4 RELATIONSHIP OF DAM STORAGE VOLUME AND DAM OUTFLOW DISCHARGE

| Name of Dam  | Surcharge Water Level (El.m) | Normal Water Level (El.m) | Effective Storage Volume (Mill. m3) | Max. Dam Inflow Discharge (m3/s) | Max. Dam Outflow Discharge (m3/s) | Max. Downstream Reference Point Discharge (m3/s) |
|--------------|------------------------------|---------------------------|-------------------------------------|----------------------------------|-----------------------------------|--|
| Kedung Suren | 70.2                         | 69.7                      | 3.93                                | 582                              | 378                               | 402  |
|              | 70.4                         | 69.7                      | 5.83                                | 582                              | 276                               | 293  |
|              | 70.6                         | 69.7                      | 7.73                                | 582                              | 194                               | 206  |
|              | 70.8                         | 69.7                      | 9.63                                | 582                              | 128                               | 135  |
|              | 70.9                         | 69.7                      | 10.58                               | 582                              | 99                                | 100  |
|              | 71.0                         | 69.7                      | 11.53                               | 582                              | 73                                | 77   |
|              | 71.2                         | 69.7                      | 13.43                               | 582                              | 34                                | 60   |
|              | 71.4                         | 69.7                      | 15.32                               | 582                              | 0                                 | 57   |
| Jatibaran    | 157.0                        | 156.0                     | 1.14                                | 340                              | 284                               | 968  |
|              | 157.0                        | 155.0                     | 2.28                                | 340                              | 208                               | 845  |
|              | 157.0                        | 154.0                     | 3.25                                | 340                              | 148                               | 802  |
|              | 157.0                        | 153.0                     | 4.33                                | 340                              | 102                               | 770  |
|              | 157.0                        | 152.0                     | 5.21                                | 340                              | 63                                | 749  |
|              | 157.0                        | 151.0                     | 6.18                                | 340                              | 32                                | 736  |
|              | 157.0                        | 150.0                     | 7.03                                | 340                              | 14                                | 731  |
|              | 157.0                        | 149.2                     | 7.93                                | 340                              | 0                                 | 728  |
| Mundingan    | 225.0                        | 224.6                     | 0.91                                | 230                              | 178                               | 875  |
|              | 225.2                        | 224.6                     | 1.48                                | 230                              | 134                               | 831  |
|              | 225.4                        | 224.6                     | 2.06                                | 230                              | 99                                | 811  |
|              | 225.6                        | 224.6                     | 2.63                                | 230                              | 71                                | 789  |
|              | 225.8                        | 224.6                     | 3.20                                | 230                              | 47                                | 779  |
|              | 226.0                        | 224.6                     | 3.77                                | 230                              | 27                                | 772  |
|              | 226.2                        | 224.6                     | 4.34                                | 230                              | 13                                | 768  |
|              | 226.5                        | 224.6                     | 5.13                                | 230                              | 0                                 | 766  |
| Babon Dam    | 70.0                         | 69.4                      | 2.08                                | 414                              | 276                               | 184*   |
|              | 70.2                         | 69.4                      | 2.95                                | 414                              | 205                               | 132*   |
|              | 70.4                         | 69.4                      | 3.83                                | 414                              | 149                               | 86*  |
|              | 70.6                         | 69.4                      | 4.70                                | 414                              | 105                               | 81*  |
|              | 70.8                         | 69.4                      | 5.58                                | 414                              | 72                                | 78*  |
|              | 71.0                         | 69.4                      | 6.45                                | 414                              | 43                                | 75*  |
|              | 71.2                         | 69.4                      | 7.33                                | 414                              | 21                                | 69*  |
|              | 71.4                         | 69.4                      | 8.20                                | 414                              | 6                                 | 67*  |
| 71.5         | 69.4                         | 8.55                      | 414                                 | 0                                | 66*                               |  |

Note: \* ; Discharge at downstream reference point for Babon Dam is estimated on the premises of the diversion discharge of 210 m3/s into the proposed floodway located upstream from reference point.

Table V.3.5 (1/5) COMPARISON OF ALTERNATIVE FLOOD CONTROL PLANS  
(BLORONG RIVER)

| Item                                   | Blorong River<br>Alternative A-1 | Blorong River<br>Alternative A-2 (1) | Blorong River<br>Alternative A-2 (2) | Blorong River<br>Alternative A-2 (3) | Blorong River<br>Alternative A-2 (4) | Blorong River<br>Alternative A-2 (5) |
|--|----------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| <b>1. Blorong River Improvement</b>    |                                  |                                      |                                      |                                      |                                      |                                      |
| Design Discharge (m <sup>3</sup> /s)   | 630                              | 500                                  | 400                                  | 300                                  | 100                                  | 60                                   |
| Improved River Length (m)              | 15,000                           | 15,000                               | 15,000                               | 15,000                               | 6,500                                | 6,500                                |
| Improvement Cost (Mill.Rp.)            | 100,044                          | 63,392                               | 49,182                               | 37,559                               | 7,742                                | 7,146                                |
| Annual OMR Cost (Mill.Rp.)             | 354                              | 241                                  | 196                                  | 162                                  | 58                                   | 57                                   |
| Land Acquisition (ha)                  | 135.9                            | 75.1                                 | 52.6                                 | 29.9                                 | 0.0                                  | 0.0                                  |
| House Evacuation (pc)                  | 452                              | 250                                  | 175                                  | 99                                   | 0                                    | 0                                    |
| <b>2. Kedung Suren Dam</b>             |                                  |                                      |                                      |                                      |                                      |                                      |
| Normal Water Level (El. m)             | -                                | 69.70                                | 69.70                                | 69.70                                | 69.70                                | 69.70                                |
| Surcharge Water Level (El. m)          | -                                | 70.10                                | 70.20                                | 70.40                                | 70.09                                | 71.20                                |
| Flood Control Capacity (MCM)           | -                                | 3.16                                 | 3.93                                 | 5.83                                 | 10.58                                | 13.43                                |
| Allocated Dam Cost (Mill.Rp.)          | -                                | 70,296                               | 72,342                               | 75,840                               | 86,305                               | 91,160                               |
| Annual OMR Cost (Allocated) (Mill.Rp.) | -                                | 110                                  | 112                                  | 116                                  | 127                                  | 133                                  |
| Land Acquisition *1 (ha)               | -                                | 25.1                                 | 30.3                                 | 42.6                                 | 82.3                                 | 96.3                                 |
| House Evacuation *1 (pc)               | -                                | 32                                   | 32                                   | 32                                   | 32                                   | 32                                   |
| <b>3. Total</b>                        |                                  |                                      |                                      |                                      |                                      |                                      |
| Project Cost (Mill.Rp.)                | 100,044                          | 131,688                              | 121,524                              | 113,399                              | 94,047                               | 98,306                               |
| Annual OMR Cost (Mill.Rp.)             | 354                              | 351                                  | 308                                  | 278                                  | 185                                  | 190                                  |
| Net Present Value (Mill.Rp.)           | 78,017                           | 103,506                              | 94,021                               | 87,677                               | 72,435                               | 75,695                               |
| Land Acquisition (ha)                  | 135.9                            | 100.2                                | 82.9                                 | 72.5                                 | 82.3                                 | 96.3                                 |
| House Evacuation (pc)                  | 452                              | 282                                  | 207                                  | 131                                  | 32                                   | 32                                   |

Notes \*1 : To be submerged by the dam reservoir within range of elevations between the dam crest level and Normal Water Level.

\*2 : Calculated on the premises of construction period of 5 years, project life of 50 years and discount rate of 10%.



Table V.3.5 (2/5) COMPARISON OF ALTERNATIVE FLOOD CONTROL PLANS  
(BRINGIN RIVER/SILANDAK RIVER)

| Item                                | Bringin River<br>Alternative B-1 |        | Bringin River<br>Alternative B-2 (1) |          | Bringin River<br>Alternative B-2 (2) |          | Bringin River<br>Alternative B-2 (3) |          | Silandak River<br>Alternative C-1 |        |
|-------------------------------------|----------------------------------|--------|--------------------------------------|----------|--------------------------------------|----------|--------------------------------------|----------|-----------------------------------|--------|
|                                     |                                  |        |                                      |          |                                      |          |                                      |          |                                   |        |
| <b>1. Bringin River Improvement</b> |                                  |        |                                      |          |                                      |          |                                      |          |                                   |        |
| Design Discharge                    | (m <sup>3</sup> /s)              | 320    | 270                                  | 220      | 120                                  | 120      | 120                                  | 120      | 120                               | 120    |
| Improved River Length               | (m)                              | 5,040  | 5,040                                | 5,040    | 5,040                                | 5,040    | 5,040                                | 5,040    | 5,310                             | 5,310  |
| Improvement Cost                    | (Mill.Rp.)                       | 25,988 | 19,990                               | 15,523   | 9,636                                | 9,636    | 9,636                                | 9,636    | 11,329                            | 11,329 |
| Annual OMR Cost                     | (Mill.Rp.)                       | 214    | 170                                  | 133      | 79                                   | 79       | 79                                   | 79       | 133                               | 133    |
| Land Acquisition                    | (ha)                             | 33.2   | 33.2                                 | 33.2     | 18.3                                 | 18.3     | 18.3                                 | 18.3     | 10                                | 10     |
| House Evacuation                    | (pc)                             | 57     | 57                                   | 57       | 31                                   | 31       | 31                                   | 31       | 0                                 | 0      |
| <b>2. Bringin Floodway</b>          |                                  |        |                                      |          |                                      |          |                                      |          |                                   |        |
| Design Discharge                    | (m <sup>3</sup> /s)              | -      | 50                                   | 100      | 200                                  | 200      | 200                                  | 200      | -                                 | -      |
| Floodway Length                     | (m)                              | -      | 4,500                                | 4,500    | 4,500                                | 4,500    | 4,500                                | 4,500    | -                                 | -      |
| Floodway Width                      | (m)                              | -      | 12 to 23                             | 21 to 41 | 37 to 54                             | 37 to 54 | 37 to 54                             | 37 to 54 | -                                 | -      |
| Construction Cost                   | (Mill.Rp.)                       | -      | 21,753                               | 26,656   | 36,947                               | 36,947   | 36,947                               | 36,947   | -                                 | -      |
| Annual OMR Cost                     | (Mill.Rp.)                       | -      | 103                                  | 139      | 216                                  | 216      | 216                                  | 216      | -                                 | -      |
| Land Acquisition                    | (ha)                             | -      | 7.8                                  | 13.3     | 20.2                                 | 20.2     | 20.2                                 | 20.2     | -                                 | -      |
| House Evacuation                    | (pc)                             | -      | 14                                   | 23       | 34                                   | 34       | 34                                   | 34       | -                                 | -      |
| <b>3. Total</b>                     |                                  |        |                                      |          |                                      |          |                                      |          |                                   |        |
| Project Cost                        | (Mill.Rp.)                       | 25,988 | 41,743                               | 42,179   | 46,583                               | 46,583   | 46,583                               | 46,583   | 11,329                            | 11,329 |
| Annual OMR Cost                     | (Mill.Rp.)                       | 214    | 273                                  | 272      | 295                                  | 295      | 295                                  | 295      | 133                               | 133    |
| Net Present Value *1                | (Mill.Rp.)                       | 21,014 | 33,320                               | 33,644   | 37,124                               | 37,124   | 37,124                               | 37,124   | 8,751                             | 8,751  |
| Land Acquisition                    | (ha)                             | 33.2   | 41.0                                 | 46.5     | 38.5                                 | 38.5     | 38.5                                 | 38.5     | 10                                | 10     |
| House Evacuation                    | (pc)                             | 57     | 71                                   | 80       | 65                                   | 65       | 65                                   | 65       | 0                                 | 0      |

Note \*1 : Calculated on the premises of construction period of 5 years, project life of 50 years and discount rate of 10%.

Table V.3.5 (3/5) COMPARISON OF ALTERNATIVE FLOOD CONTROL PLANS  
(WEST FLOODWAY/GARANG RIVER WITH JATIBARANG DAM)

| Item                                | West Floodway/<br>Garang River<br>Alternative D-1 | West Floodway/<br>Garang River<br>Alternative D-2 (1) | West Floodway/<br>Garang River<br>Alternative D-2 (2) | West Floodway/<br>Garang River<br>Alternative D-2 (3) | West Floodway/<br>Garang River<br>Alternative D-2 (4) |
|-------------------------------------|---|---|---|---|---|
| <b>1. Garang River Improvement</b>  |   |   |   |   |   |
| Design Discharge                    | (m <sup>3</sup> /s)                               | 980   | 850   | 770   | 740   |
| Improved River Length               | (m)   | 4,250   | 4,250   | 4,250   | 4,250   |
| Improvement Cost                    | (Mill. Rp.)                                       | 72,870  | 53,066  | 47,634  | 43,849  |
| Annual OMR Cost                     | (Mill. Rp.)                                       | 243   | 209   | 189   | 174   |
| Land Acquisition                    | (ha)  | 15.1  | 0.3   | 0.0   | 0.0   |
| House Evacuation                    | (pc)  | 229   | 5   | 0   | 0   |
| <b>2. West Floodway Improvement</b> |   |   |   |   |   |
| Design Discharge                    | (m <sup>3</sup> /s)                               | 980   | 850   | 770   | 740   |
| Improved Floodway Length            | (m)   | 5,290   | 5,290   | 5,290   | 5,290   |
| River Width                         | (m)   | 117 to 428  | 96 to 372   | 90 to 337   | 88 to 324   |
| Improvement Cost                    | (Mill. Rp.)                                       | 55,819  | 36,066  | 14,006  | 13,537  |
| Annual OMR Cost                     | (Mill. Rp.)                                       | 151   | 127   | 64  | 62  |
| Land Acquisition                    | (ha)  | 26.8  | 8.5   | 0.0   | 0.0   |
| House Evacuation                    | (pc)  | 406   | 128   | 0   | 0   |
| <b>3. Jatibarang Dam</b>            |   |   |   |   |   |
| Normal Water Level                  | (m)   | -   | 155.04  | 153.00  | 151.29  |
| Surcharge Water Level               | (MCH)   | -   | 157.00  | 157.00  | 157.00  |
| Flood Control Capacity              | (MCH)   | -   | 1.77  | 2.23  | 4.33  |
| Allocated Dam Cost                  | (Mill. Rp.)                                       | -   | 19,560  | 20,295  | 23,413  |
| Annual OMR Cost (Allocated)         | (Mill. Rp.)                                       | -   | 46  | 46  | 50  |
| Land Acquisition *1                 | (ha)  | -   | 9.3   | 11.8  | 20.4  |
| House Evacuation *1                 | (pc)  | -   | 0   | 0   | 0   |
| <b>4. Total</b>                     |   |   |   |   |   |
| Project Cost                        | (Mill. Rp.)                                       | 128,689   | 109,427   | 85,053  | 83,147  |
| Annual OMR Cost                     | (Mill. Rp.)                                       | 394   | 382   | 303   | 289   |
| Net Present Value *2                | (Mill. Rp.)                                       | 99,979  | 85,302  | 66,339  | 64,808  |
| Land Acquisition                    | (ha)  | 41.9  | 20.5  | 20.4  | 26.7  |
| House Evacuation                    | (pc)  | 635   | 133   | 0   | 0   |

Notes \*1 : To be submerged by the dam reservoir within range of elevations between the dam crest level and Normal Water Level.  
\*2 : Calculated on the premises of construction period of 5 years, project life of 50 years and discount rate of 10%.

Table V.3.5 (4/5) COMPARISON OF ALTERNATIVE FLOOD CONTROL PLANS  
(WEST FLOODWAY/GARANG RIVER WITH MUNDINGAN DAM)

| Item                                | West Floodway/<br>Garang River<br>Alternative D-1 | West Floodway/<br>Garang River<br>Alternative D-3 (1) | West Floodway/<br>Garang River<br>Alternative D-3 (1) | West Floodway/<br>Garang River<br>Alternative D-3 (1) |
|-------------------------------------|---|---|---|---|
| <b>1. Garang River Improvement</b>  |   |   |   |   |
| Design Discharge                    | 980   | 900   | 850   | 770   |
| Improved River Length               | 4,250   | 4,250   | 4,250   | 4,250   |
| Improvement Cost                    | 72,870  | 60,542  | 53,066  | 47,634  |
| Annual OMR Cost                     | 243   | 222   | 209   | 189   |
| Land Acquisition                    | 15.1  | 5.6   | 0.3   | 0.0   |
| House Evacuation                    | 229   | 85  | 5   | 0   |
| <b>2. West Floodway Improvement</b> |   |   |   |   |
| Design Discharge                    | 980   | 900   | 850   | 770   |
| Improved Floodway Length            | 5,290   | 5,290   | 5,290   | 5,290   |
| Improvement Cost                    | 55,819  | 43,646  | 36,066  | 14,006  |
| Annual OMR Cost                     | 151   | 136   | 127   | 64  |
| Land Acquisition                    | 26.8  | 15.5  | 8.5   | 0.0   |
| House Evacuation                    | 406   | 236   | 128   | 0   |
| <b>3. Mundingan Dam</b>             |   |   |   |   |
| Normal Water Level                  | -   | 224.60  | 224.60  | 224.60  |
| Surcharge Water Level               | -   | 224.93  | 225.12  | 226.11  |
| Flood Control Capacity              | -   | 0.74  | 1.24  | 4.09  |
| Allocated Dam Cost                  | -   | 18,100  | 19,563  | 26,750  |
| Annual OMR Cost (Allocated)         | -   | 29  | 31  | 38  |
| Land Acquisition *1                 | -   | 3.8   | 6.2   | 19.7  |
| House Evacuation *1                 | -   | 16  | 20  | 20  |
| <b>4. Total</b>                     |   |   |   |   |
| Project Cost                        | 128,689   | 122,288   | 108,695   | 88,390  |
| Annual OMR Cost                     | 394   | 367   | 367   | 291   |
| Net Present Value                   | 99,979  | 95,064  | 84,555  | 68,796  |
| Land Acquisition                    | 41.9  | 24.9  | 15.0  | 19.7  |
| House Evacuation                    | 635   | 337   | 153   | 20  |

Notes \*1 : To be submerged by the dam reservoir within range of elevations between the dam crest level and Normal Water Level.  
\*2 : Calculated on the premises of construction period of 5 years, project life of 50 years and discount rate of 10%.

Table V.3.5 (5/5) COMPARISON OF ALTERNATIVE FLOOD CONTROL PLANS  
(EAST FLOODWAY/BABON RIVER)

| Item                              | East Floodway<br>Alternative E-1 | Babon River<br>Alternative F-1 | Babon River<br>Alternative F-2 (1) | Babon River<br>Alternative F-2 (2) | Babon River<br>Alternative F-2 (3) |
|-----------------------------------|----------------------------------|--------------------------------|------------------------------------|------------------------------------|------------------------------------|
| <b>1. Babon River Improvement</b> |                                  |                                |                                    |                                    |                                    |
| Design Discharge                  | 350                              | 420                            | 300                                | 200                                | 150                                |
| Improved River Length             | 12,000                           | 17,400                         | 17,400                             | 17,400                             | 17,400                             |
| Improvement Cost                  | (Mill. Rp.)                      | 52,854                         | 39,950                             | 29,362                             | 24,598                             |
| Annual OMR Cost                   | (Mill. Rp.)                      | 244                            | 210                                | 181                                | 168                                |
| Land Acquisition                  | (ha)                             | 66.0                           | 38.7                               | 18.0                               | 9.7                                |
| House Evacuation                  | (pc)                             | 289                            | 169                                | 78                                 | 43                                 |
| <b>2. Babon Floodway *1</b>       |                                  |                                |                                    |                                    |                                    |
| Design Discharge                  | -                                | 210                            | 210                                | 210                                | 210                                |
| Construction Length               | -                                | 18,300                         | 18,300                             | 18,300                             | 18,300                             |
| Construction Cost                 | (Mill. Rp.)                      | 46,022                         | 46,022                             | 46,022                             | 46,022                             |
| Annual OMR Cost                   | (Mill. Rp.)                      | 225                            | 225                                | 225                                | 225                                |
| Land Acquisition                  | (ha)                             | 277.0                          | 277.0                              | 277.0                              | 277.0                              |
| House Evacuation                  | (pc)                             | 125                            | 125                                | 125                                | 125                                |
| <b>3. Babon Dam</b>               |                                  |                                |                                    |                                    |                                    |
| Normal Water Level                | (El. m)                          | -                              | 69.40                              | 69.40                              | 69.40                              |
| Surcharge Water Level             | (El. m)                          | -                              | 69.72                              | 69.96                              | 70.13                              |
| Flood Control Capacity            | (MCM)                            | -                              | 1.10                               | 1.94                               | 2.65                               |
| Allocated Dam Cost                | (Mill. Rp.)                      | -                              | 67,298                             | 72,080                             | 75,298                             |
| Annual OMR Cost (Allocated)       | (Mill. Rp.)                      | -                              | 114                                | 121                                | 125                                |
| Land Acquisition *2               | (ha)                             | -                              | 6.0                                | 10.6                               | 13.8                               |
| House Evacuation *2               | (pc)                             | -                              | 16                                 | 27                                 | 29                                 |
| <b>4. Total</b>                   |                                  |                                |                                    |                                    |                                    |
| Project Cost                      | (Mill. Rp.)                      | 30,642                         | 153,270                            | 147,464                            | 145,918                            |
| Annual OMR Cost                   | (Mill. Rp.)                      | 180                            | 549                                | 527                                | 518                                |
| Net Present Value *3              | (Mill. Rp.)                      | 24,450                         | 119,565                            | 115,028                            | 113,801                            |
| Land Acquisition                  | (ha)                             | 1.1                            | 321.7                              | 305.6                              | 300.5                              |
| House Evacuation                  | (pc)                             | 40                             | 310                                | 230                                | 197                                |

Notes \*1 : Proposed by Jaturuseluna Project.

\*2 : To be submerged by the dam reservoir within range of elevations between the dam crest level and Normal Water Level.

\*3 : Calculated on the premises of construction period of 5 years, project life of 50 years and discount rate of 10%.

TABLE V.3.6 OPTIMUM PLAN FOR EACH OBJECTIVE RIVER

| Description                                      | Blorong River | Bringin River | Silandak River | West Floodway/<br>Garang River | East Floodway | Babon River |
|--|---------------|---------------|----------------|--------------------------------|---------------|-------------|
| <b>1. Entire Project</b>                         |               |               |                |                                |               |             |
| (1) Design Scale (year of R.P.)                  | 20            | 50            | 100            | 100                            | 100           | 50          |
| (2) Project Cost (Mill. Rp.)                     | 94,047        | 25,988        | 6,983          | 85,053                         | 30,642        | 98,876      |
| (3) Operation/Maintenance Cost (Mill. Rp./yr.)   | 185           | 214           | 50             | 303                            | 180           | 469         |
| (4) Land Acquisition Area (ha)                   | 82.3          | 33.3          | 10.0           | 20.4                           | 1.1           | 66.0        |
| (5) Number of House Evacuated (pc)               | 32            | 57            | 0              | 0                              | 40            | 289         |
| <b>2. River Improvement Portion</b>              |               |               |                |                                |               |             |
| (1) Standard Flood Discharge (m <sup>3</sup> /s) | 630           | 320           | 120            | 980                            | 350           | 630         |
| (2) Design Flood Discharge (m <sup>3</sup> /s)   | 100           | 320           | 120            | 770                            | 350           | 420         |
| (3) Improvement Length (km)                      | 6.5           | 5.0           | 5.3            | 9.5                            | 12.0          | 17.4        |
| (4) Improvement Cost (Mill. Rp.)                 | 7,742         | 25,988        | 6,983          | 61,640                         | 30,642        | 52,854      |
| (5) Operation/Maintenance Cost (Mill. Rp./yr.)   | 58            | 214           | 133            | 253                            | 180           | 244         |
| (6) Land Acquisition Area (ha)                   | 0.0           | 33.2          | 10.0           | 0.0                            | 1.1           | 66.0        |
| (7) Number of House Evacuated (pc)               | 0             | 57            | 0              | 0                              | 40            | 289         |
| <b>3. Flood Control Dam Portion</b>              |               |               |                |                                |               |             |
| (1) Name of Dam                                  | Kedung Suren  | -             | -              | Jatibarang                     | -             | -           |
| (2) Flood Storage Capacity (MCM)                 | 10.73         | -             | -              | 4.33                           | -             | -           |
| (3) Normal Water Level (NWL) (El. m)             | 69.7          | -             | -              | 153.0                          | -             | -           |
| (4) Surcharge Water Level (SWL) (El. m)          | 71.0          | -             | -              | 157.0                          | -             | -           |
| (5) Allocated Cost (Mill. Rp.)                   | 86,305        | -             | -              | 23,413                         | -             | -           |
| (6) Operation/Maintenance Cost (Mill. Rp./yr.)   | 127           | -             | -              | 50                             | -             | -           |
| (7) Land Acquisition Area (ha)                   | 82.3          | -             | -              | 20.4                           | -             | -           |
| (8) Number of House Evacuated (pc)               | 32            | -             | -              | 0                              | -             | -           |
| <b>4. Floodway Portion</b>                       |               |               |                |                                |               |             |
| (1) Design Flood Discharge (m <sup>3</sup> /s)   | -             | -             | -              | -                              | -             | 210         |
| (2) Construction Length (km)                     | -             | -             | -              | -                              | -             | 18.3        |
| (3) Project Cost (Mill. Rp.)                     | -             | -             | -              | -                              | -             | 46,022      |
| (4) Operation/Maintenance Cost (Mill. Rp./yr.)   | -             | -             | -              | -                              | -             | 225         |
| (5) Land Acquisition Area (ha)                   | -             | -             | -              | -                              | -             | 277         |
| (6) Number of House Evacuated (pc)               | -             | -             | -              | -                              | -             | 125         |

Table V.4.1 ALTERNATIVE SURCHARGE WATER LEVEL AND  
DAM CREST LEVEL

(DESIGN DISCHARGE FOR RIVER IMPROVEMENT = 770 m<sup>3</sup>/s FIXED)

| Surcharge<br>Water<br>Level<br>(SWL)<br>(EL. m) | Normal<br>Water<br>Level<br>(NWL)<br>(EL. m) | Flood<br>Control<br>Outlet<br>Width<br>(m) | Auxiliary<br>Spillway<br>Crest<br>Level<br>(EL. m) | Main<br>Spillway<br>Crest<br>Level<br>(EL. m) | Dam<br>Crest<br>Level<br>(EL. m) |
|---|--|--|--|---|----------------------------------|
| 165.00  | 161.93                                       | 12.30                                      | 166.19   | 167.99  | 169.99                           |
| 164.00  | 160.93                                       | 12.30                                      | 165.24   | 167.02  | 169.02                           |
| 163.00  | 159.92                                       | 12.30                                      | 164.25   | 166.03  | 168.03                           |
| 162.00  | 158.79                                       | 11.30                                      | 163.27   | 165.08  | 167.08                           |
| 161.00  | 157.66                                       | 10.50                                      | 162.28   | 164.11  | 166.11                           |
| 160.00  | 156.53                                       | 10.30                                      | 161.27   | 163.09  | 165.09                           |
| 159.00  | 155.53                                       | 10.30                                      | 160.32   | 162.12  | 164.12                           |
| 158.00  | 154.46                                       | 9.90                                       | 159.35   | 161.15  | 163.15                           |
| 157.00  | 153.31                                       | 9.10                                       | 158.37   | 160.20  | 162.20                           |
| 156.00  | 152.17                                       | 8.50                                       | 157.39   | 159.24  | 161.24                           |
| 155.00  | 151.02                                       | 8.40                                       | 156.37   | 158.22  | 160.22                           |

- Note :
- (1) Width of Auxiliary Spillway = 150 m
  - (2) Width of Main Spillway = 60 m
  - (3) Main Spillway Crest Level = Design Flood Water Level (DFWL)
  - (4) Dam Crest Elevation = DFWL + 2 m

Table V.4.2 ALTERNATIVE FLOOD CONTROL CAPACITY AND DESIGN FLOOD DISCHARGE

(DESIGN FLOOD WATER LEVEL = EL. 162 m FIXED)

| Surcharge Water Level (NWL) (El. m) | Normal Water Level (SWL) (El. m) | Flood Control Outlet Width (m) | Flood Control Capacity (MCM) | Auxiliary Spillway Crest Level (El. m) | Design Flood Water Level (DFWL) (El. m) | Design Flood Discharge at    |   |
|-------------------------------------|----------------------------------|--------------------------------|------------------------------|--|---|------------------------------|---|
|                                     |                                  |                                |                              |  |   | Dam Site (m <sup>3</sup> /s) | River Improvement Section (m <sup>3</sup> /s) |
| 158.57                              | 153.57                           | 2.30                           | 5.93                         | 159.96                                 | 162.00                                  | 39                           | 739   |
| 158.80                              | 155.30                           | 10.00                          | 4.33                         | 160.13                                 | 162.00                                  | 99                           | 770   |
| 159.17                              | 156.47                           | 21.60                          | 3.34                         | 160.39                                 | 162.00                                  | 145                          | 796   |
| 159.77                              | 157.97                           | 57.40                          | 2.23                         | 160.74                                 | 162.00                                  | 211                          | 849   |
| 160.15                              | 158.75                           | 94.20                          | 1.76                         | 160.97                                 | 162.00                                  | 242                          | 890   |

Note : (1) Width of Auxiliary Spillway = 150 m

(2) Width of Main Spillway = 60 m

Table V.4.3 COST OF ALTERNATIVE FLOOD CONTROL PLANS FOR WEST FLOODWAY/GARANG RIVER

| Item                                | Alt. 1 (1) | Alt. 1 (2) | Alt. 1 (3) | Alt. 1 (4) | Alt. 2  |
|-------------------------------------|------------|------------|------------|------------|---------|
| <b>1. Garang River Improvement</b>  |            |            |            |            |         |
| Design Discharge                    | 740        | 770        | 850        | 900        | 980     |
| Improved River Length               | 4,250      | 4,250      | 4,250      | 4,250      | 4,250   |
| Construction Cost                   | 43,849     | 47,622     | 53,066     | 60,542     | 72,870  |
| OMR Cost                            | 174        | 189        | 209        | 222        | 243     |
| Land Acquisition                    | 0.0        | 0.0        | 0.3        | 5.6        | 15.1    |
| House Evacuation                    | 0          | 0          | 5          | 85         | 229     |
| <b>2. West Floodway Improvement</b> |            |            |            |            |         |
| Design Discharge                    | 740        | 770        | 850        | 900        | 980     |
| Improved Floodway Length            | 5,290      | 5,290      | 5,290      | 5,290      | 5,290   |
| Construction Cost                   | 13,845     | 14,896     | 36,399     | 43,992     | 56,177  |
| OMR Cost                            | 63         | 68         | 128        | 138        | 152     |
| Land Acquisition                    | 0.0        | 0.0        | 8.5        | 15.5       | 26.8    |
| House Evacuation                    | 0          | 0          | 128        | 236        | 406     |
| <b>3. Jatibarang Dam</b>            |            |            |            |            |         |
| Dam Height                          | 81.000     | 81.000     | 81.000     | 81.000     | -       |
| Total Capacity                      | 27,640     | 27,830     | 29,120     | 29,610     | -       |
| Sediment Capacity                   | 6.800      | 6.800      | 6.800      | 6.800      | -       |
| Flood Control Capacity              | 5.880      | 4.330      | 2.220      | 1.760      | -       |
| Water Supply Capacity               | 14,960     | 16,700     | 20,100     | 21,050     | -       |
| Construction Cost                   | 31,343     | 28,349     | 22,079     | 20,394     | -       |
| OMR Cost                            | 57         | 51         | 40         | 37         | -       |
| Land Acquisition                    | 15.1       | 10.6       | 2.4        | 0.1        | -       |
| House Evacuation                    | 0          | 0          | 0          | 0          | -       |
| <b>4. Total</b>                     |            |            |            |            |         |
| Construction Cost                   | 89,037     | 90,867     | 111,544    | 124,928    | 129,047 |
| OMR Cost                            | 294        | 308        | 377        | 397        | 395     |
| Net Present Value                   | 69,305     | 70,778     | 86,877     | 97,146     | 100,257 |
| Land Acquisition                    | 15.1       | 10.6       | 11.2       | 21.2       | 41.9    |
| House Evacuation                    | 0          | 0          | 133        | 321        | 635     |

Notes \*1 : The difference in the compensation value between the multipurpose dam and the water supply dam.

\*2 : Total of Construction Cost & OMR Cost (Condition; Construction Period=5years, Project Life=50years, Discount Rate=10%)



Table V.5.1 (1/3) LONGITUDINAL PROFILE PROPOSED FOR  
THE OPTIMUM RIVER IMPROVEMENT PLAN  
(WEST FLOODWAY) (Unit: El. m)

| Sta. No.<br>(Distance<br>from River<br>Mouth in km) | Existing     |       |            |       | Proposed               |                       |                        |
|---|--------------|-------|------------|-------|------------------------|-----------------------|------------------------|
|   | Ground Level |       | Dike Level |       | Lowest<br>River<br>Bed | River<br>Bed<br>Level | Design<br>HWL<br>Level |
|   | Left         | Right | Left       | Right |                        |                       |                        |
| 0.000   | 1.44         | 0.14  | 1.98       | 1.64  | -2.01                  | -2.01                 | 0.60                   |
| 0.050   | 1.55         | 0.34  | 1.72       | 1.54  | -2.42                  | -1.99                 | 0.61                   |
| 0.100   | 1.54         | 0.50  | 1.66       | 1.26  | -2.15                  | -1.97                 | 0.62                   |
| 0.150   | 1.71         | 0.05  | 1.71       | 1.08  | -2.17                  | -1.95                 | 0.63                   |
| 0.200   | 1.76         | 0.26  | 1.76       | 1.18  | -2.42                  | -1.93                 | 0.65                   |
| 0.250   | 1.76         | 0.25  | 1.76       | 1.16  | -2.29                  | -1.91                 | 0.66                   |
| 0.300   | 1.81         | 0.25  | 1.81       | 1.28  | -2.53                  | -1.89                 | 0.68                   |
| 0.350   | 1.84         | 0.40  | 1.84       | 1.17  | -2.60                  | -1.87                 | 0.69                   |
| 0.400   | 1.85         | 0.60  | 1.85       | 1.54  | -2.79                  | -1.85                 | 0.71                   |
| 0.450   | 1.82         | 0.47  | 1.82       | 1.31  | -2.59                  | -1.84                 | 0.73                   |
| 0.500   | 1.85         | 0.35  | 1.85       | 1.38  | -2.73                  | -1.82                 | 0.76                   |
| 0.550   | 1.86         | 0.56  | 1.86       | 1.21  | -3.07                  | -1.80                 | 0.75                   |
| 0.600   | 1.54         | 0.12  | 1.54       | 1.02  | -3.11                  | -1.78                 | 0.86                   |
| 0.650   | 1.21         | 0.44  | 1.95       | 1.36  | -3.10                  | -1.76                 | 0.95                   |
| 0.697   | 1.53         | 1.21  | 1.70       | 1.50  | -3.04                  | -1.74                 | 1.02                   |
| 0.747   | 1.34         | 0.17  | 1.53       | 1.28  | -3.49                  | -1.72                 | 1.10                   |
| 0.797   | 1.32         | 0.60  | 1.54       | 1.63  | -3.70                  | -1.70                 | 1.17                   |
| 0.847   | 1.62         | 0.53  | 1.14       | 1.38  | -3.31                  | -1.68                 | 1.23                   |
| 0.897   | 0.98         | 1.00  | 1.62       | 1.76  | -2.82                  | -1.66                 | 1.30                   |
| 0.967   | 1.06         | 1.19  | 1.40       | 1.25  | -3.10                  | -1.64                 | 1.38                   |
| 1.007   | 1.29         | 1.62  | 1.06       | 1.67  | -3.67                  | -1.62                 | 1.42                   |
| 1.057   | 0.95         | 2.64  | 0.95       | 1.63  | -3.48                  | -1.60                 | 1.47                   |
| 1.107   | 1.46         | 2.12  | 1.21       | 2.84  | -2.94                  | -1.58                 | 1.52                   |
| 1.155   | 0.63         | 1.53  | 2.36       | 2.71  | -3.26                  | -1.56                 | 1.56                   |
| 1.205   | 0.76         | 2.24  | 2.38       | 2.76  | -2.94                  | -1.54                 | 1.61                   |
| 1.255   | 0.97         | 1.15  | 2.71       | 2.71  | -2.41                  | -1.52                 | 1.65                   |
| 1.305   | 0.80         | 1.35  | 2.77       | 2.74  | -2.38                  | -1.50                 | 1.70                   |
| 1.355   | 1.02         | 1.55  | 2.83       | 2.80  | -2.88                  | -1.48                 | 1.74                   |
| 1.405   | 0.99         | 1.21  | 2.83       | 2.85  | -2.60                  | -1.47                 | 1.78                   |
| 1.455   | 1.14         | 1.53  | 2.83       | 2.84  | -2.80                  | -1.45                 | 1.82                   |
| 1.505   | 1.05         | 1.36  | 2.97       | 2.96  | -2.55                  | -1.43                 | 1.86                   |
| 1.555   | 0.83         | 1.47  | 2.96       | 3.02  | -2.67                  | -1.41                 | 1.89                   |
| 1.605   | 1.66         | 1.72  | 3.04       | 3.08  | -2.76                  | -1.39                 | 1.93                   |
| 1.655   | 1.72         | 1.16  | 3.05       | 3.17  | -2.84                  | -1.37                 | 1.97                   |
| 1.705   | 1.71         | 1.66  | 3.19       | 3.17  | -2.82                  | -1.35                 | 2.00                   |
| 1.755   | 1.67         | 1.79  | 3.04       | 3.24  | -2.03                  | -1.33                 | 2.04                   |
| 1.805   | 2.15         | 1.31  | 3.22       | 3.28  | -1.82                  | -1.31                 | 2.07                   |
| 1.855   | 1.30         | 1.14  | 3.33       | 3.29  | -2.12                  | -1.29                 | 2.10                   |
| 1.905   | 1.30         | 1.26  | 3.21       | 3.32  | -1.97                  | -1.27                 | 2.14                   |
| 1.955   | 1.20         | 1.29  | 3.32       | 3.32  | -2.17                  | -1.25                 | 2.17                   |
| 2.005   | 1.78         | 1.70  | 3.36       | 3.38  | -2.32                  | -1.23                 | 2.20                   |
| 2.055   | 1.71         | 1.41  | 3.80       | 3.41  | -1.92                  | -1.21                 | 2.23                   |

Table V.5.1 (2/3) LONGITUDINAL PROFILE PROPOSED FOR  
THE OPTIMUM RIVER IMPROVEMENT PLAN  
(WEST FLOODWAY) (Unit: El. m)

| Sta. No.<br>(Distance<br>from River<br>Mouth in km) | Existing     |       |            |       |                        | Proposed              |                        |
|---|--------------|-------|------------|-------|------------------------|-----------------------|------------------------|
|   | Ground Level |       | Dike Level |       | Lowest<br>River<br>Bed | River<br>Bed<br>Level | Design<br>HWL<br>Level |
|   | Left         | Right | Left       | Right |                        |                       |                        |
| 2.105   | 2.00         | 1.47  | 3.44       | 3.57  | -2.32                  | -1.19                 | 2.26                   |
| 2.155   | 1.82         | 1.34  | 3.33       | 3.57  | -1.65                  | -1.17                 | 2.30                   |
| 2.205   | 1.75         | 1.44  | 3.39       | 3.51  | -1.80                  | -1.16                 | 2.33                   |
| 2.255   | 1.74         | 1.36  | 3.42       | 3.45  | -1.76                  | -1.14                 | 2.36                   |
| 2.305   | 1.91         | 1.47  | 3.42       | 3.41  | -1.96                  | -1.12                 | 2.39                   |
| 2.355   | 1.88         | 1.07  | 3.05       | 3.43  | -1.71                  | -1.10                 | 2.41                   |
| 2.405   | 2.01         | 1.80  | 3.52       | 3.60  | -1.72                  | -1.08                 | 2.44                   |
| 2.455   | 2.09         | 1.95  | 3.43       | 3.55  | -1.61                  | -1.06                 | 2.47                   |
| 2.505   | 2.19         | 1.61  | 3.56       | 3.52  | -1.34                  | -1.04                 | 2.50                   |
| 2.555   | 2.42         | 2.02  | 3.65       | 3.65  | -1.21                  | -1.02                 | 2.53                   |
| 2.605   | 2.64         | 2.32  | 3.76       | 3.76  | -1.51                  | -1.00                 | 2.55                   |
| 2.655   | 2.76         | 2.44  | 3.83       | 3.75  | -1.61                  | -0.98                 | 2.57                   |
| 2.705   | 2.74         | 2.26  | 4.05       | 3.83  | -1.84                  | -0.96                 | 2.59                   |
| 2.755   | 2.94         | 2.90  | 4.24       | 3.90  | -2.12                  | -0.94                 | 2.61                   |
| 2.805   | 3.11         | 2.86  | 4.37       | 3.90  | -1.29                  | -0.92                 | 2.64                   |
| 2.855   | 2.89         | 2.99  | 4.37       | 3.96  | -1.59                  | -0.90                 | 2.67                   |
| 2.905   | 2.90         | 3.09  | 4.02       | 4.15  | -1.73                  | -0.88                 | 2.70                   |
| 2.955   | 2.61         | 2.83  | 4.27       | 4.05  | -1.42                  | -0.86                 | 2.73                   |
| 3.005   | 2.88         | 2.89  | 4.35       | 4.20  | -1.25                  | -0.85                 | 2.76                   |
| 3.055   | 3.01         | 3.00  | 4.36       | 3.85  | -1.39                  | -0.83                 | 2.80                   |
| 3.105   | 3.10         | 2.86  | 4.46       | 4.38  | -1.32                  | -0.81                 | 2.84                   |
| 3.155   | 3.93         | 3.25  | 4.50       | 4.34  | -1.53                  | -0.79                 | 2.88                   |
| 3.205   | 3.54         | 3.43  | 4.33       | 4.47  | -0.94                  | -0.77                 | 2.92                   |
| 3.255   | 3.61         | 3.52  | 3.93       | 4.43  | -1.10                  | -0.75                 | 2.97                   |
| 3.305   | 3.72         | 3.64  | 4.38       | 4.51  | -1.23                  | -0.73                 | 3.02                   |
| 3.355   | 3.75         | 3.15  | 4.57       | 4.40  | -1.40                  | -0.71                 | 3.15                   |
| 3.405   | 3.86         | 3.89  | 4.49       | 4.64  | -1.61                  | -0.69                 | 3.27                   |
| 3.455   | 4.02         | 3.99  | 4.57       | 4.53  | -1.56                  | -0.67                 | 3.37                   |
| 3.505   | 4.04         | 4.28  | 4.58       | 4.72  | -2.22                  | -0.65                 | 3.46                   |
| 3.555   | 4.41         | 4.38  | 4.62       | 4.80  | -1.45                  | -0.63                 | 3.55                   |
| 3.605   | 5.33         | 5.36  | 5.33       | 5.36  | -1.28                  | -0.61                 | 3.63                   |
| 3.665   | 5.32         | 4.96  | 5.32       | 4.96  | -2.03                  | -0.59                 | 3.72                   |
| 3.715   | 5.48         | 5.12  | 5.48       | 5.12  | -1.42                  | -0.57                 | 3.79                   |
| 3.765   | 5.57         | 4.86  | 5.57       | 4.86  | -1.62                  | -0.55                 | 3.85                   |
| 3.815   | 5.79         | 4.73  | 5.79       | 4.73  | -2.35                  | -0.53                 | 3.91                   |
| 3.865   | 5.89         | 4.75  | 5.89       | 4.75  | -2.98                  | -0.51                 | 3.97                   |
| 3.915   | 5.57         | 4.68  | 5.57       | 4.68  | -2.98                  | -0.49                 | 4.03                   |
| 3.966   | 5.90         | 5.26  | 5.90       | 5.26  | -3.21                  | -0.47                 | 4.09                   |
| 4.000   | 6.41         | 6.42  | 6.41       | 6.42  | -2.76                  | -0.46                 | 4.12                   |
| 4.076   | 5.08         | 5.23  | 5.08       | 5.23  | -1.51                  | -0.43                 | 4.20                   |
| 4.126   | 4.93         | 5.90  | 4.93       | 5.90  | -1.49                  | -0.41                 | 4.25                   |
| 4.176   | 5.34         | 6.00  | 5.34       | 6.00  | -1.36                  | -0.39                 | 4.30                   |

Table V.5.1 (3/3) LONGITUDINAL PROFILE PROPOSED FOR  
 THE OPTIMUM RIVER IMPROVEMENT PLAN  
 (WEST FLOODWAY) (Unit: El. m)

| Sta. No.<br>(Distance<br>from River<br>Mouth in km) | Existing     |       |            |       | Lowest<br>River<br>Bed | Proposed              |                        |
|---|--------------|-------|------------|-------|------------------------|-----------------------|------------------------|
|   | Ground Level |       | Dike Level |       |                        | River<br>Bed<br>Level | Design<br>HWL<br>Level |
|   | Left         | Right | Left       | Right |                        |                       |                        |
| 4.226   | 5.05         | 6.03  | 5.05       | 6.03  | -1.65                  | -0.37                 | 4.35                   |
| 4.276   | 5.43         | 6.41  | 5.43       | 6.41  | -1.71                  | -0.35                 | 4.39                   |
| 4.326   | 5.76         | 6.22  | 5.76       | 6.22  | -1.22                  | -0.33                 | 4.44                   |
| 4.376   | 5.84         | 6.28  | 5.84       | 6.28  | -1.36                  | -0.31                 | 4.48                   |
| 4.426   | 5.89         | 6.53  | 5.89       | 6.53  | -1.00                  | -0.29                 | 4.53                   |
| 4.476   | 6.10         | 6.25  | 6.10       | 6.25  | -1.06                  | -0.28                 | 4.57                   |
| 4.527   | 6.23         | 6.44  | 6.23       | 6.44  | -1.16                  | -0.26                 | 4.61                   |
| 4.577   | 6.24         | 6.40  | 6.24       | 6.40  | -0.86                  | -0.24                 | 4.65                   |
| 4.627   | 6.25         | 6.61  | 6.25       | 6.61  | -1.16                  | -0.22                 | 4.69                   |
| 4.677   | 6.39         | 6.76  | 6.39       | 6.76  | -1.28                  | -0.20                 | 4.73                   |
| 4.727   | 6.38         | 6.84  | 6.38       | 6.84  | -1.12                  | -0.18                 | 4.77                   |
| 4.777   | 6.36         | 6.78  | 6.36       | 6.78  | -1.32                  | -0.16                 | 4.80                   |
| 4.827   | 6.51         | 7.08  | 6.51       | 7.08  | -1.01                  | -0.14                 | 4.84                   |
| 4.877   | 6.52         | 6.95  | 6.52       | 6.95  | -0.89                  | -0.12                 | 4.88                   |
| 4.927   | 6.42         | 7.14  | 6.42       | 7.14  | -1.45                  | -0.10                 | 4.91                   |
| 4.977   | 6.67         | 7.43  | 6.67       | 7.43  | -0.92                  | -0.08                 | 4.95                   |
| 5.027   | 7.17         | 7.47  | 7.17       | 7.47  | -0.99                  | -0.06                 | 4.98                   |
| 5.087   | 8.38         | 7.28  | 8.38       | 7.28  | 0.00                   | -0.04                 | 5.03                   |
| 5.137   | 9.05         | 7.90  | 9.05       | 7.90  | -0.33                  | -0.02                 | 5.06                   |
| 5.187   | 9.59         | 8.07  | 9.59       | 8.07  | 0.00                   | 0.00                  | 5.09                   |
| 5.237   | 8.99         | 8.78  | 8.99       | 8.78  | -0.97                  | 0.02                  | 5.13                   |
| 5.287   | 9.18         | 9.94  | 9.18       | 9.94  | 1.45                   | 0.04                  | 5.16                   |

Table V.5.2 (1/2) LONGITUDINAL PROFILE PROPOSED FOR  
THE OPTIMUM RIVER IMPROVEMENT PLAN  
(GARANG RIVER) (Unit: El. m)

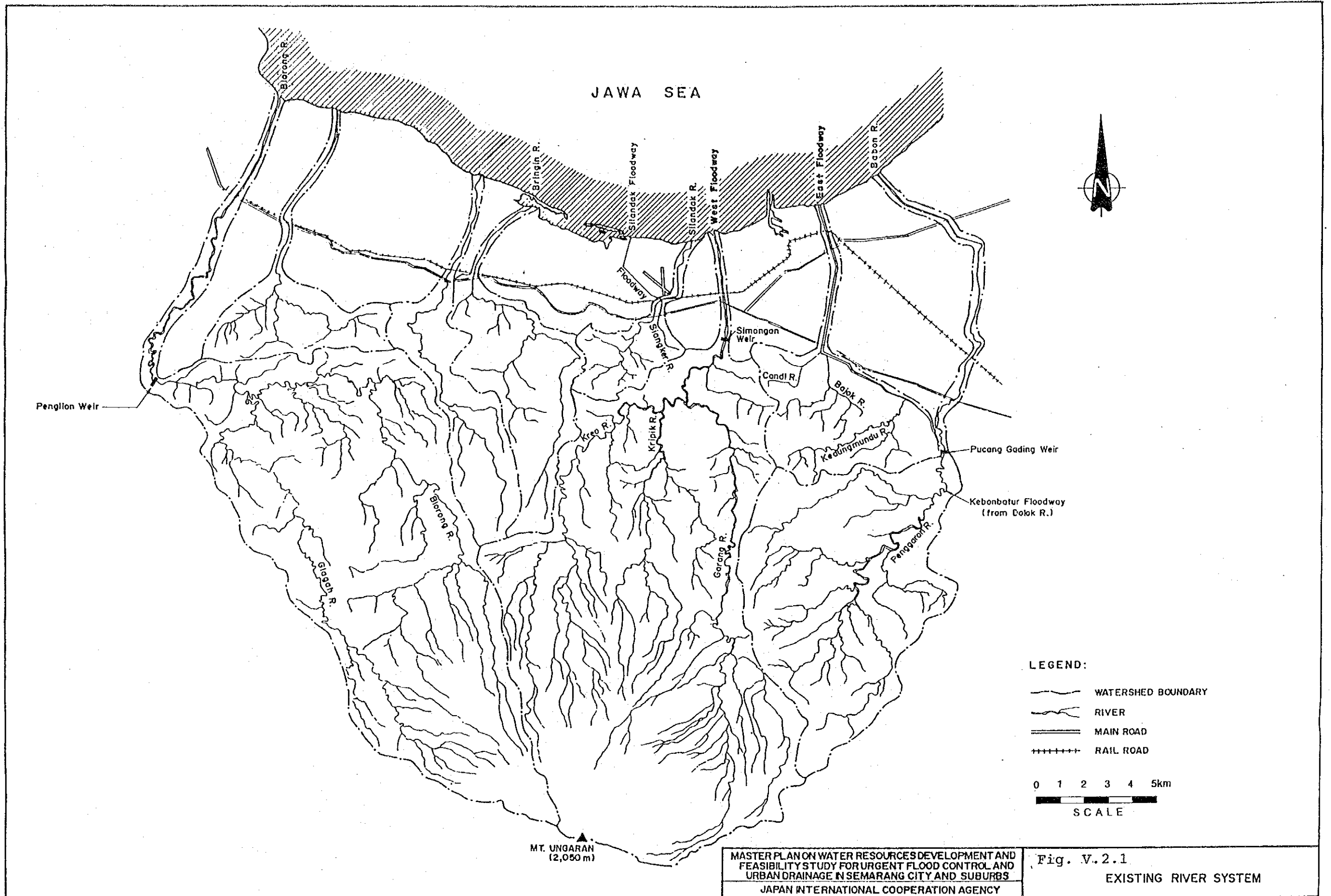
| Sta. No.<br>(Distance<br>from River<br>Mouth in km) | Existing     |       |            |       |                        | Proposed              |                        |
|---|--------------|-------|------------|-------|------------------------|-----------------------|------------------------|
|   | Ground Level |       | Dike Level |       | Lowest<br>River<br>Bed | River<br>Bed<br>Level | Design<br>HWL<br>Level |
|   | Left         | Right | Left       | Right |                        |                       |                        |
| 5.337   | 9.08         | 9.08  | 9.08       | 9.08  | 4.07                   | 1.51                  | 6.49                   |
| 5.377   | 7.25         | 10.61 | 7.25       | 11.22 | 4.08                   | 1.54                  | 6.52                   |
| 5.429   | 7.44         | 10.41 | 7.44       | 10.66 | 3.42                   | 1.58                  | 6.57                   |
| 5.472   | 6.99         | 10.27 | 6.99       | 10.87 | 3.82                   | 1.62                  | 6.60                   |
| 5.522   | 6.38         | 10.52 | 6.38       | 10.81 | 4.06                   | 1.66                  | 6.65                   |
| 5.570   | 8.63         | 11.09 | 8.63       | 11.69 | 4.28                   | 1.70                  | 6.69                   |
| 5.620   | 9.37         | 10.54 | 9.37       | 11.14 | 4.52                   | 1.74                  | 6.73                   |
| 5.670   | 9.49         | 10.29 | 9.49       | 10.79 | 4.60                   | 1.78                  | 6.77                   |
| 5.722   | 9.31         | 11.37 | 9.31       | 11.37 | 4.29                   | 1.82                  | 6.82                   |
| 5.775   | 11.15        | 12.14 | 11.15      | 12.14 | 4.25                   | 1.86                  | 6.86                   |
| 5.827   | 12.42        | 12.63 | 12.42      | 12.63 | 3.54                   | 1.90                  | 6.91                   |
| 5.877   | 11.05        | 12.93 | 11.05      | 12.93 | 3.01                   | 1.94                  | 6.95                   |
| 5.929   | 11.00        | 11.18 | 11.31      | 11.31 | 3.82                   | 1.98                  | 6.96                   |
| 5.953   | 7.90         | 10.03 | 11.33      | 11.33 | 3.13                   | 2.00                  | 6.98                   |
| 5.987   | 7.89         | 9.79  | 10.36      | 11.36 | 3.04                   | 2.03                  | 7.02                   |
| 6.023   | 8.94         | 9.81  | 11.39      | 11.40 | 4.16                   | 2.06                  | 7.07                   |
| 6.063   | 8.03         | 10.08 | 11.42      | 11.44 | 3.58                   | 2.09                  | 7.11                   |
| 6.087   | 8.21         | 9.88  | 11.44      | 11.42 | 4.40                   | 2.11                  | 7.14                   |
| 6.133   | 7.96         | 9.77  | 11.48      | 11.31 | 3.33                   | 2.14                  | 7.19                   |
| 6.161   | 7.75         | 9.78  | 11.50      | 11.56 | 1.47                   | 2.17                  | 7.22                   |
| 6.207   | 8.09         | 10.54 | 11.54      | 11.29 | 1.30                   | 2.20                  | 7.27                   |
| 6.251   | 8.07         | 9.62  | 11.58      | 10.58 | 3.78                   | 2.24                  | 7.32                   |
| 6.291   | 8.11         | 10.62 | 11.62      | 10.62 | 2.63                   | 2.27                  | 7.36                   |
| 6.325   | 8.56         | 10.03 | 11.64      | 10.03 | 2.43                   | 2.30                  | 7.40                   |
| 6.353   | 8.65         | 10.03 | 11.66      | 10.03 | 1.89                   | 2.32                  | 7.43                   |
| 6.377   | 8.80         | 11.13 | 11.69      | 11.13 | 1.79                   | 2.34                  | 7.45                   |
| 6.413   | 8.79         | 8.99  | 11.72      | 10.72 | 3.10                   | 2.37                  | 7.49                   |
| 6.453   | 8.39         | 10.83 | 11.75      | 11.75 | 4.00                   | 2.40                  | 7.53                   |
| 6.485   | 8.77         | 8.10  | 11.78      | 11.79 | 4.23                   | 2.43                  | 7.56                   |
| 6.511   | 8.84         | 7.66  | 11.80      | 11.80 | 3.96                   | 2.45                  | 7.59                   |
| 6.535   | 8.87         | 8.45  | 11.82      | 11.82 | 4.27                   | 3.96                  | 7.67                   |
| 6.559   | 8.83         | 8.21  | 11.84      | 11.84 | 3.90                   | 3.98                  | 7.75                   |
| 6.581   | 8.97         | 8.64  | 11.86      | 11.86 | 3.81                   | 4.00                  | 7.92                   |
| 6.605   | 9.41         | 8.11  | 11.88      | 11.88 | 3.73                   | 4.02                  | 8.05                   |
| 6.631   | 9.45         | 9.53  | 11.90      | 11.90 | 4.09                   | 4.04                  | 8.16                   |
| 6.673   | 9.46         | 9.99  | 9.46       | 11.94 | 3.21                   | 4.07                  | 8.31                   |
| 6.925   | 10.88        | 9.04  | 10.88      | 11.74 | 4.54                   | 4.27                  | 8.91                   |
| 6.967   | 10.50        | 9.64  | 13.44      | 11.74 | 4.44                   | 4.30                  | 8.98                   |
| 7.015   | 9.08         | 9.74  | 12.43      | 11.74 | 4.68                   | 4.34                  | 9.06                   |
| 7.065   | 9.49         | 9.10  | 13.41      | 11.74 | 4.34                   | 4.38                  | 9.14                   |
| 7.135   | 9.04         | 9.31  | 13.45      | 11.48 | 4.63                   | 4.44                  | 9.24                   |
| 7.181   | 9.40         | 8.74  | 13.49      | 11.73 | 4.88                   | 4.48                  | 9.30                   |

Table V.5.2 (2/2) LONGITUDINAL PROFILE PROPOSED FOR THE OPTIMUM RIVER IMPROVEMENT PLAN (GARANG RIVER) (Unit: El. m)

| Sta. No.<br>(Distance<br>from River<br>Mouth in km) | Existing     |       |            |       | Lowest<br>River<br>Bed | Proposed              |                        |
|---|--------------|-------|------------|-------|------------------------|-----------------------|------------------------|
|   | Ground Level |       | Dike Level |       |                        | River<br>Bed<br>Level | Design<br>HWL<br>Level |
|   | Left         | Right | Left       | Right |                        |                       |                        |
| 7.225   | 9.84         | 11.56 | 13.54      | 11.56 | 4.88                   | 4.51                  | 9.37                   |
| 7.271   | 9.68         | 11.42 | 13.59      | 11.42 | 4.44                   | 4.55                  | 9.43                   |
| 7.523   | 10.00        | 10.10 | 13.63      | 13.56 | 5.10                   | 4.75                  | 9.74                   |
| 7.563   | 9.74         | 9.10  | 13.66      | 13.56 | 4.86                   | 4.78                  | 9.79                   |
| 7.613   | 9.91         | 9.71  | 13.70      | 13.58 | 5.00                   | 4.82                  | 9.84                   |
| 7.669   | 10.48        | 9.49  | 13.76      | 13.61 | 4.71                   | 4.86                  | 9.91                   |
| 7.725   | 10.42        | 9.72  | 13.78      | 13.77 | 4.94                   | 4.91                  | 9.97                   |
| 7.779   | 11.58        | 9.91  | 13.82      | 13.89 | 5.35                   | 4.95                  | 10.03                  |
| 7.833   | 10.56        | 10.99 | 13.85      | 13.90 | 4.33                   | 5.00                  | 10.08                  |
| 7.883   | 11.31        | 10.02 | 13.88      | 14.00 | 5.33                   | 5.03                  | 10.14                  |
| 7.933   | 12.31        | 10.92 | 12.31      | 14.00 | 4.57                   | 5.07                  | 10.19                  |
| 7.989   | 11.11        | 11.90 | 11.11      | 13.79 | 5.11                   | 5.12                  | 10.25                  |
| 8.045   | 10.71        | 12.00 | 10.71      | 13.92 | 5.75                   | 5.16                  | 10.30                  |
| 8.091   | 14.07        | 11.50 | 14.07      | 14.03 | 5.12                   | 5.20                  | 10.35                  |
| 8.135   | 10.78        | 11.64 | 10.78      | 14.03 | 5.39                   | 5.24                  | 10.39                  |
| 8.183   | 11.97        | 11.48 | 13.22      | 14.05 | 5.28                   | 5.27                  | 10.44                  |
| 8.311   | 12.39        | 11.45 | 13.33      | 14.09 | 5.13                   | 5.38                  | 10.56                  |
| 8.367   | 12.18        | 11.54 | 13.38      | 14.33 | 5.12                   | 5.42                  | 10.62                  |
| 8.413   | 12.12        | 12.00 | 13.42      | 14.42 | 5.45                   | 5.46                  | 10.66                  |
| 8.461   | 12.10        | 12.00 | 13.46      | 14.56 | 5.70                   | 5.50                  | 10.71                  |
| 8.511   | 12.53        | 11.58 | 13.50      | 14.69 | 5.49                   | 5.54                  | 10.75                  |
| 8.555   | 12.42        | 12.74 | 13.54      | 14.78 | 5.39                   | 5.57                  | 10.79                  |
| 8.607   | 11.69        | 13.92 | 13.58      | 14.76 | 5.32                   | 5.61                  | 10.84                  |
| 8.661   | 13.00        | 12.66 | 13.63      | 14.92 | 5.74                   | 5.66                  | 10.89                  |
| 8.713   | 14.01        | 12.08 | 14.01      | 15.00 | 5.70                   | 5.70                  | 10.94                  |
| 8.769   | 12.80        | 11.65 | 12.80      | 14.97 | 5.36                   | 5.74                  | 10.99                  |
| 8.821   | 15.31        | 12.02 | 15.31      | 15.07 | 5.98                   | 5.78                  | 11.04                  |
| 8.875   | 15.75        | 12.28 | 15.75      | 15.03 | 6.06                   | 5.83                  | 11.08                  |
| 8.929   | 14.16        | 11.79 | 14.16      | 14.87 | 5.96                   | 5.87                  | 11.13                  |
| 8.985   | 11.03        | 11.81 | 11.03      | 14.93 | 5.77                   | 5.91                  | 11.18                  |
| 9.041   | 11.93        | 11.82 | 11.93      | 15.01 | 5.90                   | 5.96                  | 11.23                  |
| 9.087   | 11.97        | 12.61 | 11.97      | 14.96 | 5.91                   | 6.00                  | 11.27                  |
| 9.137   | 13.02        | 12.69 | 13.02      | 15.00 | 6.07                   | 6.03                  | 11.32                  |
| 9.187   | 12.63        | 12.47 | 12.63      | 15.02 | 6.01                   | 6.07                  | 11.36                  |
| 9.233   | 10.82        | 12.40 | 10.82      | 15.05 | 6.12                   | 6.11                  | 11.40                  |
| 9.269   | 12.64        | 12.95 | 12.64      | 15.10 | 6.30                   | 6.14                  | 11.43                  |
| 9.315   | 12.34        | 13.92 | 12.34      | 15.24 | 6.20                   | 6.18                  | 11.47                  |
| 9.363   | 10.18        | 8.71  | 10.18      | 8.71  | 6.76                   | 6.22                  | 11.51                  |
| 9.425   | 12.85        | 9.38  | 12.85      | 9.38  | 7.32                   | 6.26                  | 11.57                  |
| 9.477   | 13.22        | 9.74  | 13.22      | 9.74  | 7.04                   | 6.31                  | 11.61                  |
| 9.529   | 13.56        | 13.43 | 13.56      | 13.43 | 6.79                   | 6.35                  | 11.65                  |
| 9.583   | 13.47        | 12.47 | 13.47      | 12.47 | 6.43                   | 6.39                  | 11.70                  |

**FIGURES**


















**LEGEND:**

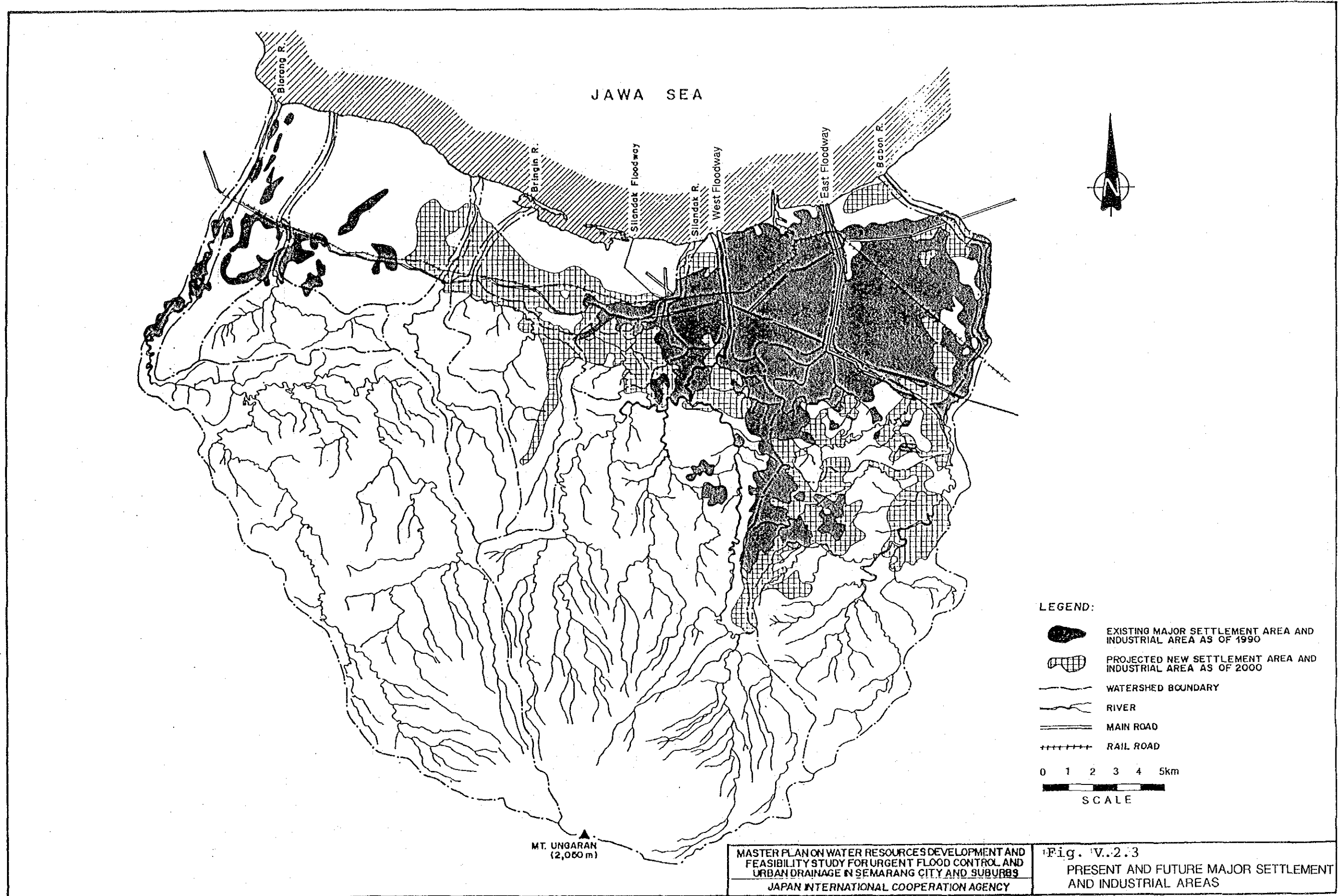
-  FOREST
-  SETTLEMENT AREA
-  PADDY FIELD
-  FARM / PLANTATION
-  FISH POND / PARK
-  WATERSHED BOUNDARY
-  RIVER
-  MAIN ROAD
-  RAIL ROAD

0 1 2 3 4 5km  
SCALE

MT. UNGARAN  
(2,000 m)

MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V.2.2  
PRESENT LAND USE IN THE STUDY AREA



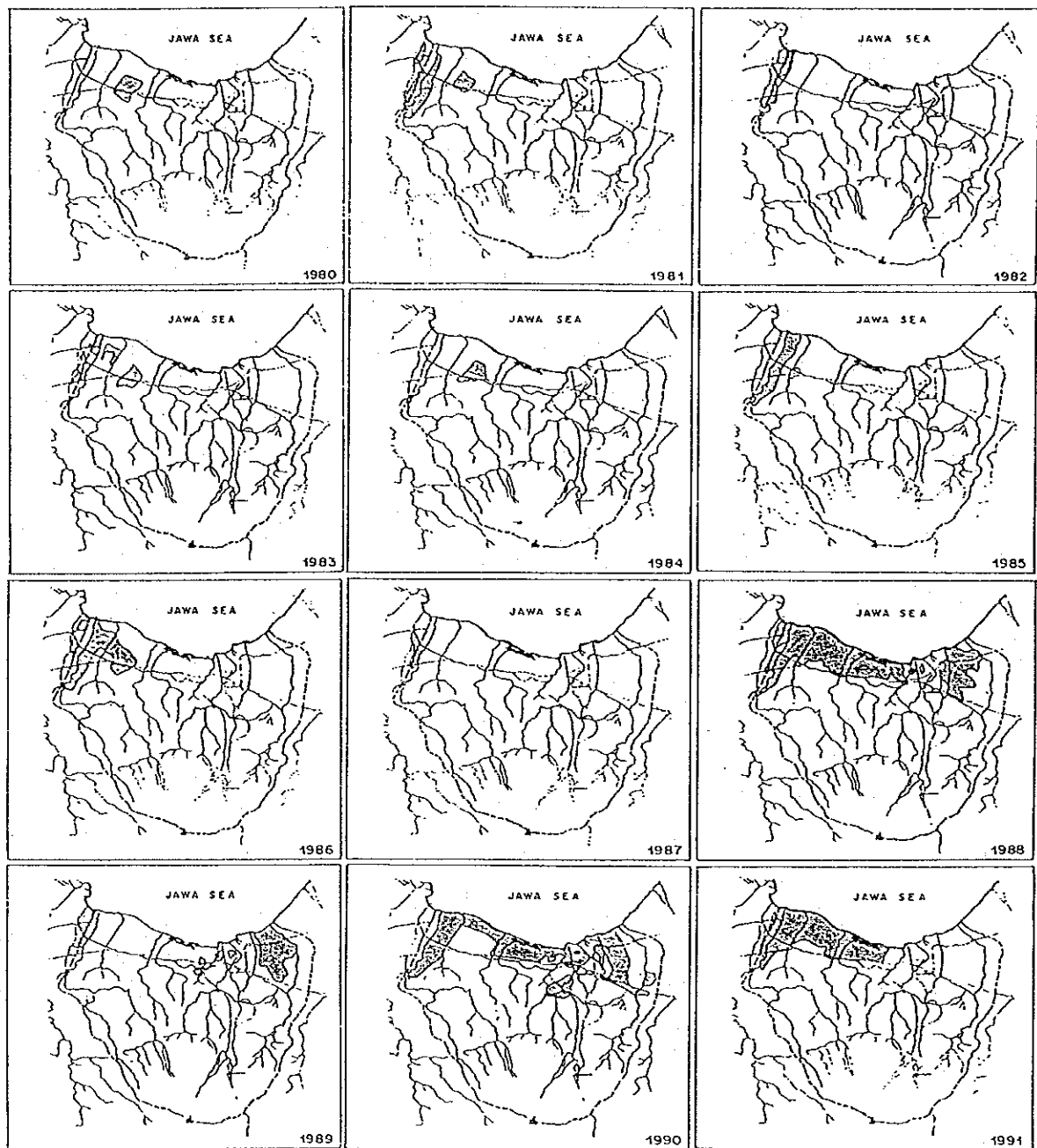
**LEGEND:**

- EXISTING MAJOR SETTLEMENT AREA AND INDUSTRIAL AREA AS OF 1990
- PROJECTED NEW SETTLEMENT AREA AND INDUSTRIAL AREA AS OF 2000
- WATERSHED BOUNDARY
- RIVER
- MAIN ROAD
- RAIL ROAD

0 1 2 3 4 5km  
SCALE

MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
JAPAN INTERNATIONAL COOPERATION AGENCY

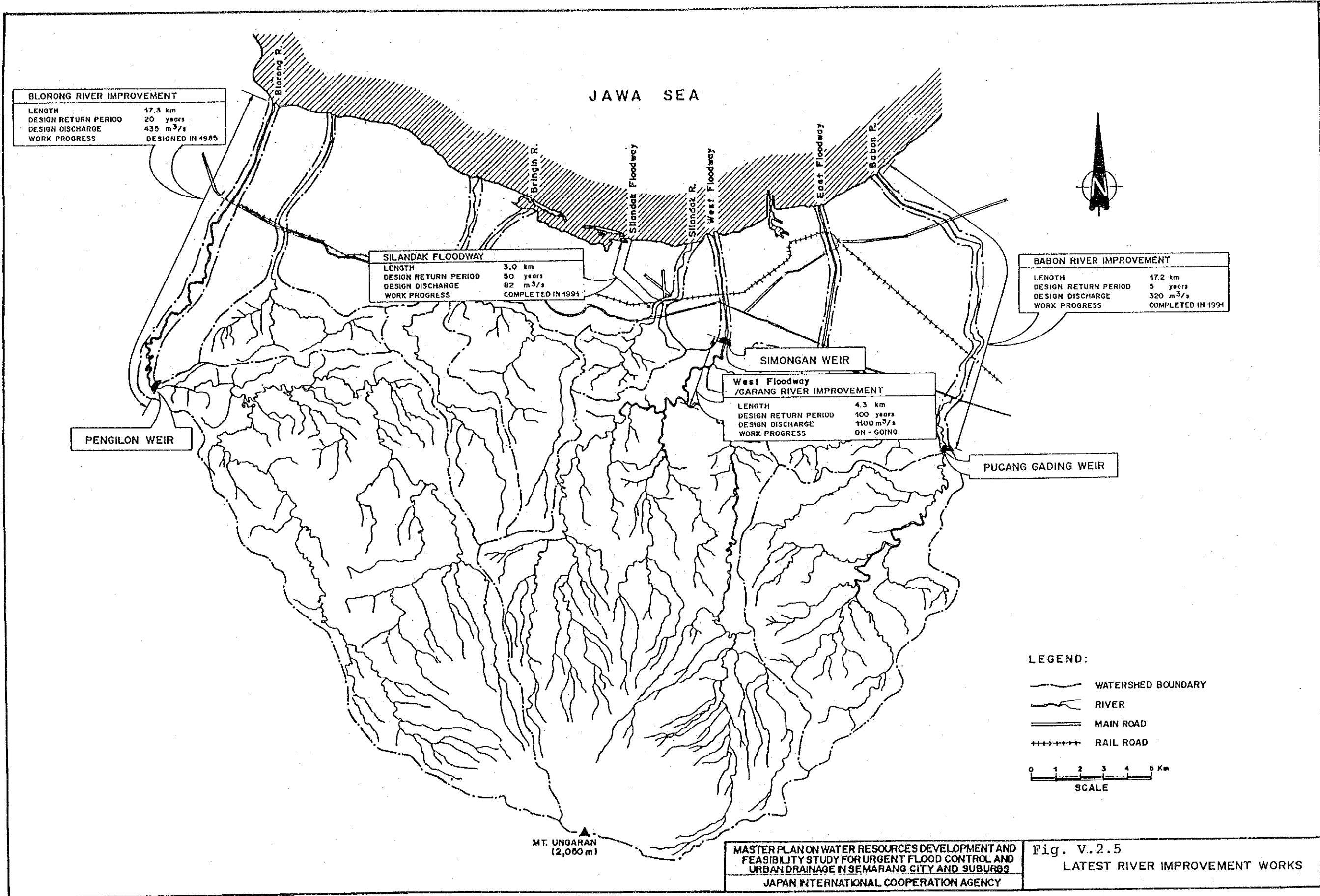
Fig. V.2.3  
PRESENT AND FUTURE MAJOR SETTLEMENT AND INDUSTRIAL AREAS



MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
 FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
 JAPAN INTERNATIONAL COOPERATION AGENCY

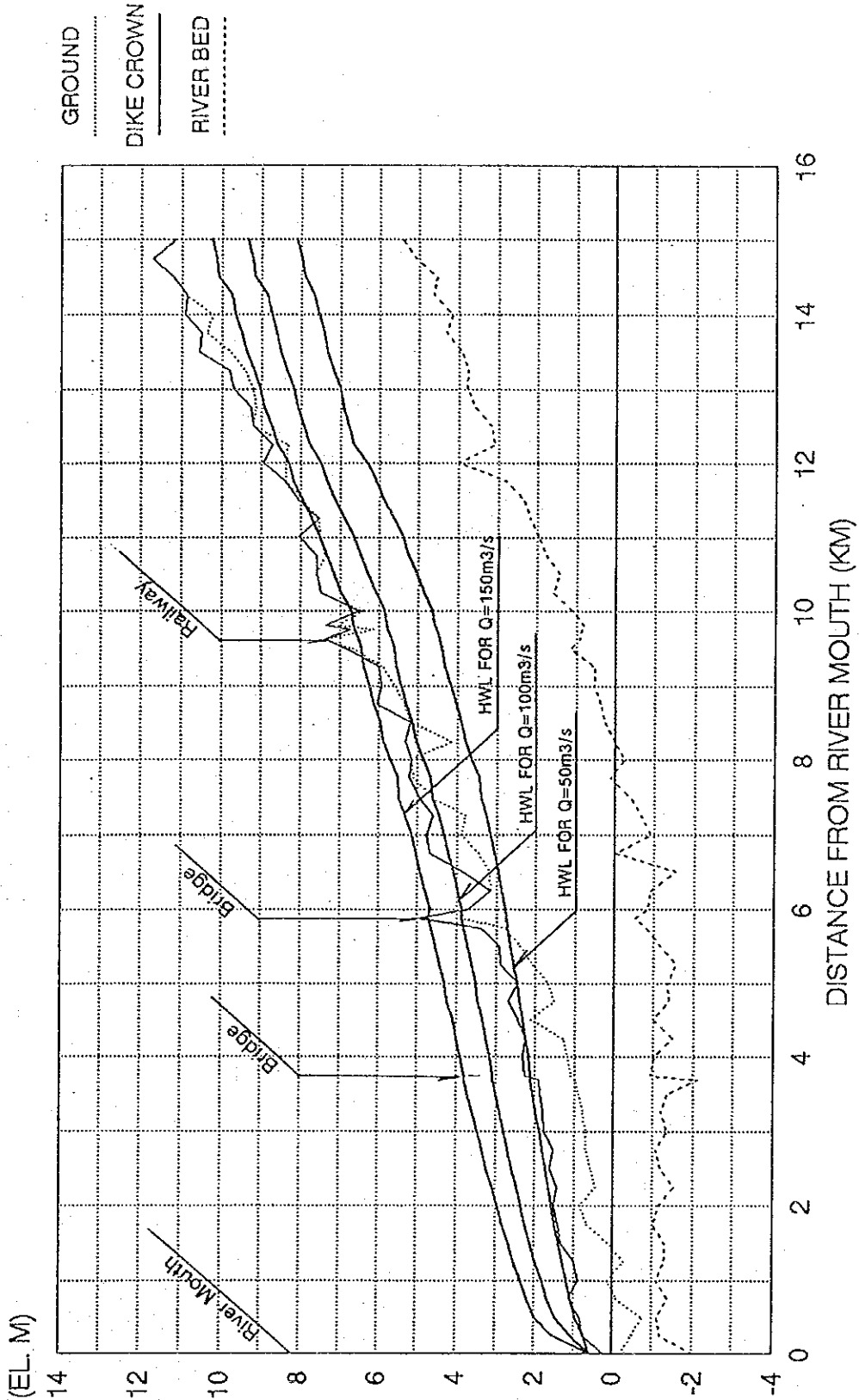
Fig. V.2.4 ANNUAL MAXIMUM FLOOD  
 INUNDATION AREA







# BLORONG RIVER

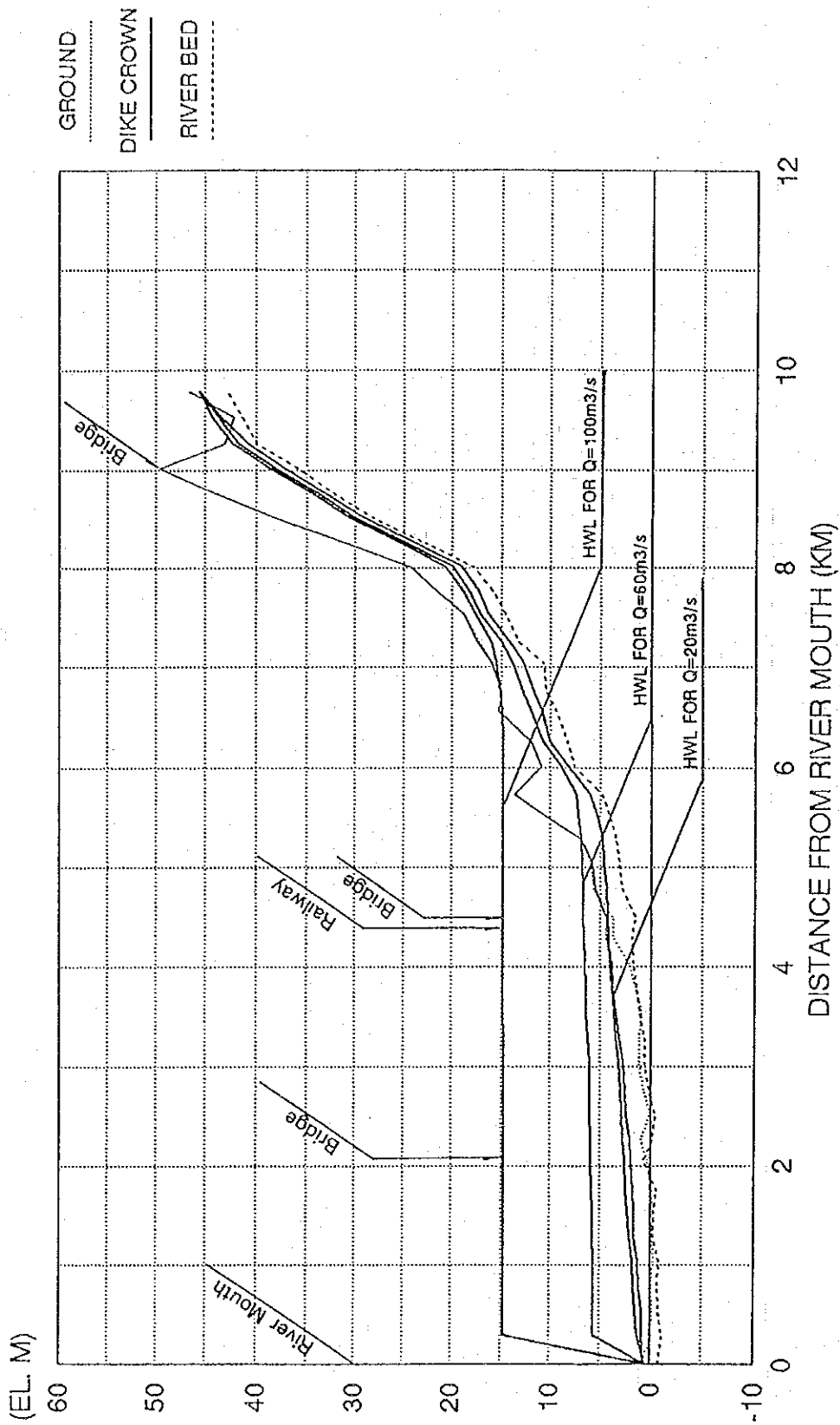


MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
 FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V.2.6 (1/7) PROBABLE HIGH WATER LEVEL FOR  
 EXISTING RIVER CHANNEL  
 (BLORONG RIVER)

# BRINGIN RIVER

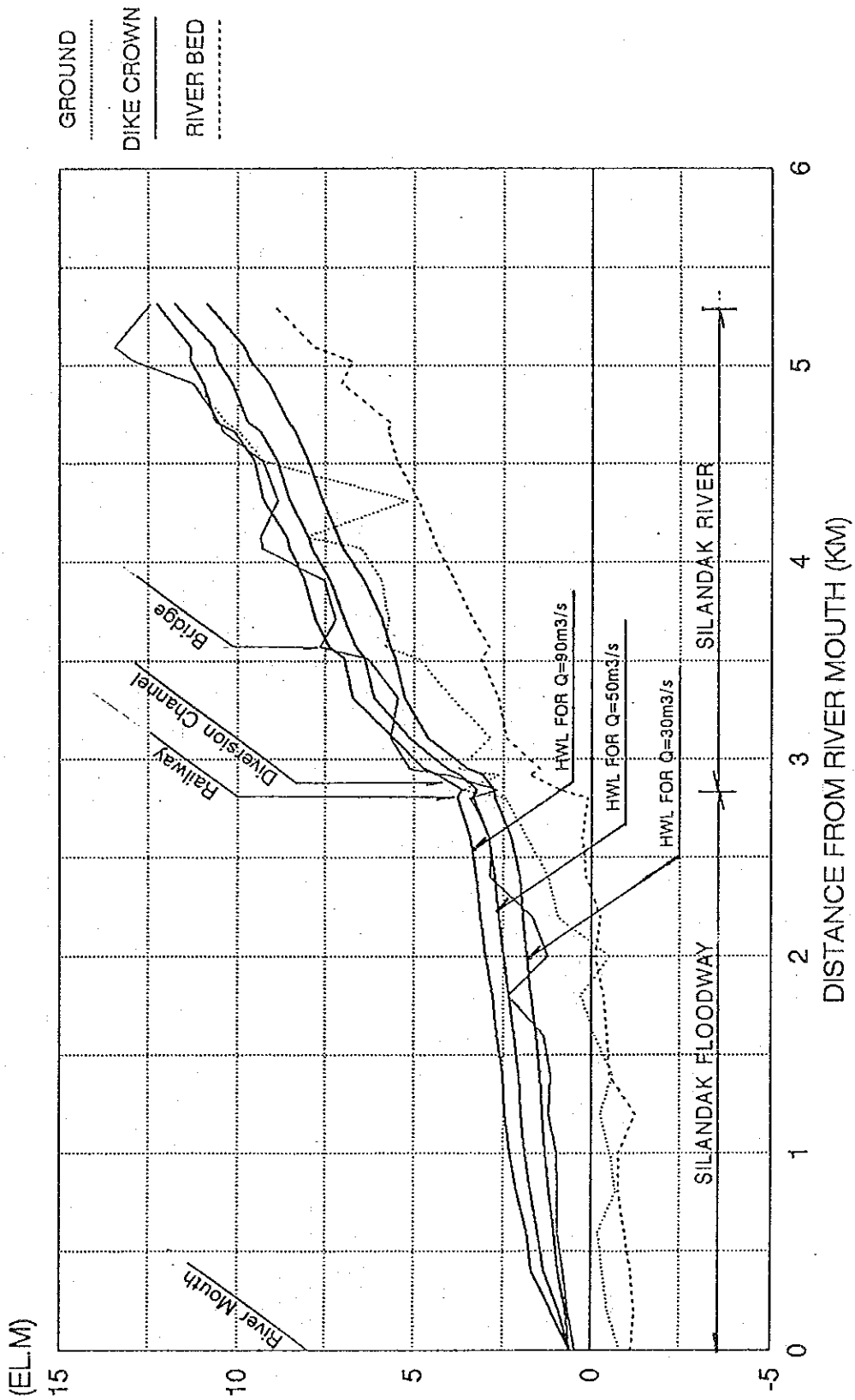


MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
 FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
 JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V.2.6 (2/7) PROBABLE HIGH WATER LEVEL FOR  
 EXISTING RIVER CHANNEL  
 (BRINGIN RIVER)



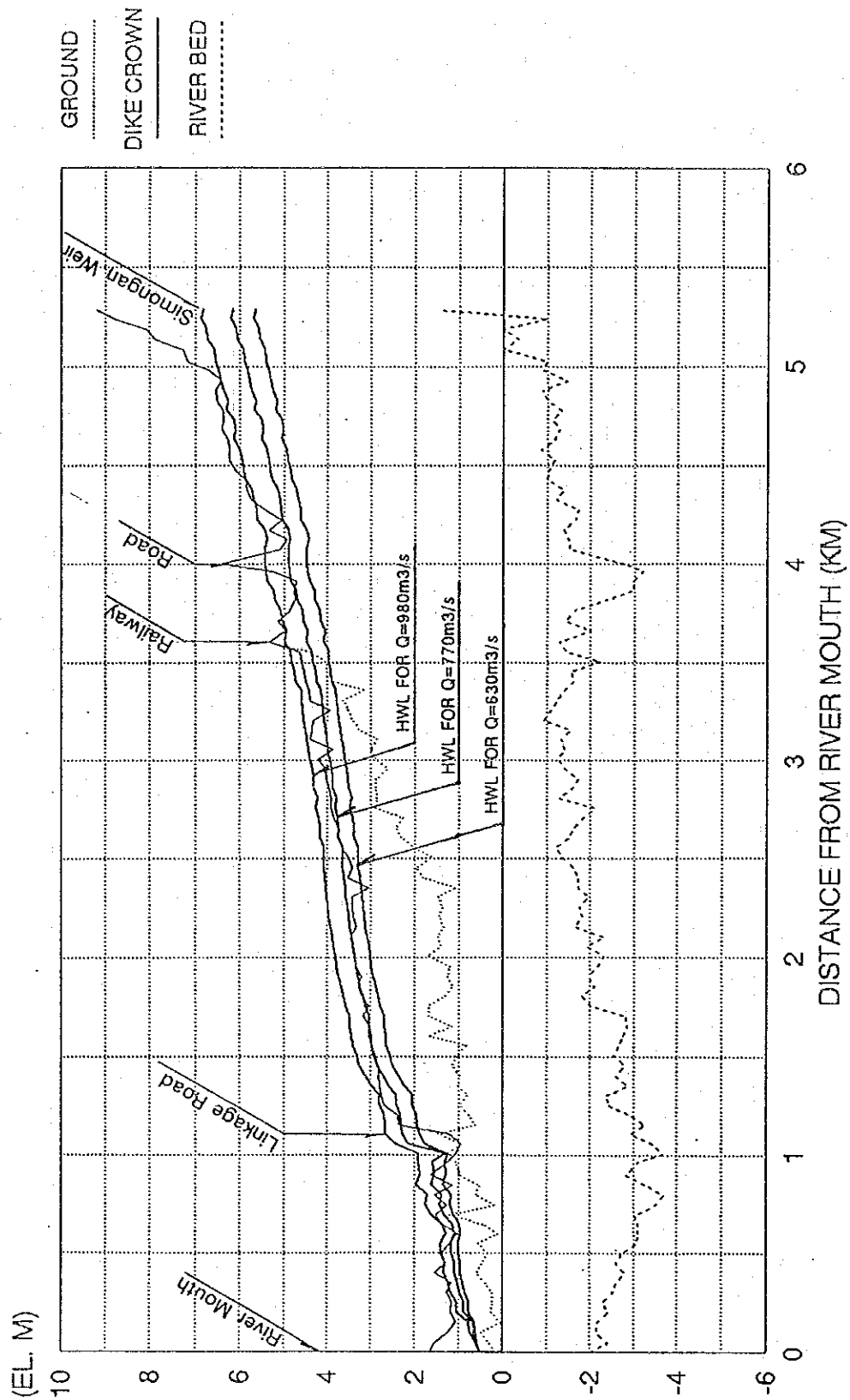
SILANDAK FLOODWAY



MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V.2.6 (3/7) PROBABLE HIGH WATER LEVEL FOR  
EXISTING RIVER CHANNEL  
(SILANDAK RIVER)

WEST FLOODWAY

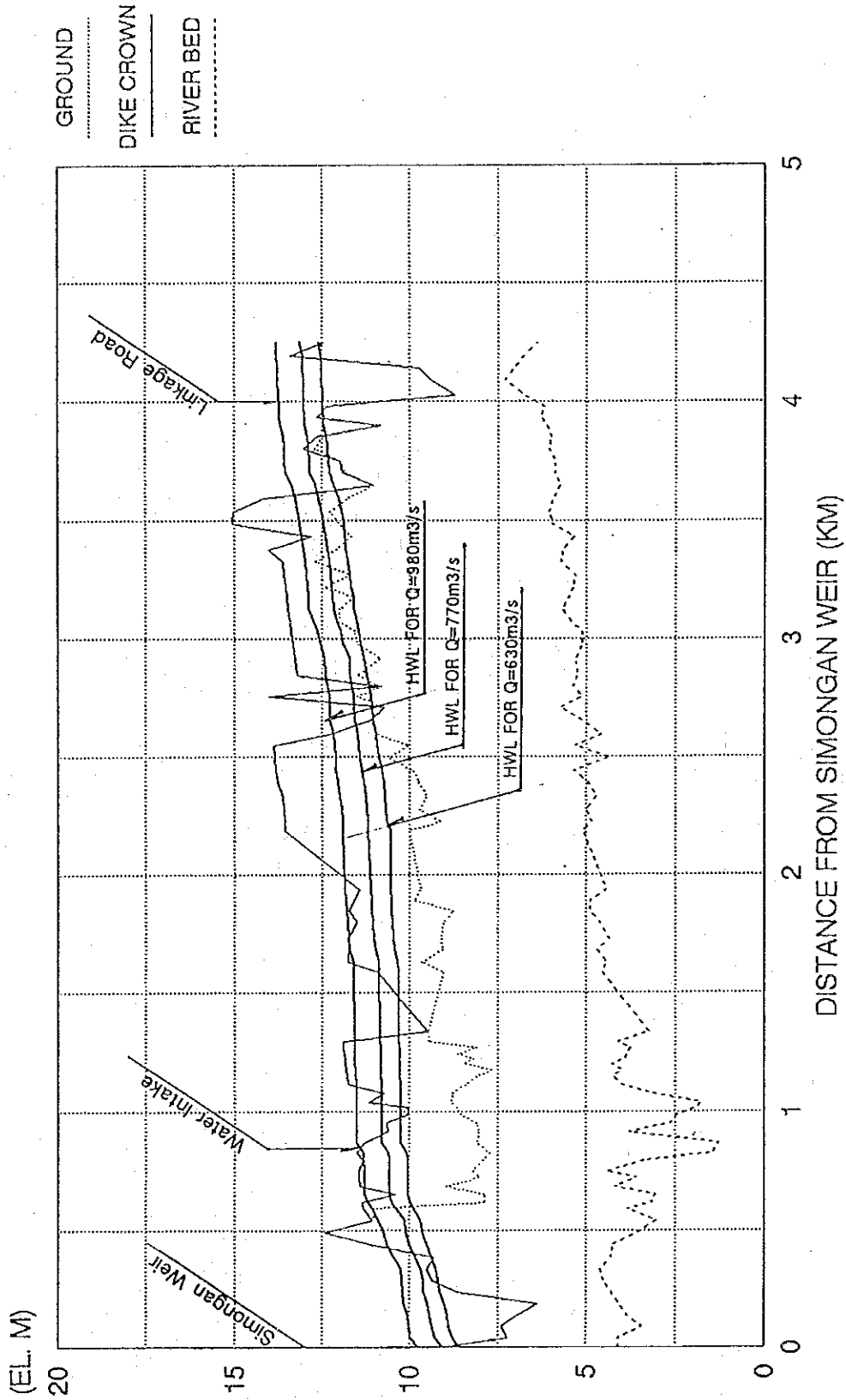


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URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V.2.6 (4/7)

PROBABLE HIGH WATER LEVEL FOR  
EXISTING RIVER CHANNEL  
(WEST FLOODWAY)

# GARANG RIVER

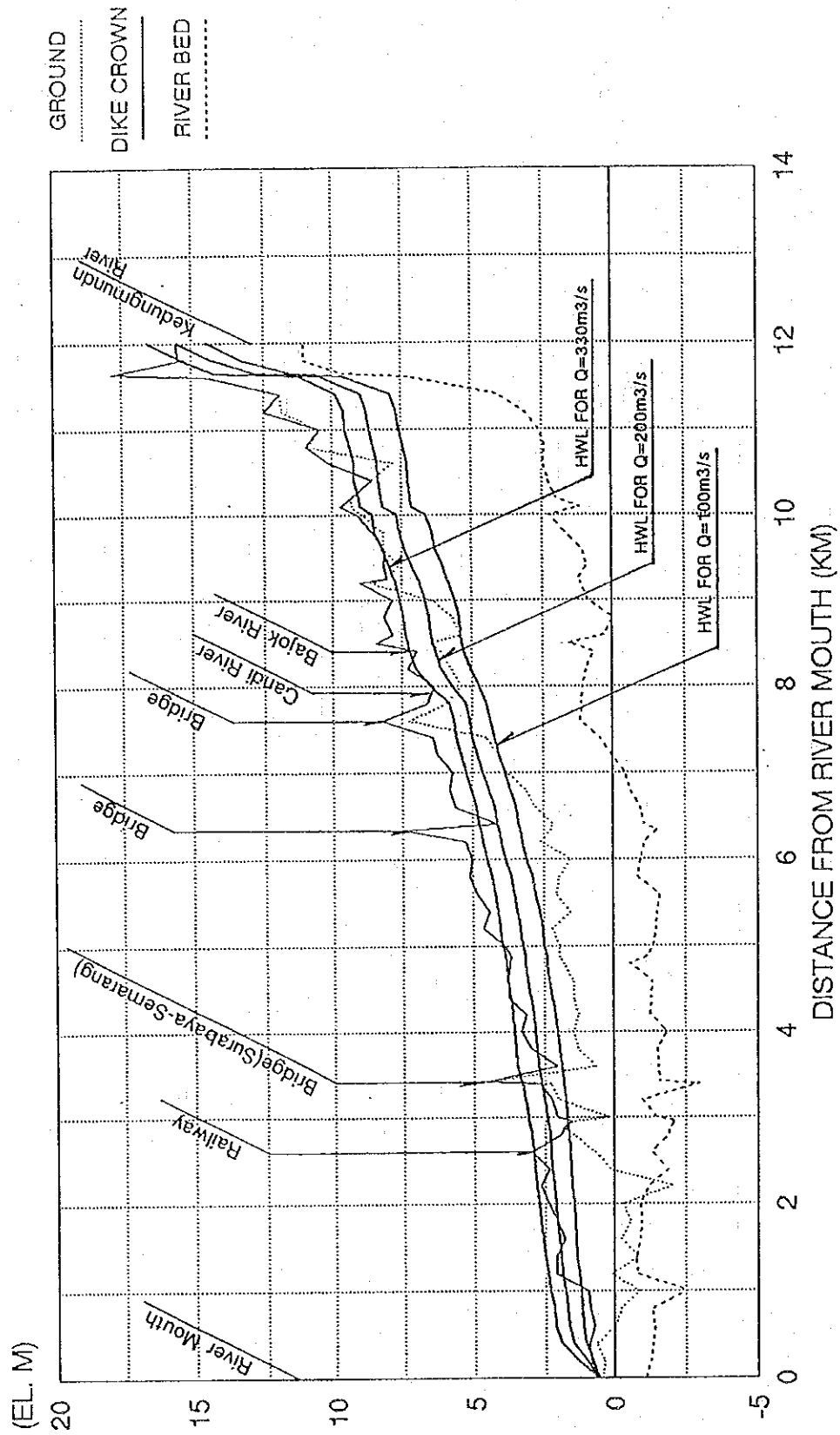


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URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V.2.6 (5/7)

PROBABLE HIGH WATER LEVEL FOR  
EXISTING RIVER CHANNEL  
(GARANG RIVER)

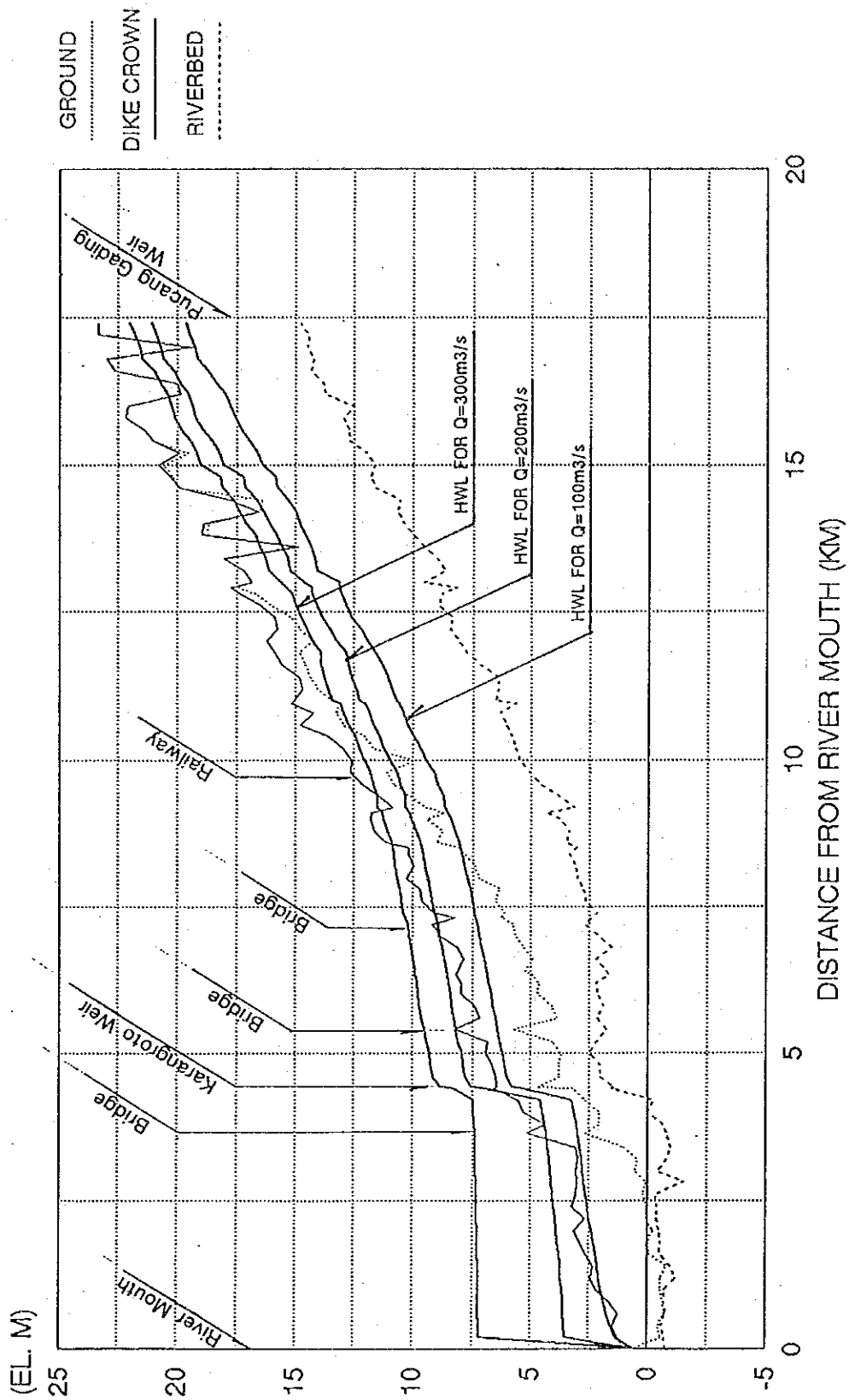
# EAST FLOODWAY



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FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
JAPAN INTERNATIONAL COOPERATION AGENCY

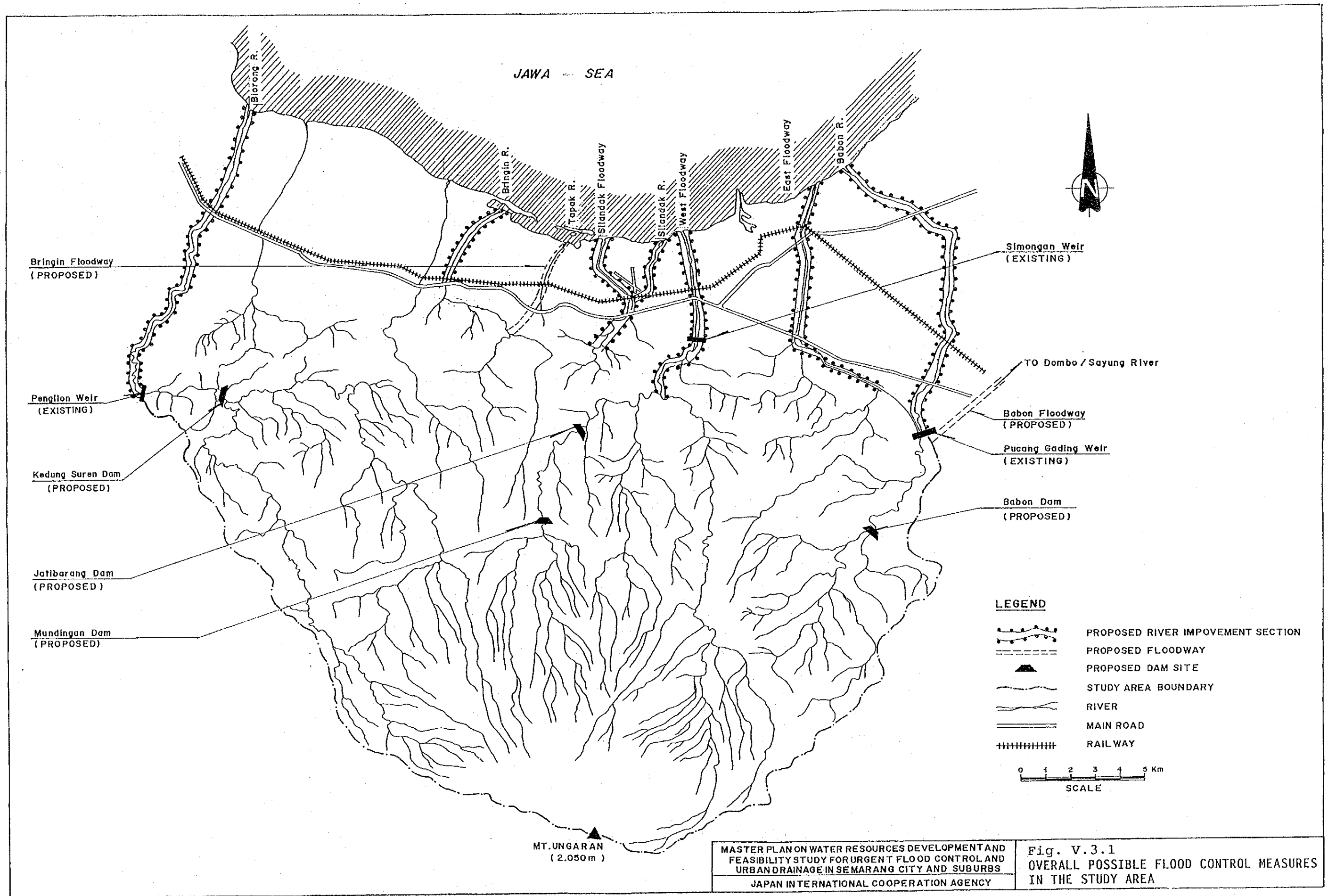
Fig. V.2:6 (6/7) PROBABLE HIGH WATER LEVEL FOR  
EXISTING RIVER CHANNEL  
(EAST FLOODWAY)

BABON RIVER

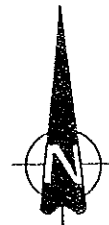


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URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.2.6 (7/7) PROBABLE HIGH WATER LEVEL FOR  
EXISTING RIVER CHANNEL  
(BABON RIVER)



JAWA SEA



Bringin Floodway  
(PROPOSED)

Simongan Weir  
(EXISTING)

Pengilon Weir  
(EXISTING)

TO Dombo / Sayung River

Kedung Suren Dam  
(PROPOSED)

Babon Floodway  
(PROPOSED)

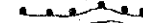



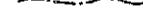

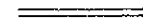
Jatibarang Dam  
(PROPOSED)

Pucang Gading Weir  
(EXISTING)

Mundingan Dam  
(PROPOSED)

Babon Dam  
(PROPOSED)

**LEGEND**

-  PROPOSED RIVER IMPROVEMENT SECTION
-  PROPOSED FLOODWAY
-  PROPOSED DAM SITE
-  STUDY AREA BOUNDARY
-  RIVER
-  MAIN ROAD
-  RAILWAY



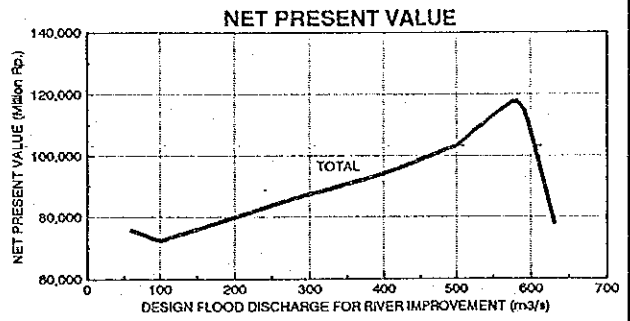
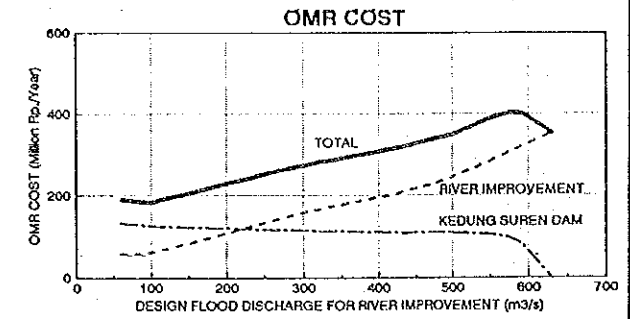
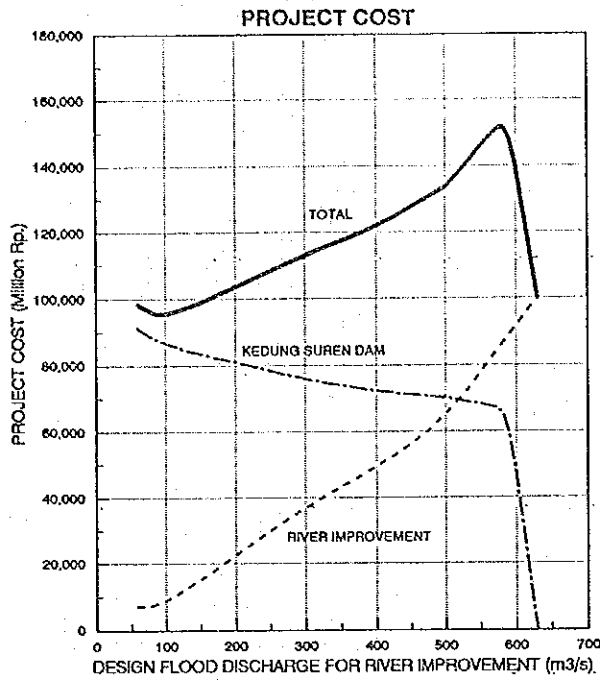
MT. UNGARAN  
(2.050 m)

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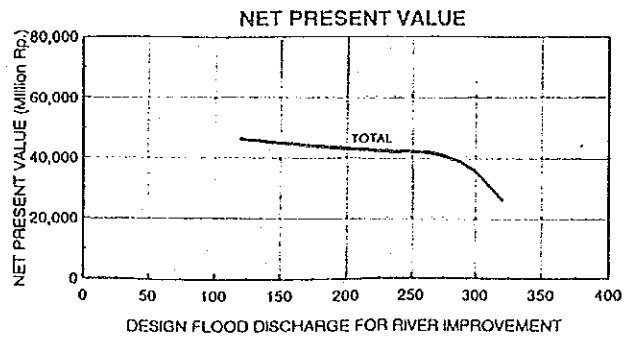
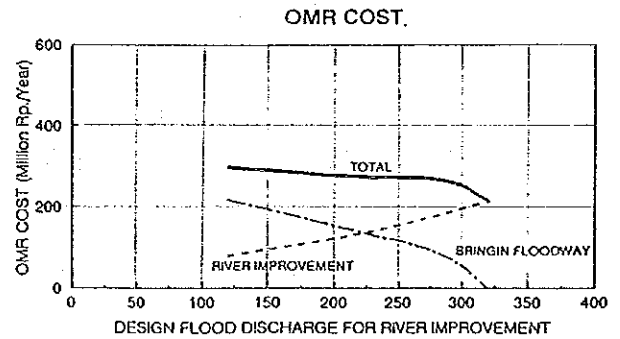
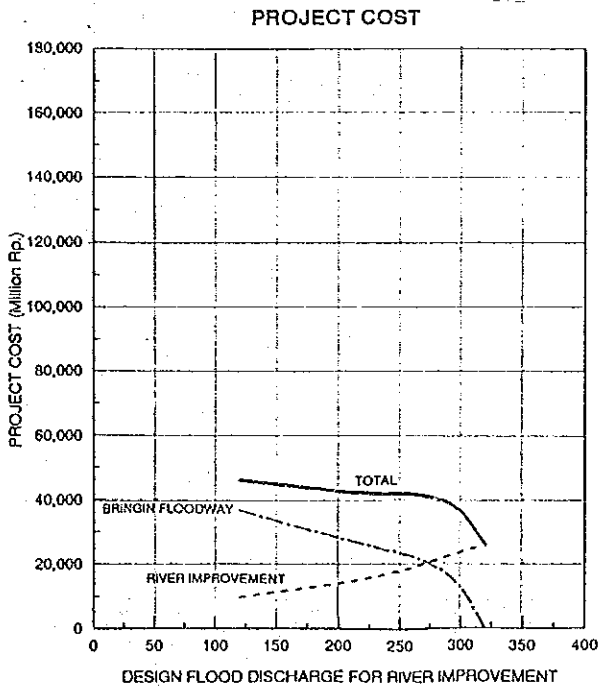
Fig. V.3.1  
OVERALL POSSIBLE FLOOD CONTROL MEASURES  
IN THE STUDY AREA



## BLORONG RIVER



## BRINGIN RIVER

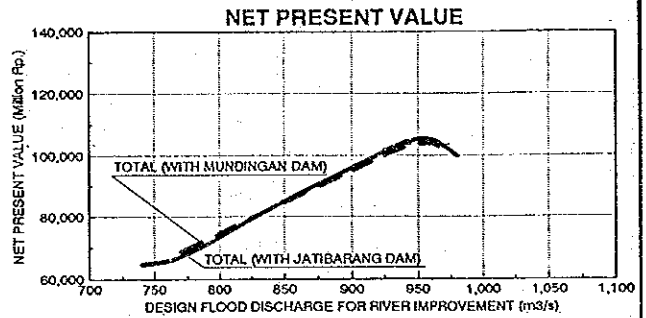
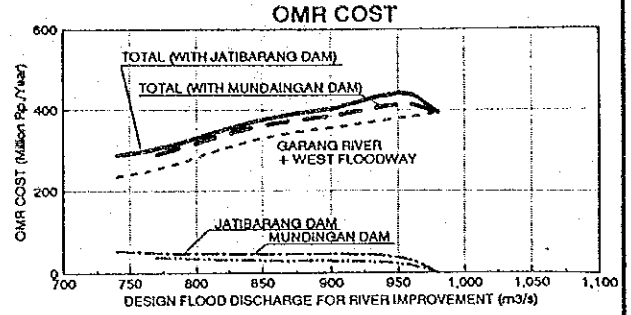
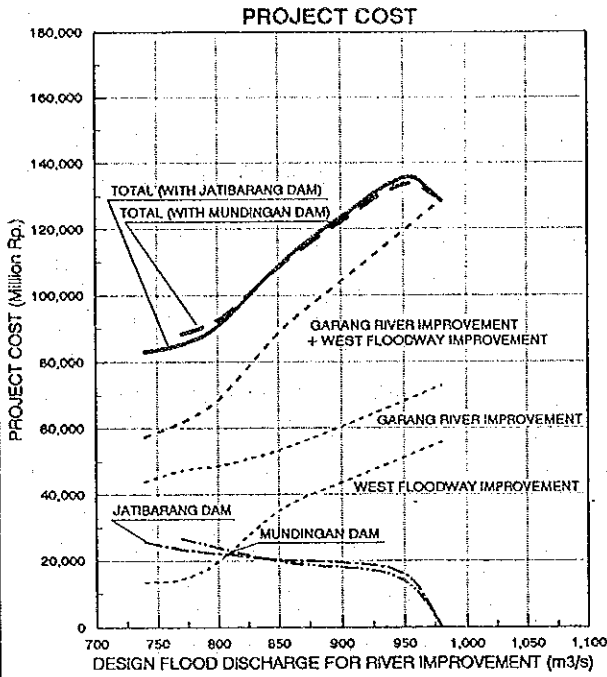


MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
JAPAN INTERNATIONAL COOPERATION AGENCY

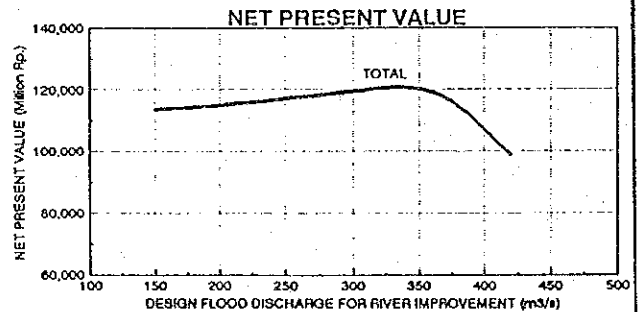
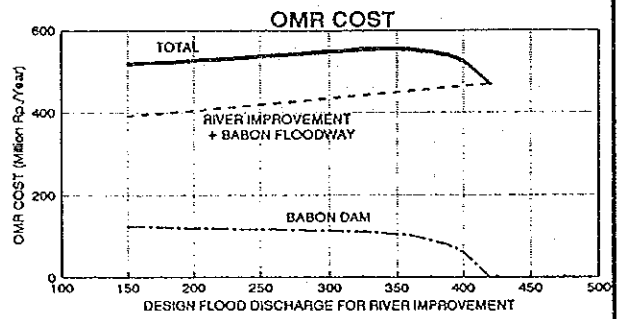
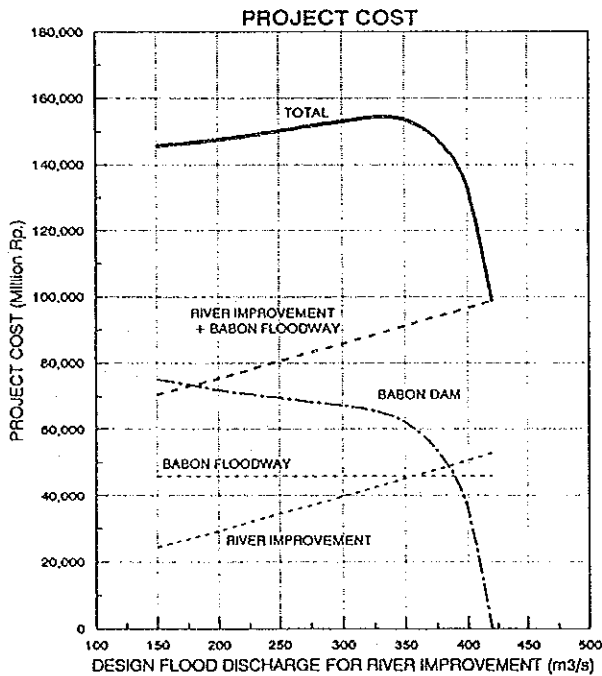
Fig. V.3.2 (1/2) COST COMPARISON OF ALTERNATIVE  
DESIGN FLOOD DISCHARGE AT OBJECTIVE  
RIVER IMPROVEMENT SECTION



## WEST FLOODWAY/GARANG RIVER



## BABON RIVER

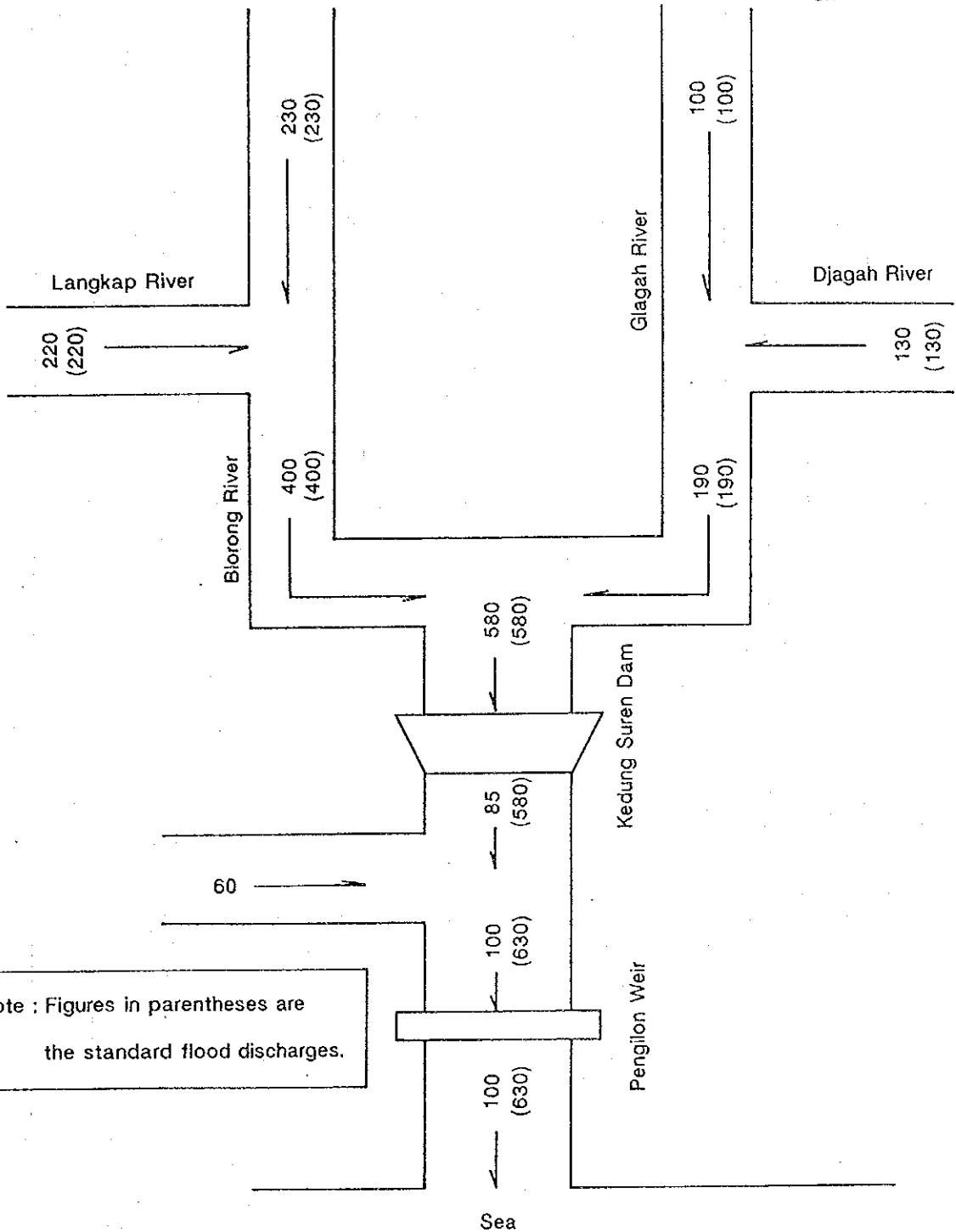


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FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.3.2 (2/2) COST COMPARISON OF ALTERNATIVE  
DESIGN FLOOD DISCHARGE AT OBJECTIVE  
RIVER IMPROVEMENT SECTION

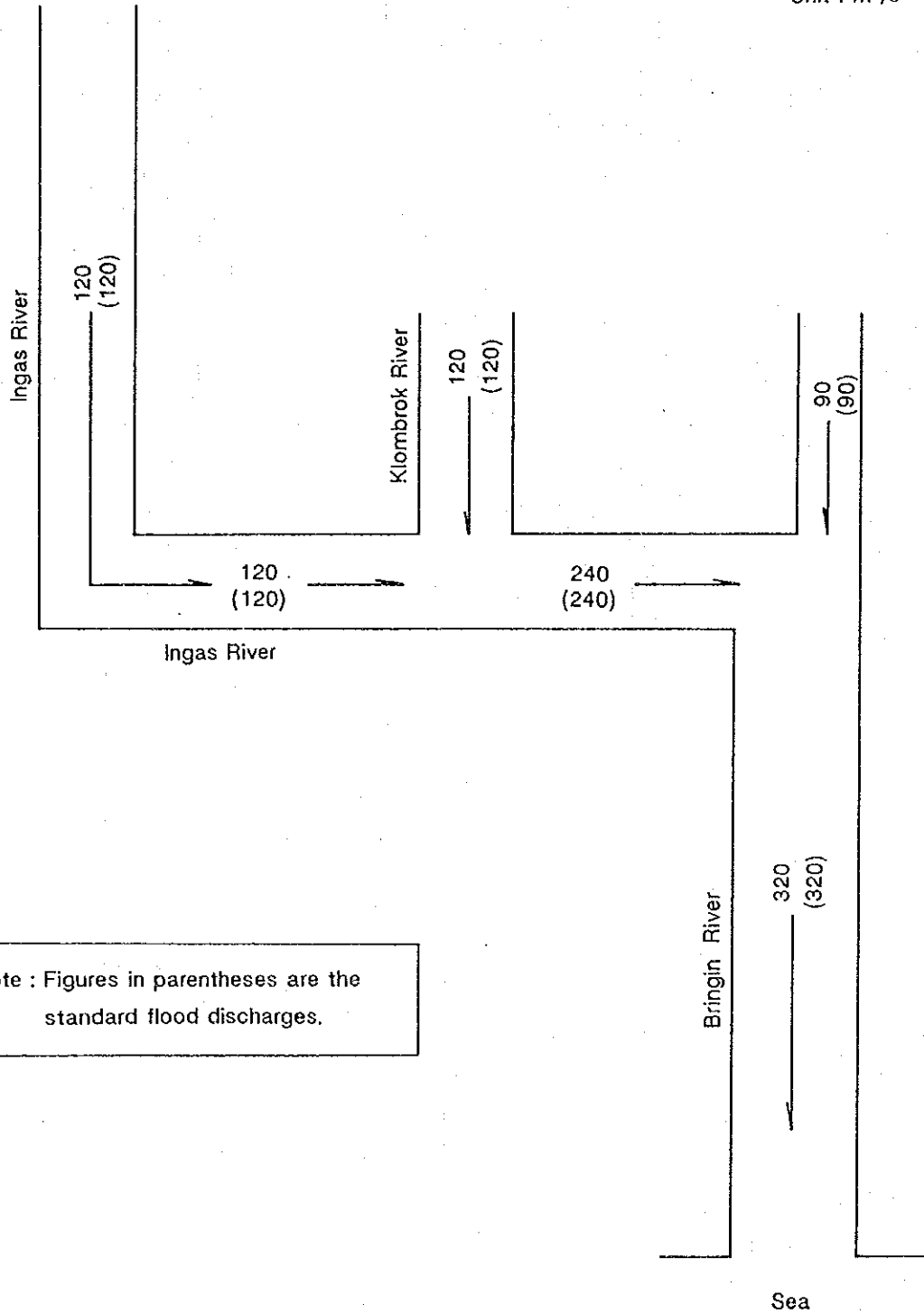
Design Scale : 20-Year Return Period

Unit : m<sup>3</sup>/s



Design Scale : 50-Year Return Period

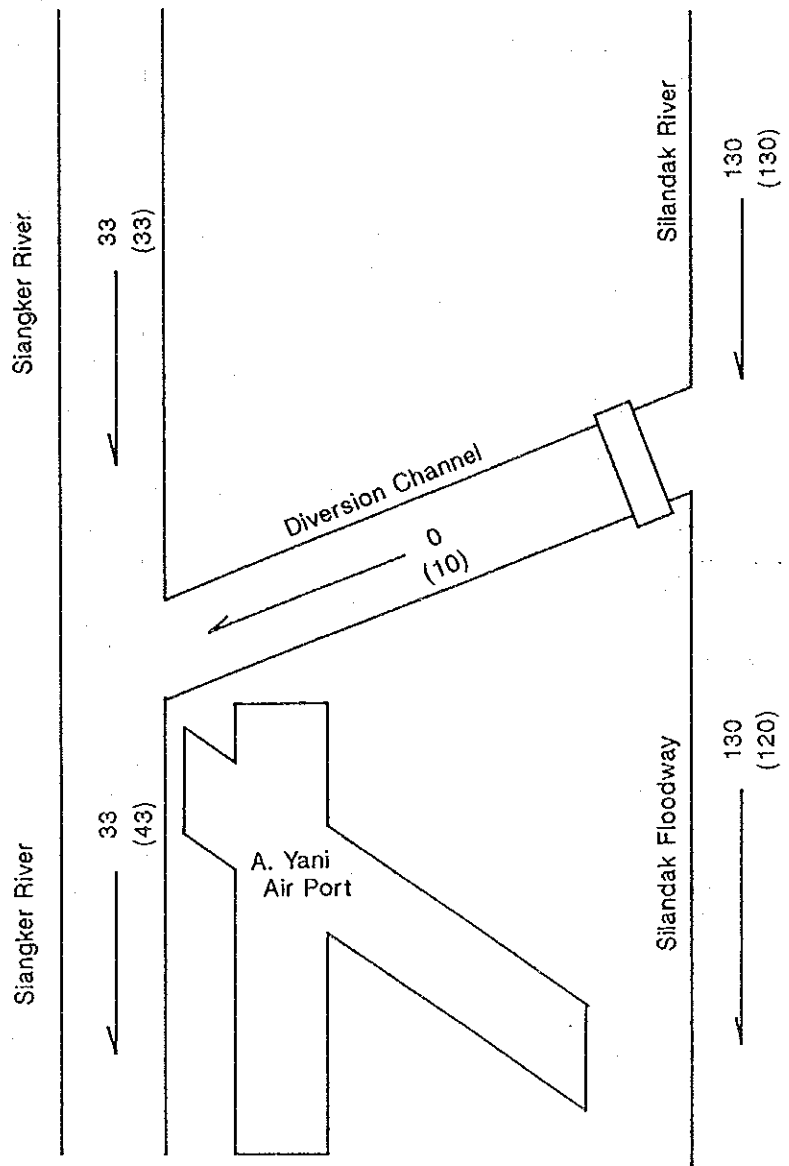
Unit : m<sup>3</sup>/s



Note : Figures in parentheses are the standard flood discharges.

Design Scale : 100-Year Return Period

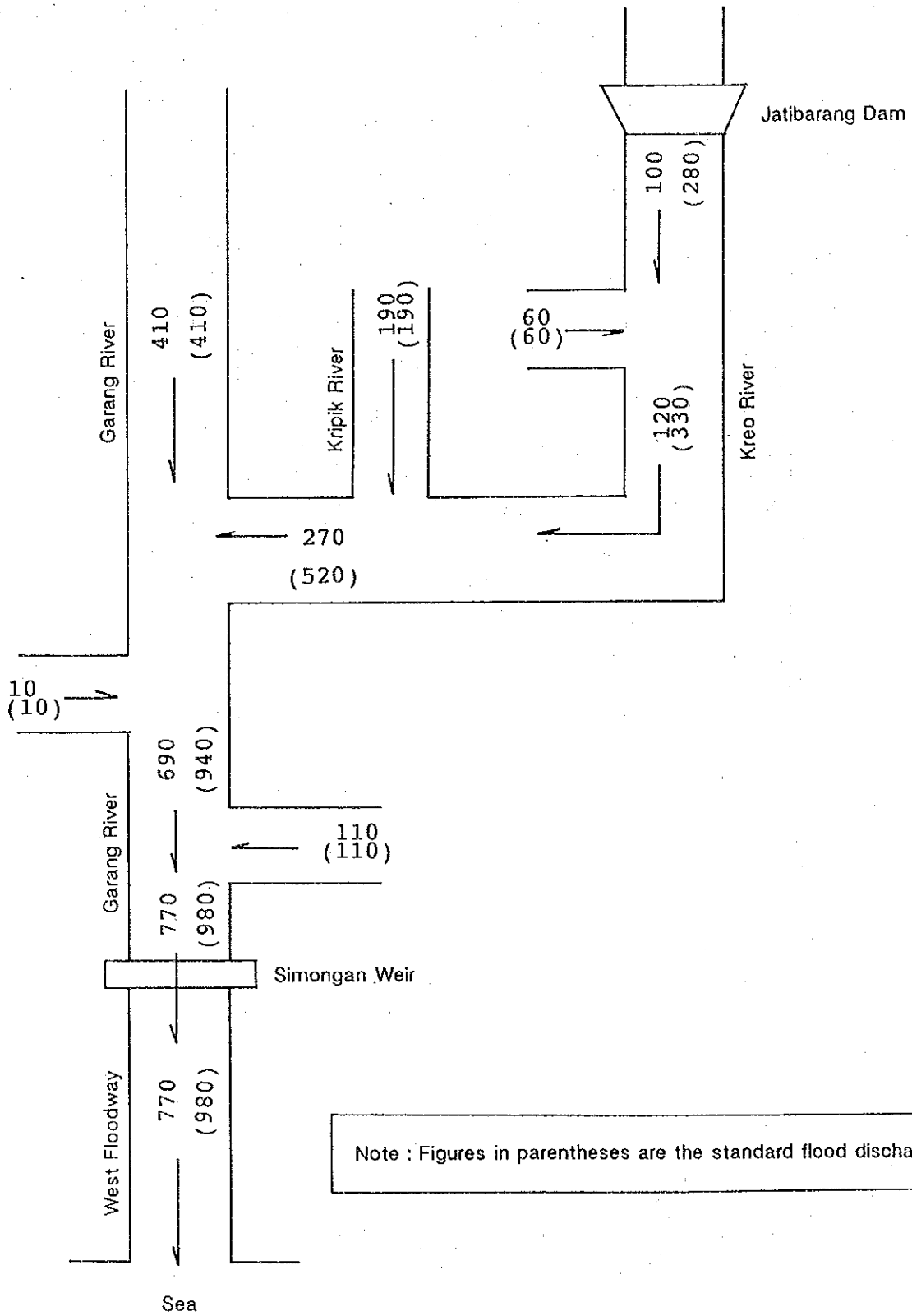
Unit : m<sup>3</sup>/s



Note : Figures in parentheses are the standard flood discharges.

Design Scale : 100-Year Return Period

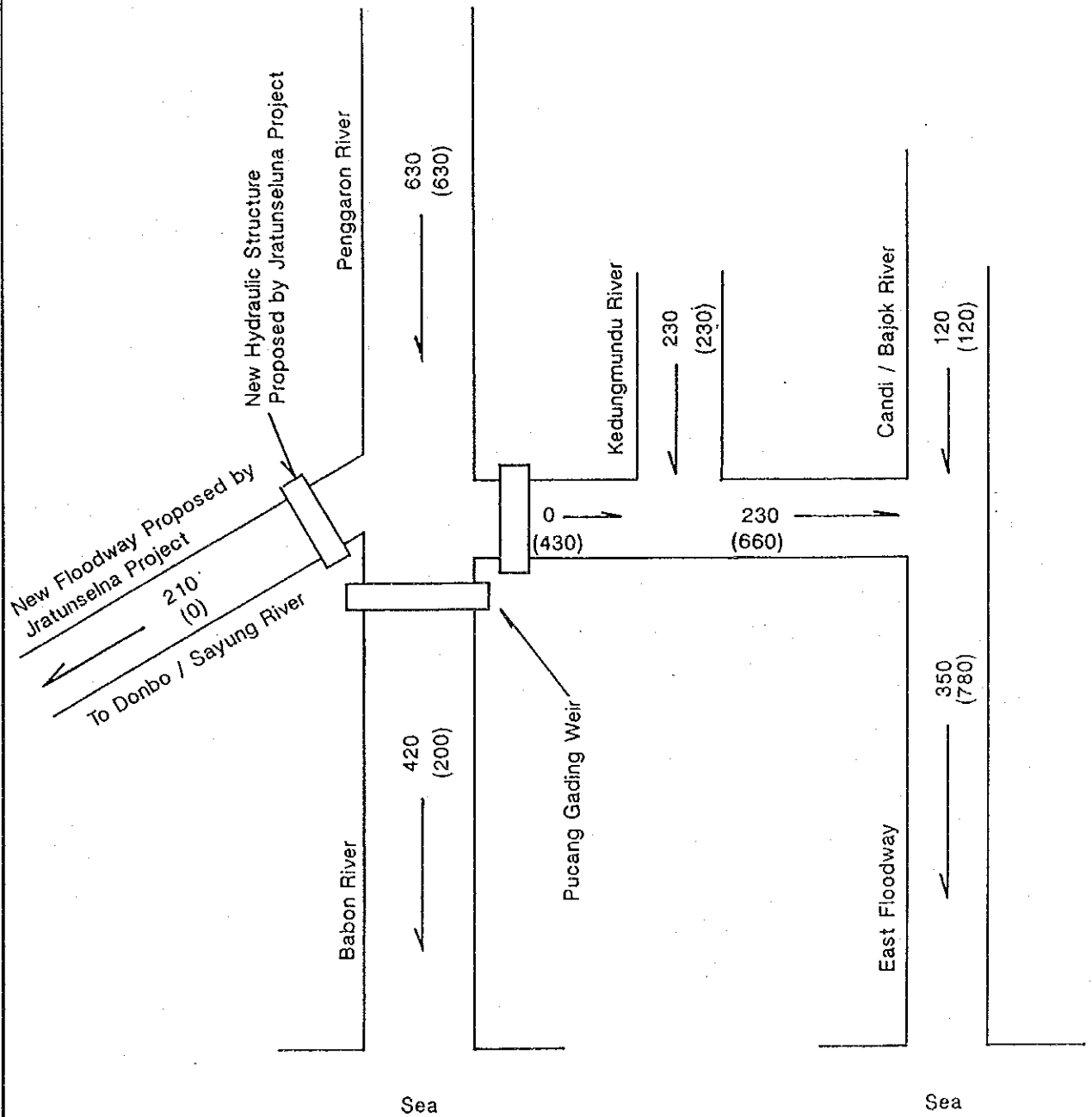
Unit : m<sup>3</sup>/s



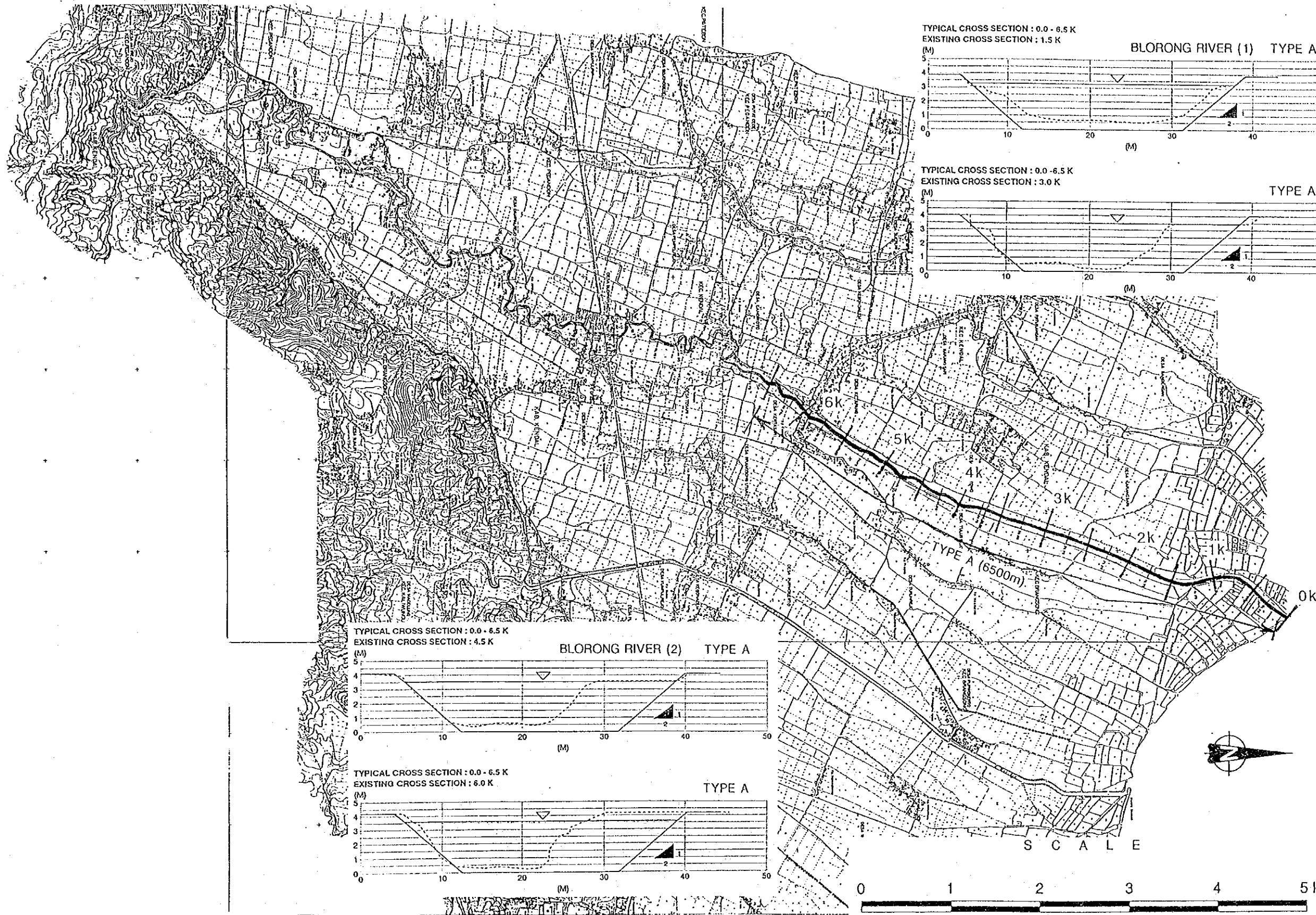
Note : Figures in parentheses are the standard flood discharges

Design Scale : 50 - Year Return Period

Unit : m<sup>3</sup>/s

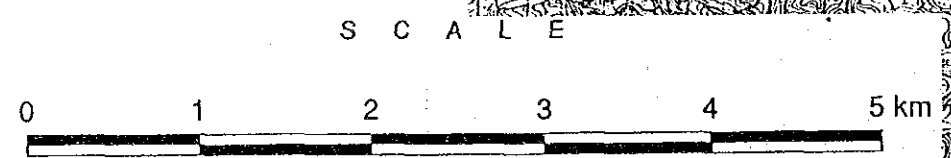
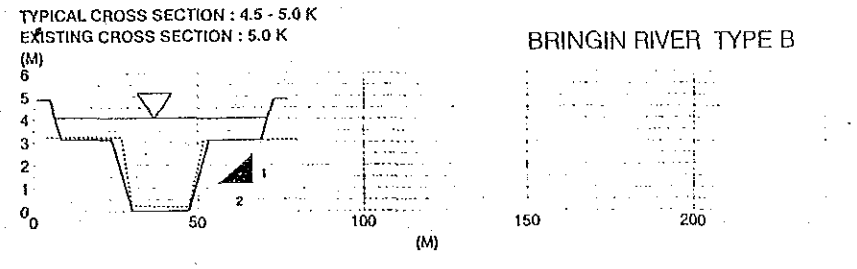
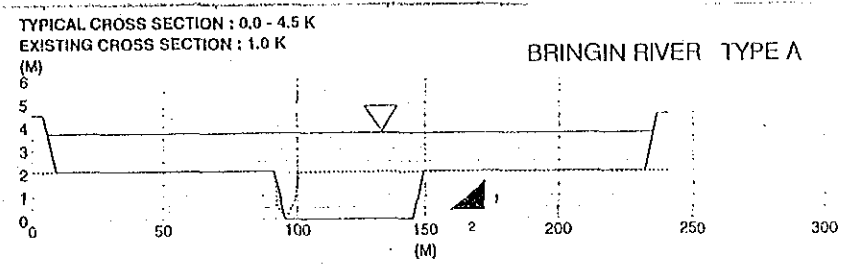
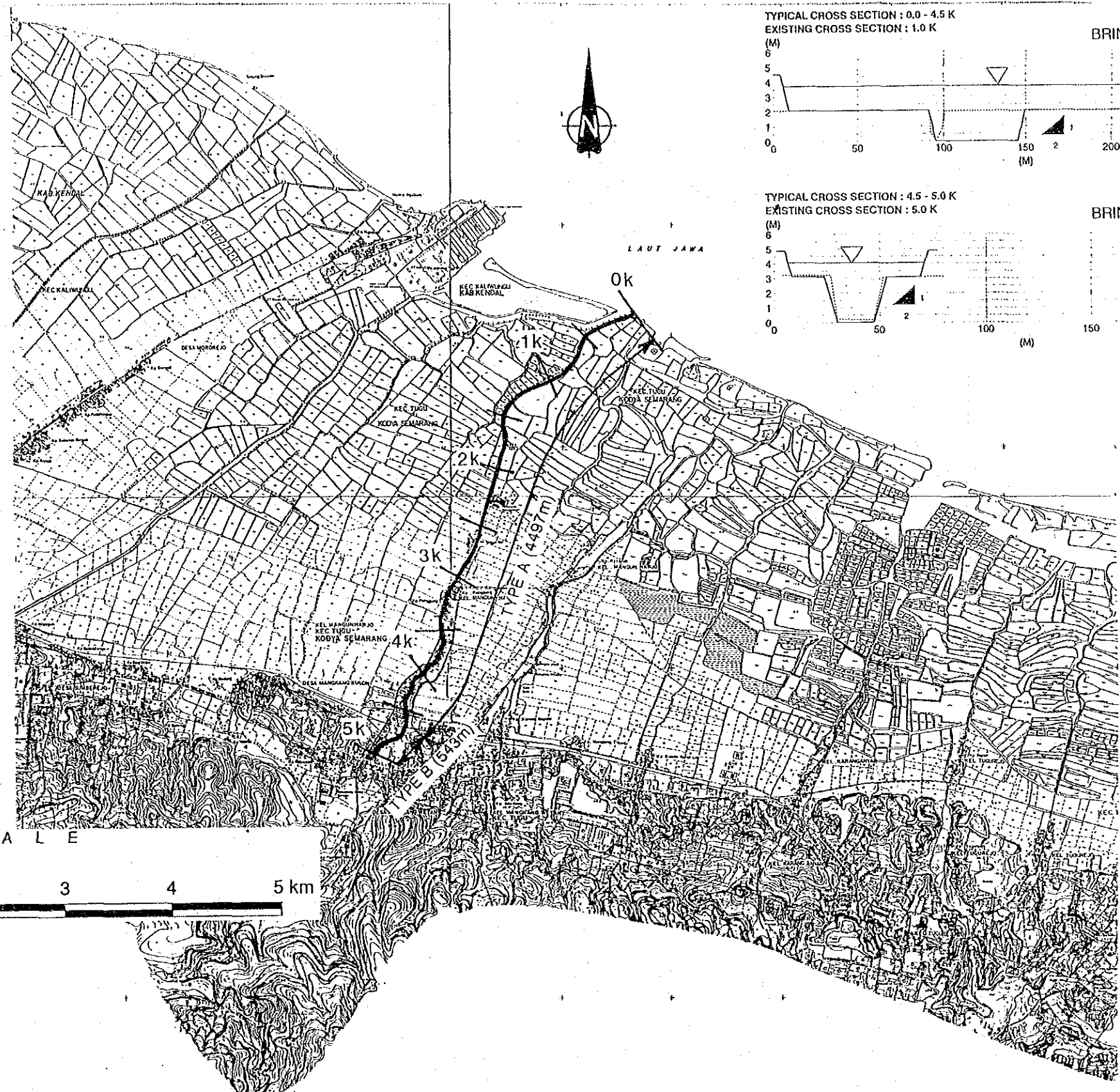


Note : Figures in Parentheses are the standard flood discharge



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Fig. V.3.4 (1/4) PROPOSED TYPICAL CROSS SECTION FOR  
 OPTIMUM RIVER IMPROVEMENT PLAN  
 (BLORONG RIVER)

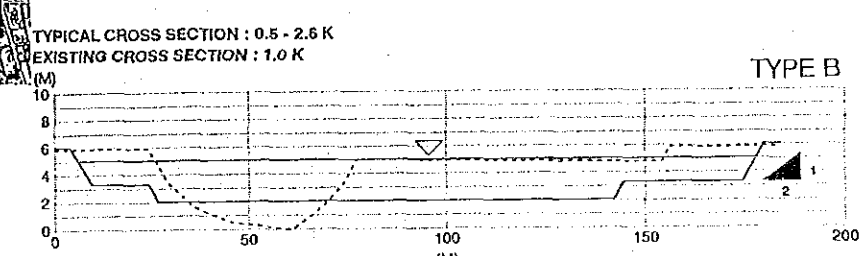
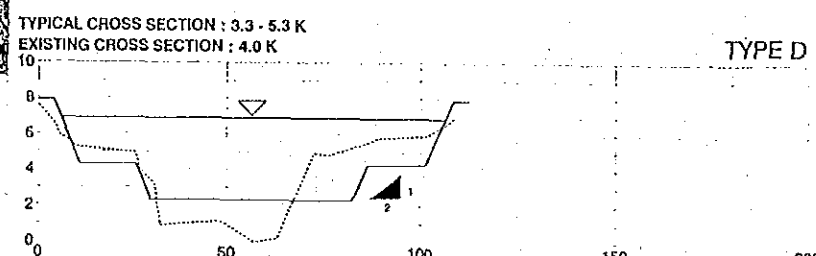
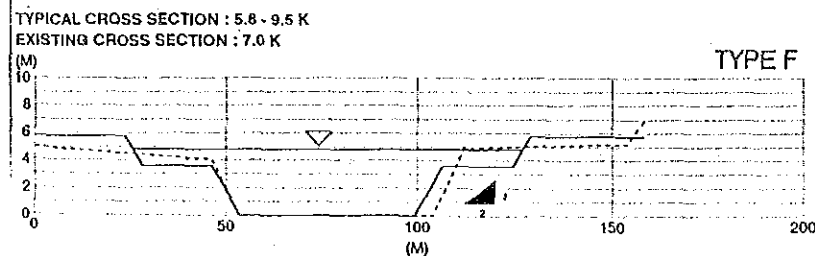
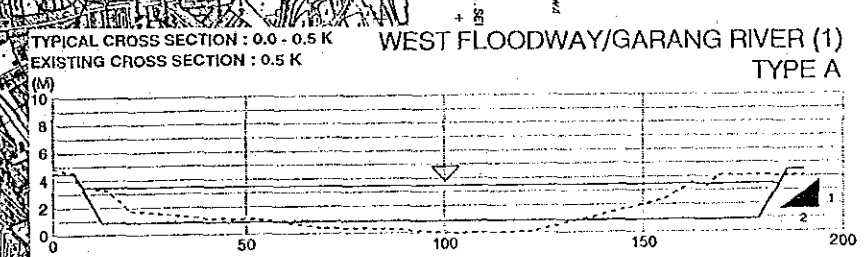
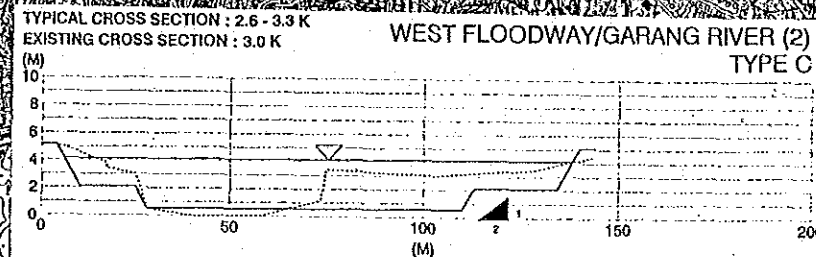
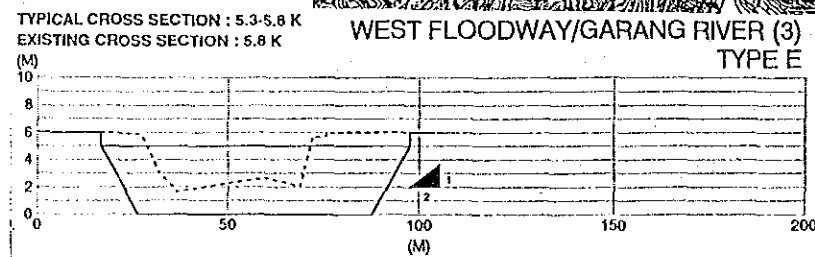
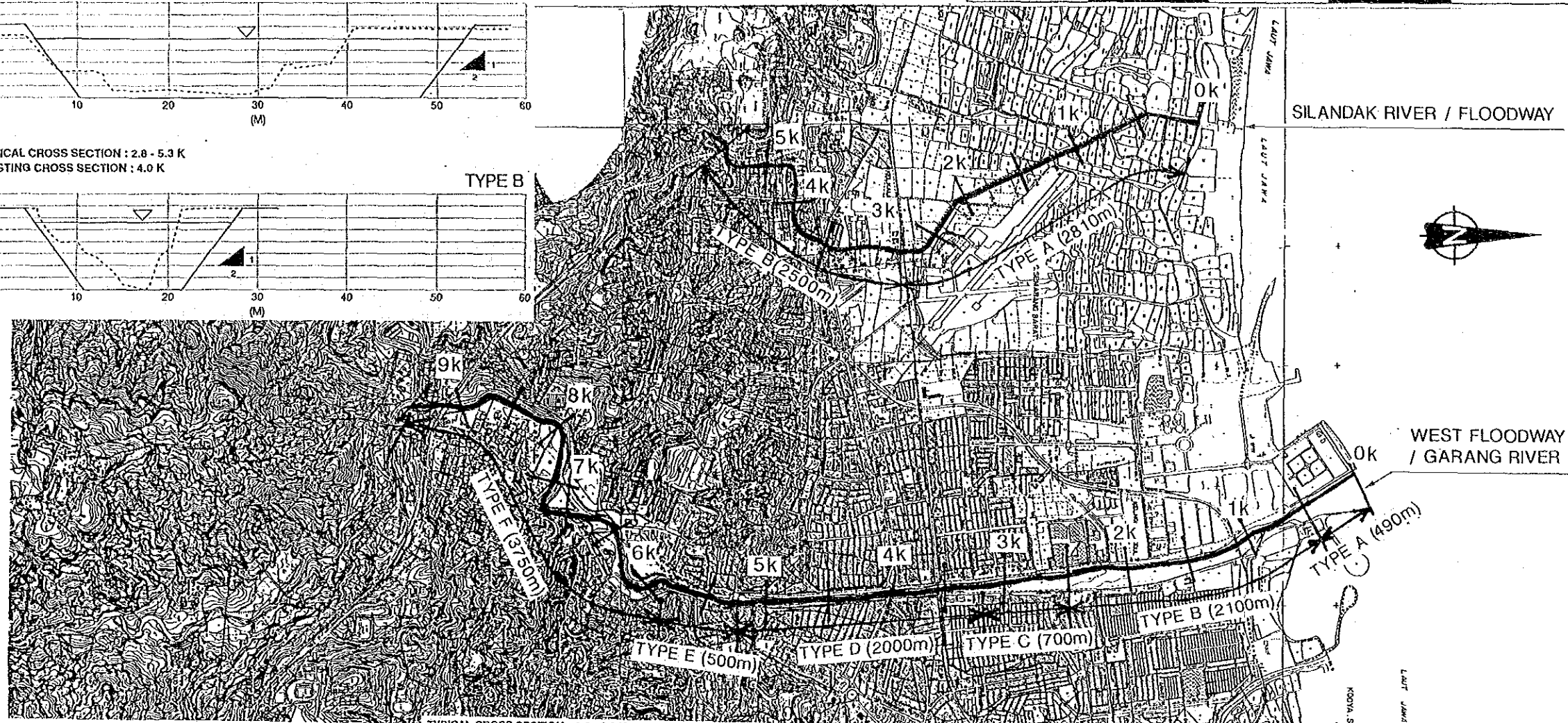
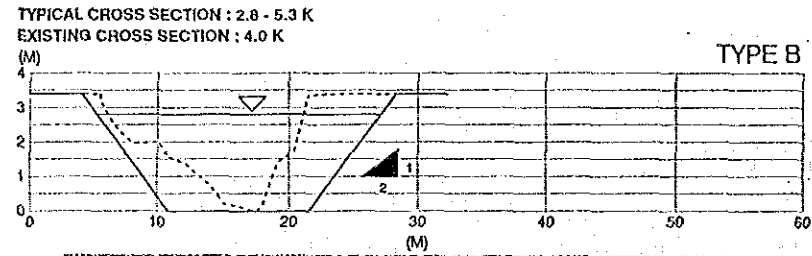
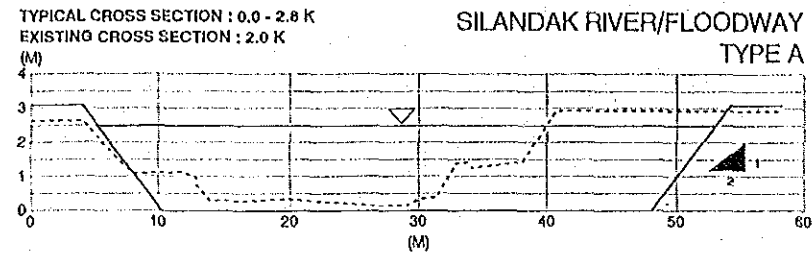


MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V.3.4 (2/4) PROPOSED TYPICAL CROSS SECTION  
FOR OPTIMUM RIVER IMPROVEMENT  
PLAN (BRINGIN RIVER)

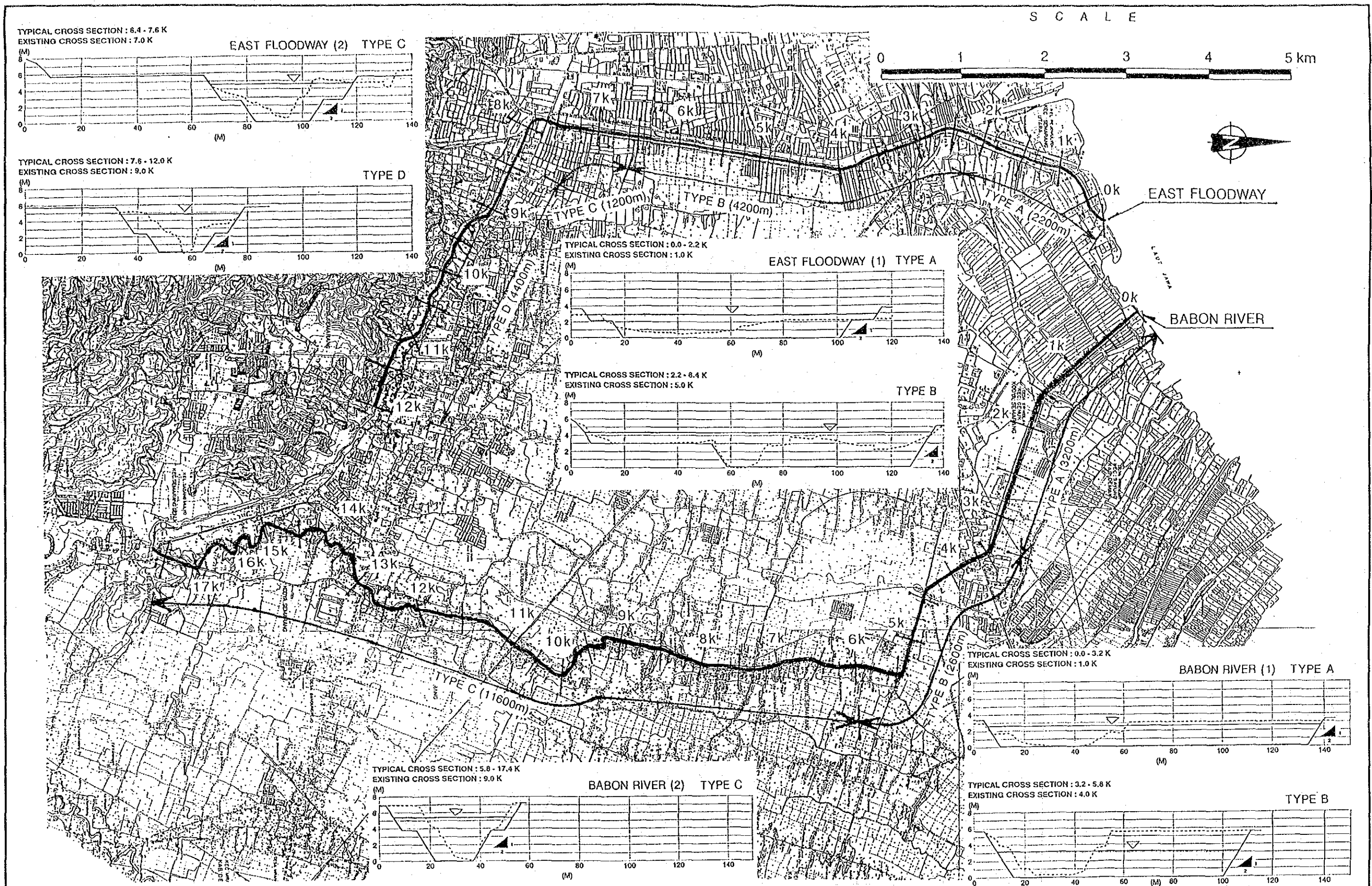


SCALE



MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.3.4 (3/4) PROPOSED TYPICAL CROSS SECTION  
FOR OPTIMUM RIVER IMPROVEMENT  
PLAN (SILANDAK RIVER AND WEST  
FLOODWAY/GARANG RIVER)

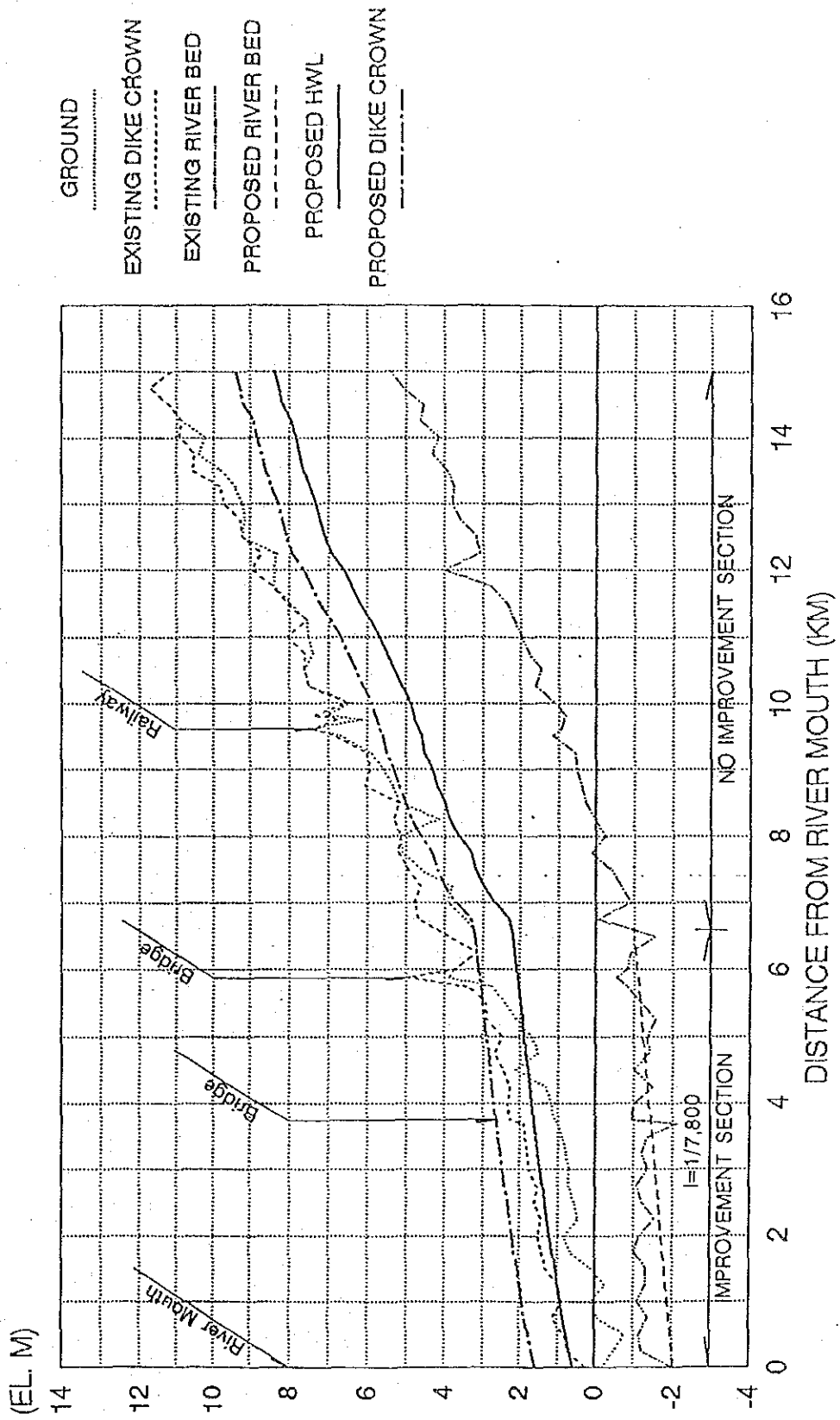


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 FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.3.4 (4/4) : PROPOSED TYPICAL CROSS SECTION FOR  
 OPTIMUM RIVER IMPROVEMENT PLAN  
 (EAST FLOODWAY AND BABON RIVER)



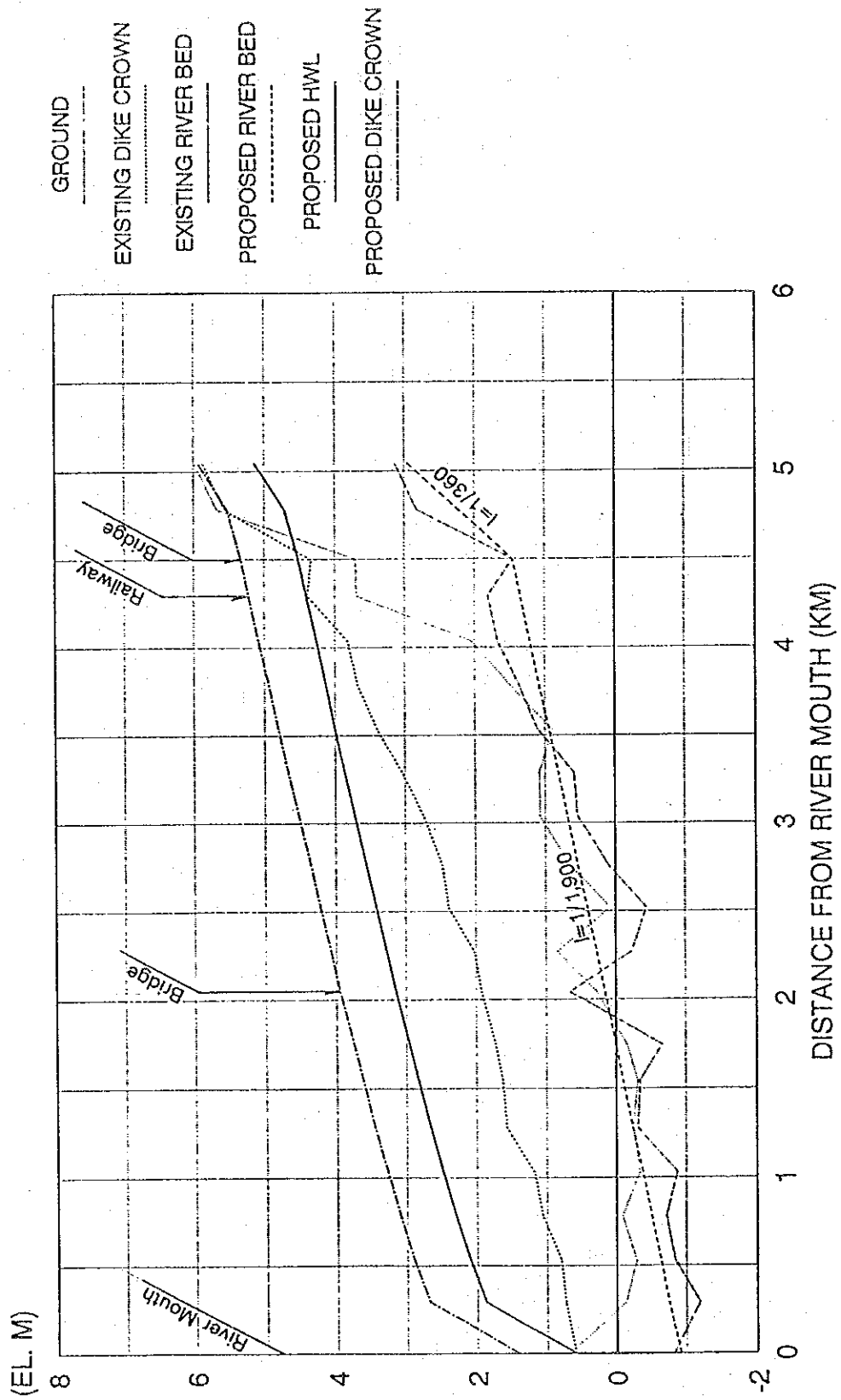
# BLORONG RIVER



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 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.3.5 (1/7) PROPOSED LONGITUDINAL PROFILE FOR  
 OPTIMUM RIVER IMPROVEMENT PLAN  
 (BLORONG RIVER)

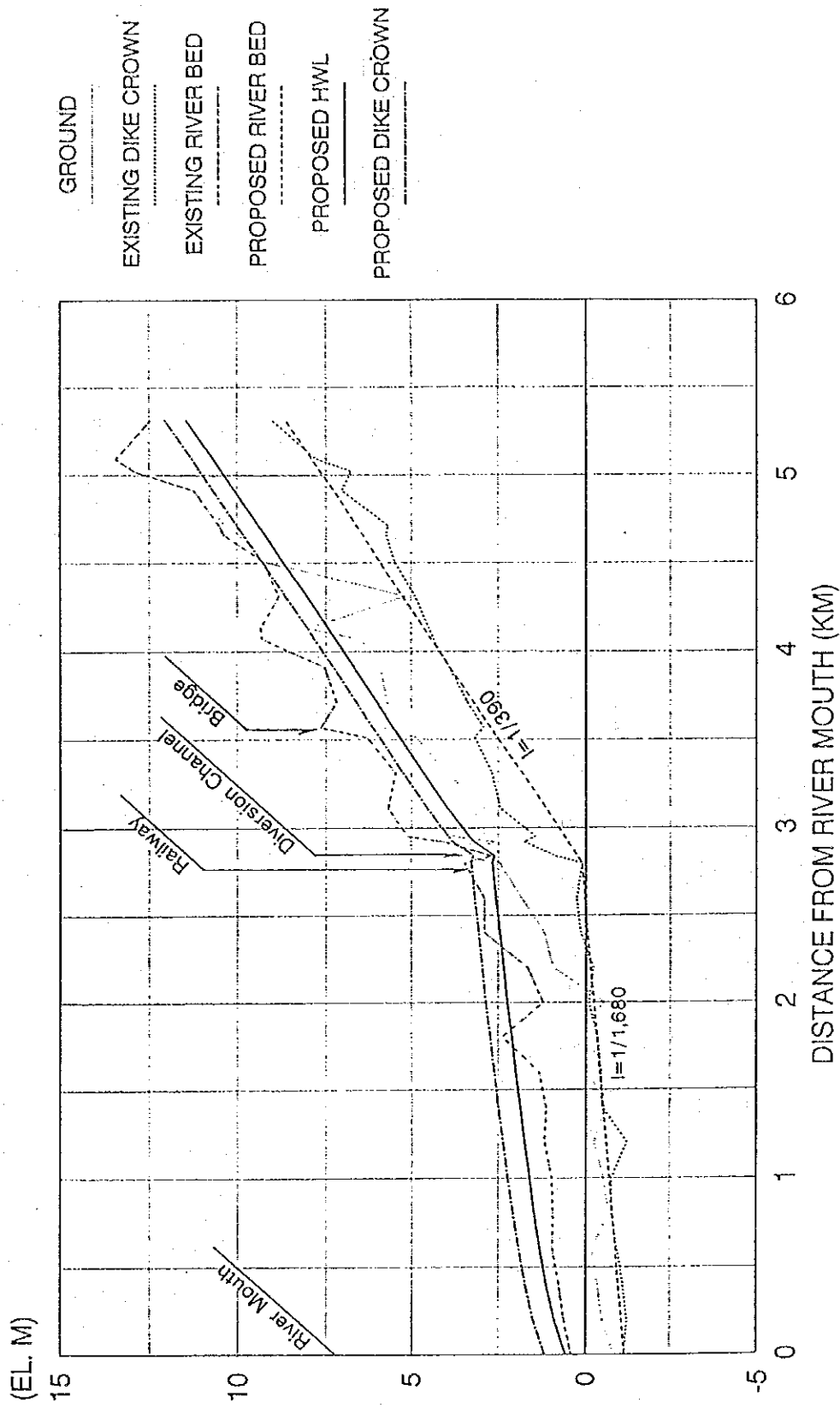
BRINGIN RIVER



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 FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.3.5 (2/7) PROPOSED LONGITUDINAL PROFILE FOR  
 OPTIMUM RIVER IMPROVEMENT PLAN  
 (BRINGIN FLOODWAY)

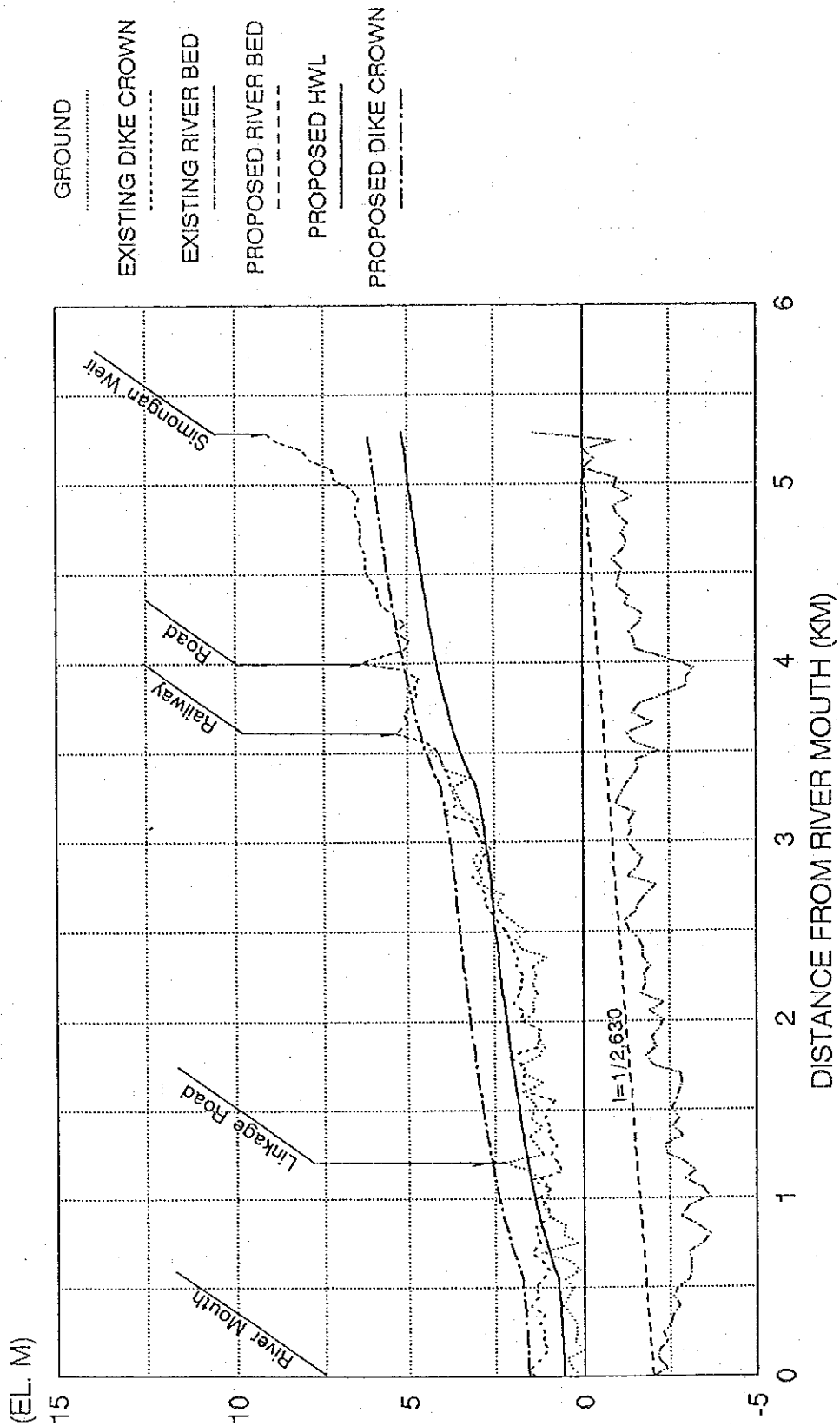
SILANDAK RIVER/FLOODWAY



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 FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
 JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V.3.5 (3/7) PROPOSED LONGITUDINAL PROFILE FOR  
 OPTIMUM RIVER IMPROVEMENT PLAN  
 (SILANDAK RIVER)

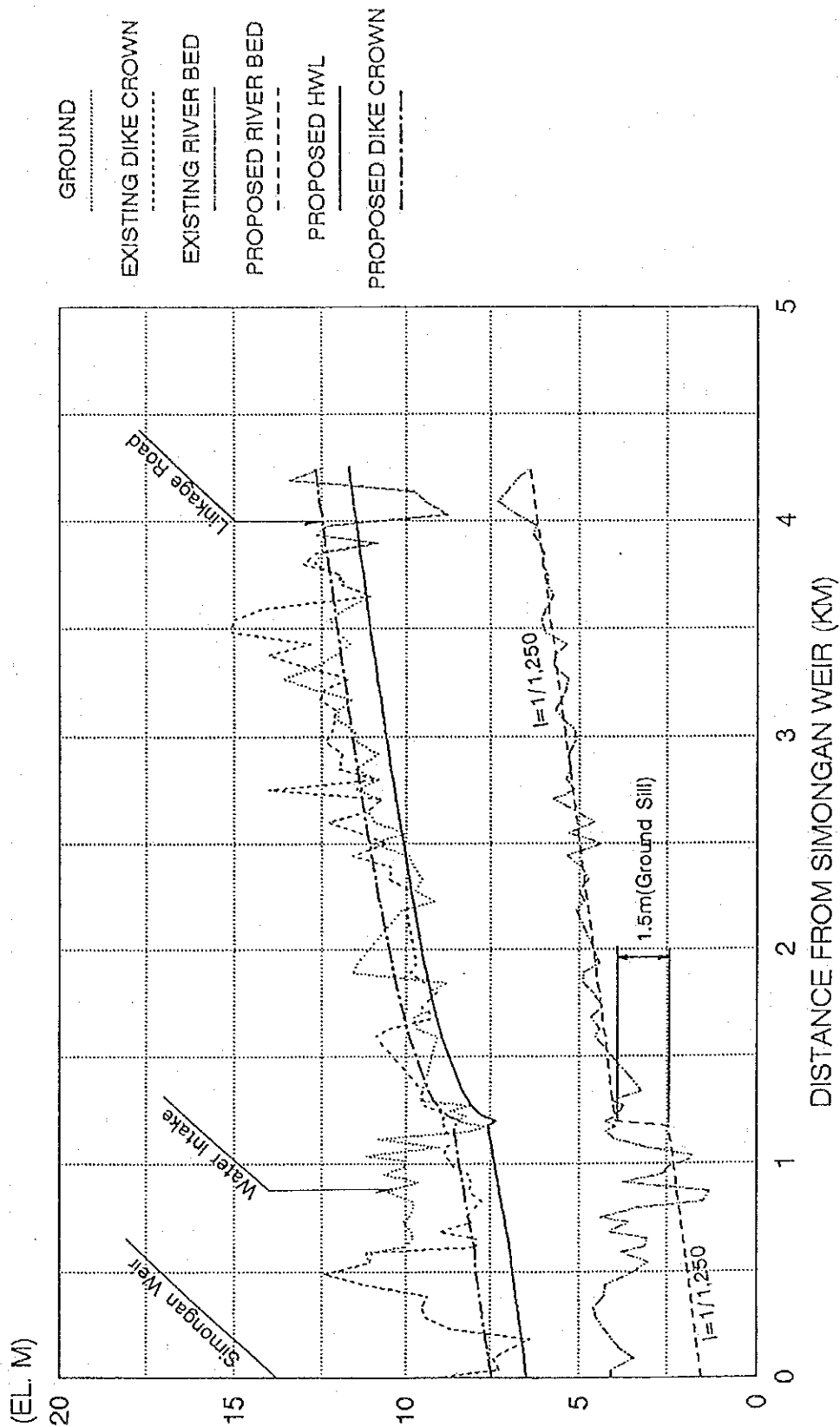
WEST FLOODWAY



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FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.3.5 (4/7); PROPOSED LONGITUDINAL PROFILE FOR  
OPTIMUM RIVER IMPROVEMENT PLAN  
(WEST FLOODWAY)

# GARANG RIVER

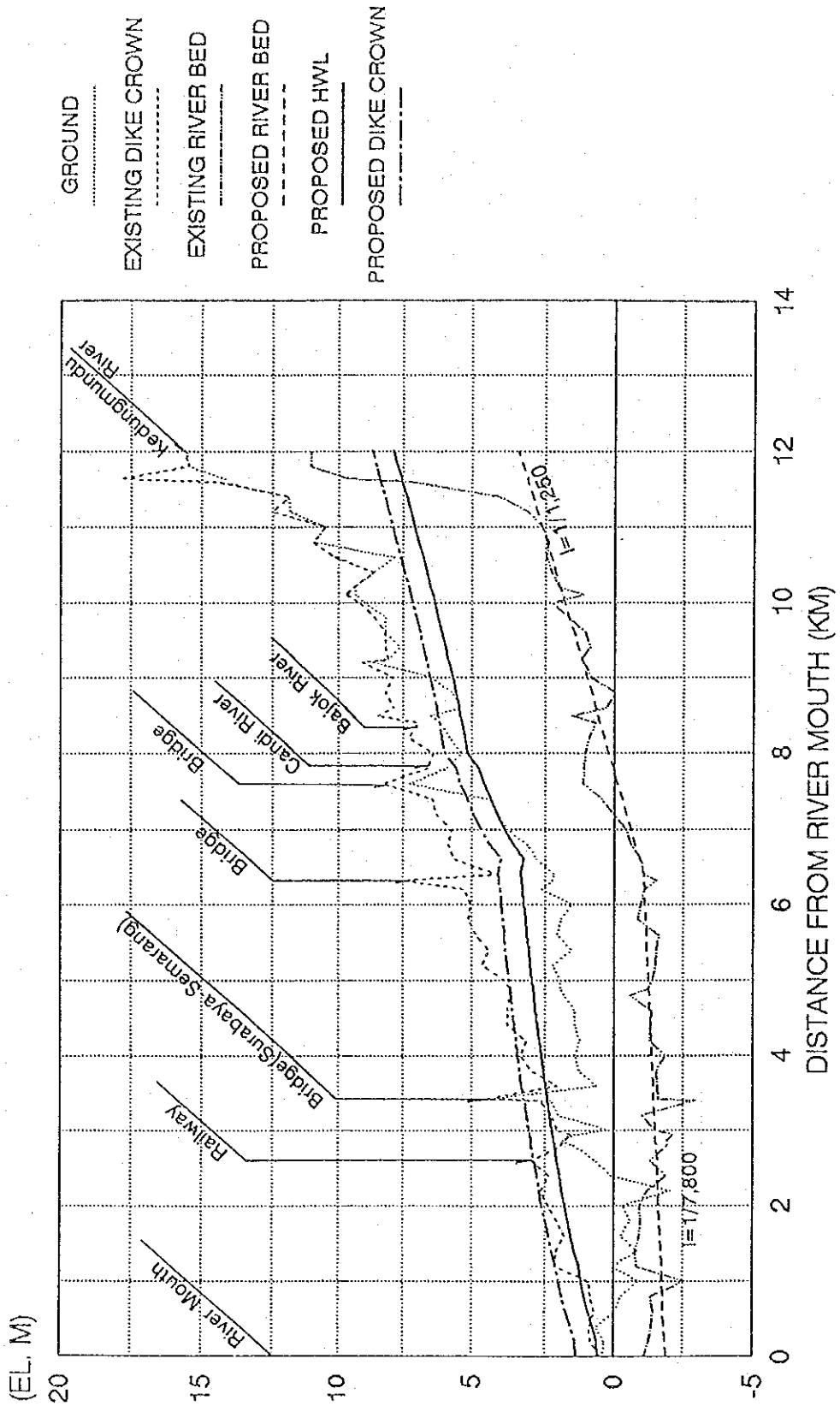


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 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.3.5. (5/7) PROPOSED LONGITUDINAL PROFILE FOR  
 OPTIMUM RIVER IMPROVEMENT PLAN  
 (GARANG RIVER)



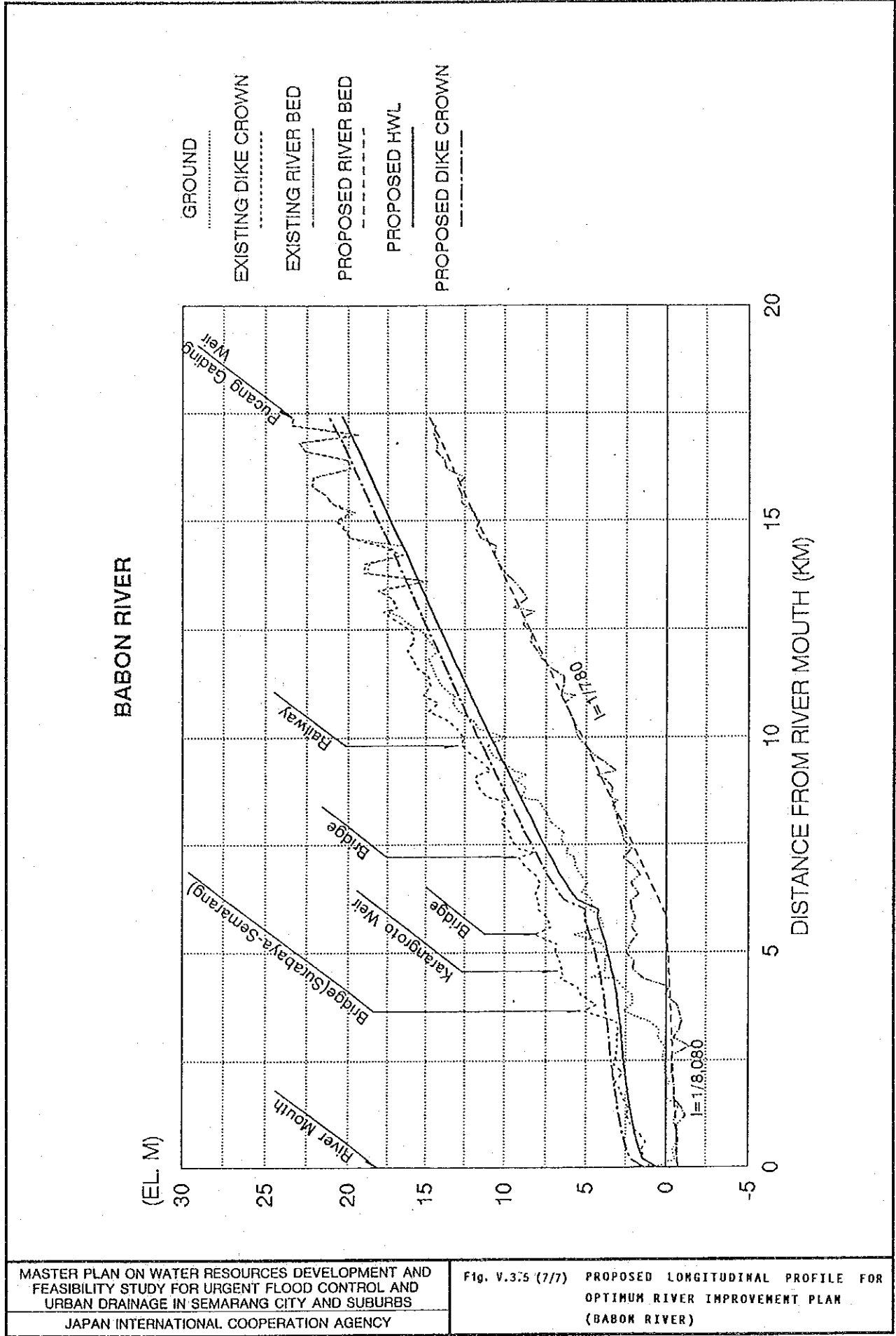
EAST FLOODWAY



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FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.3.5 (6/7)

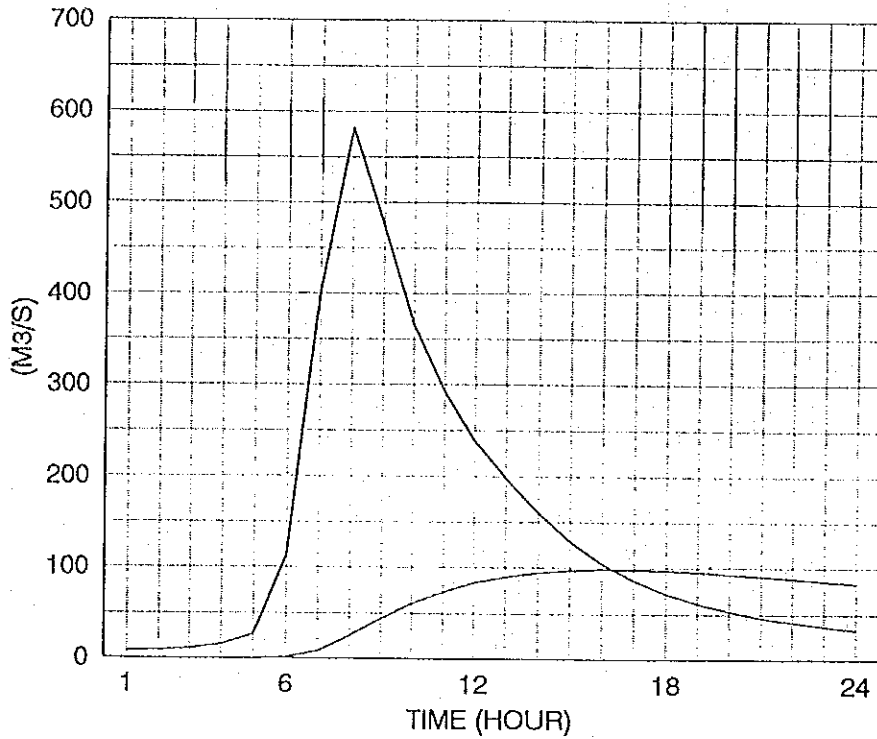
PROPOSED LONGITUDINAL PROFILE FOR  
OPTIMUM RIVER IMPROVEMENT PLAN  
(EAST FLOODWAY)



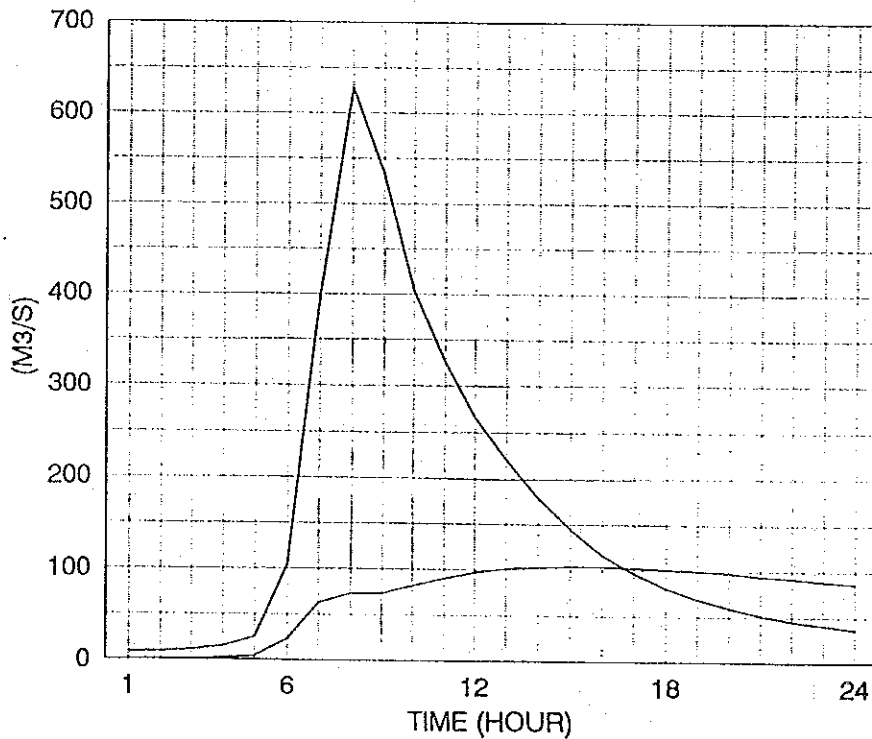
MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
 FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.3:5 (7/7) PROPOSED LONGITUDINAL PROFILE FOR  
 OPTIMUM RIVER IMPROVEMENT PLAN  
 (BABON RIVER)

DAM INFLOW AND OUTFLOW DISCHARGE



STANDARD AND DESIGN FLOOD DISCHARGE ON THE DOWNSTREAM RIVER IMPROVEMENT STRETCH

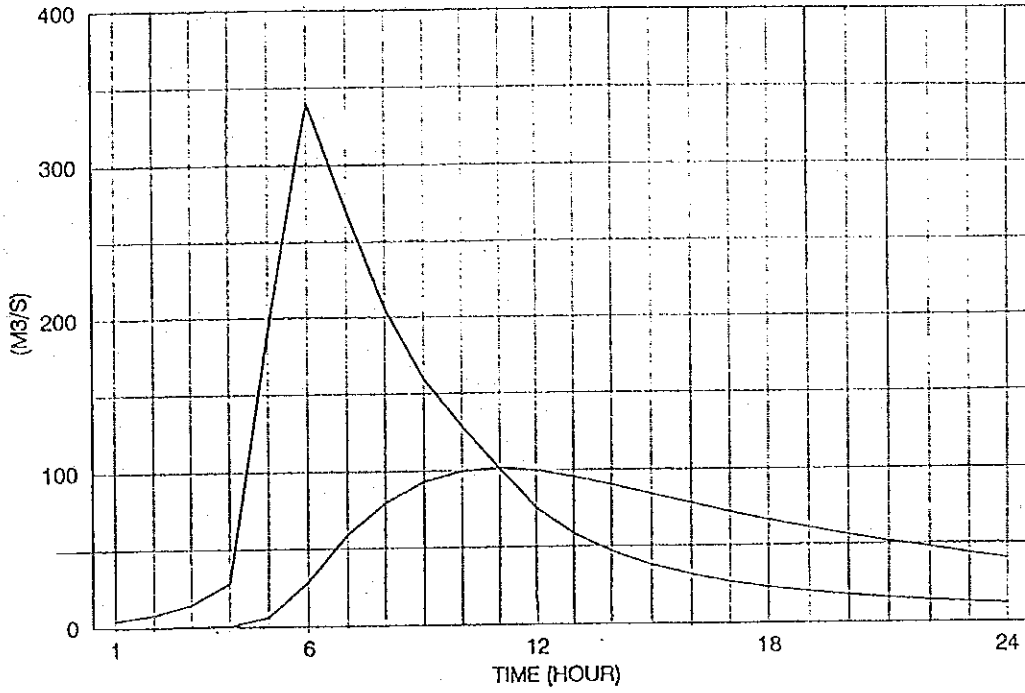


MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
JAPAN INTERNATIONAL COOPERATION AGENCY

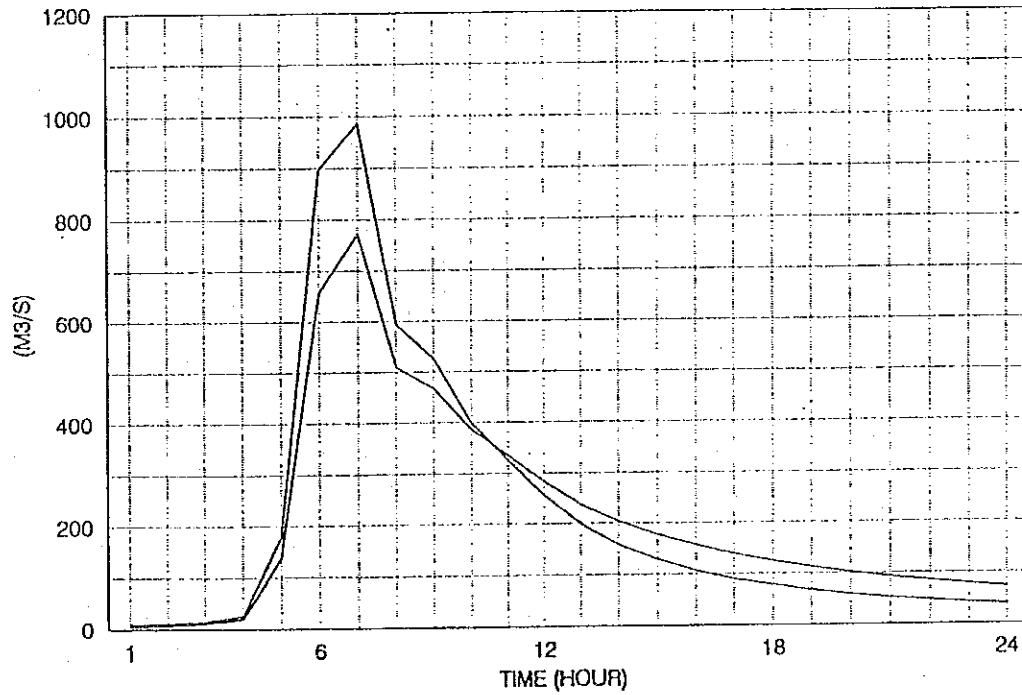
Fig. V.3.6 (1/2)

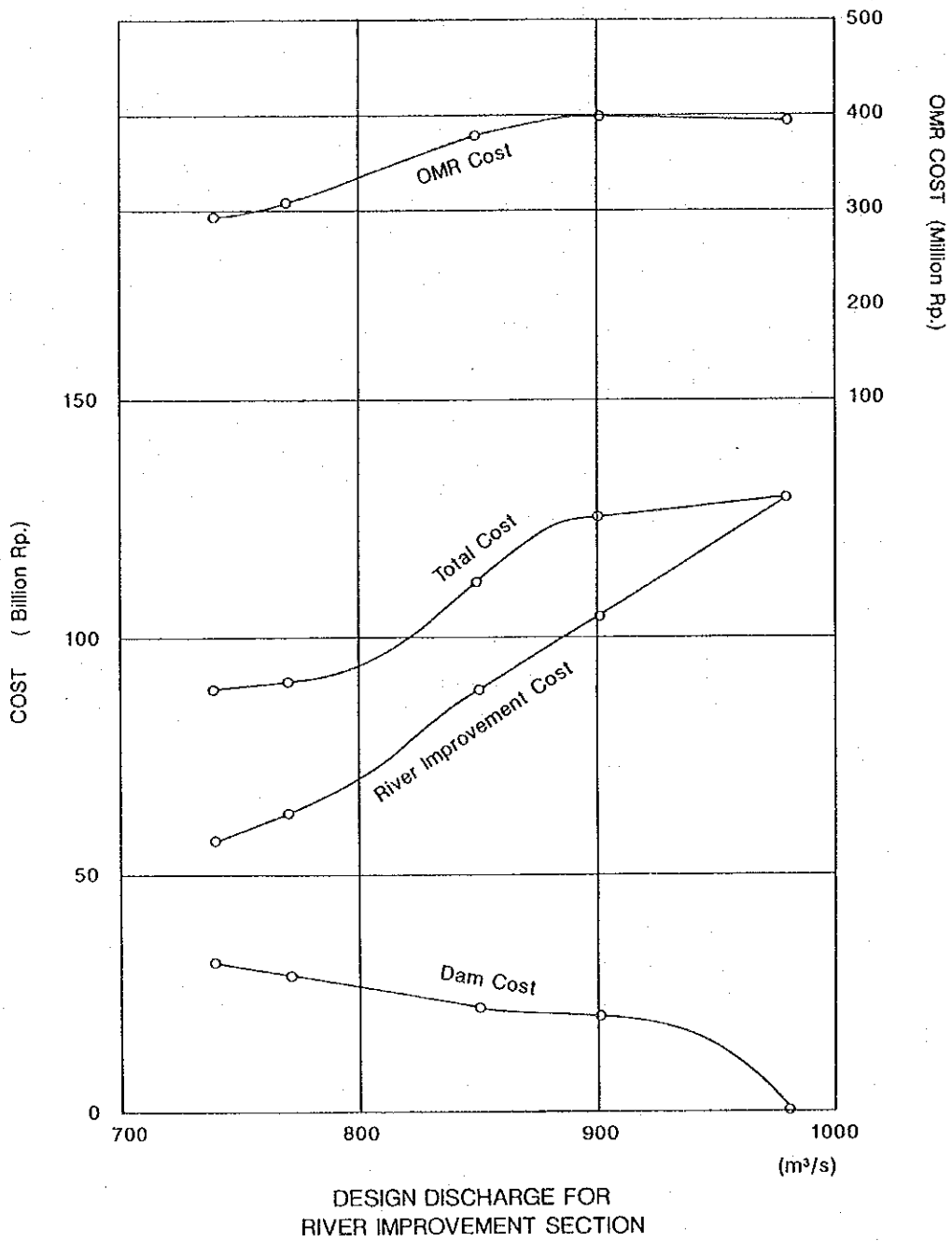
**FLOOD CONTROL EFFECT BY  
PROPOSED DAM  
(KEDUNG SUREN DAM)**

DAM INFLOW AND OUTFLOW DISCHARGE



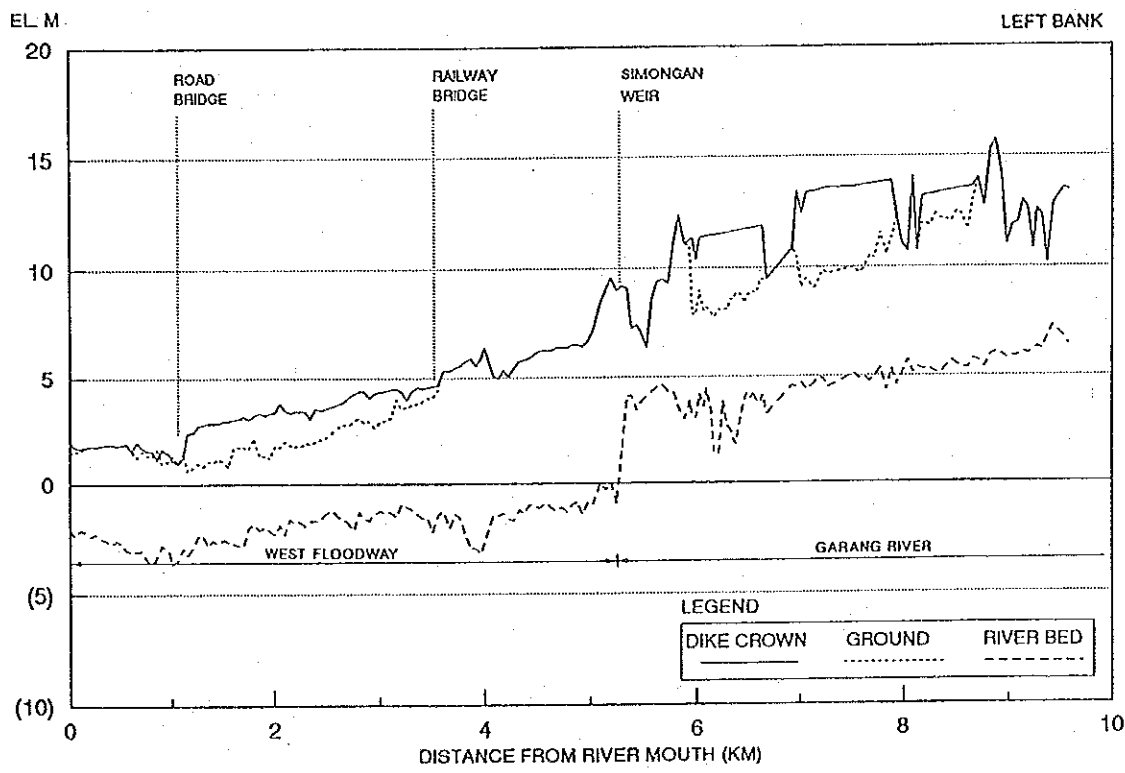
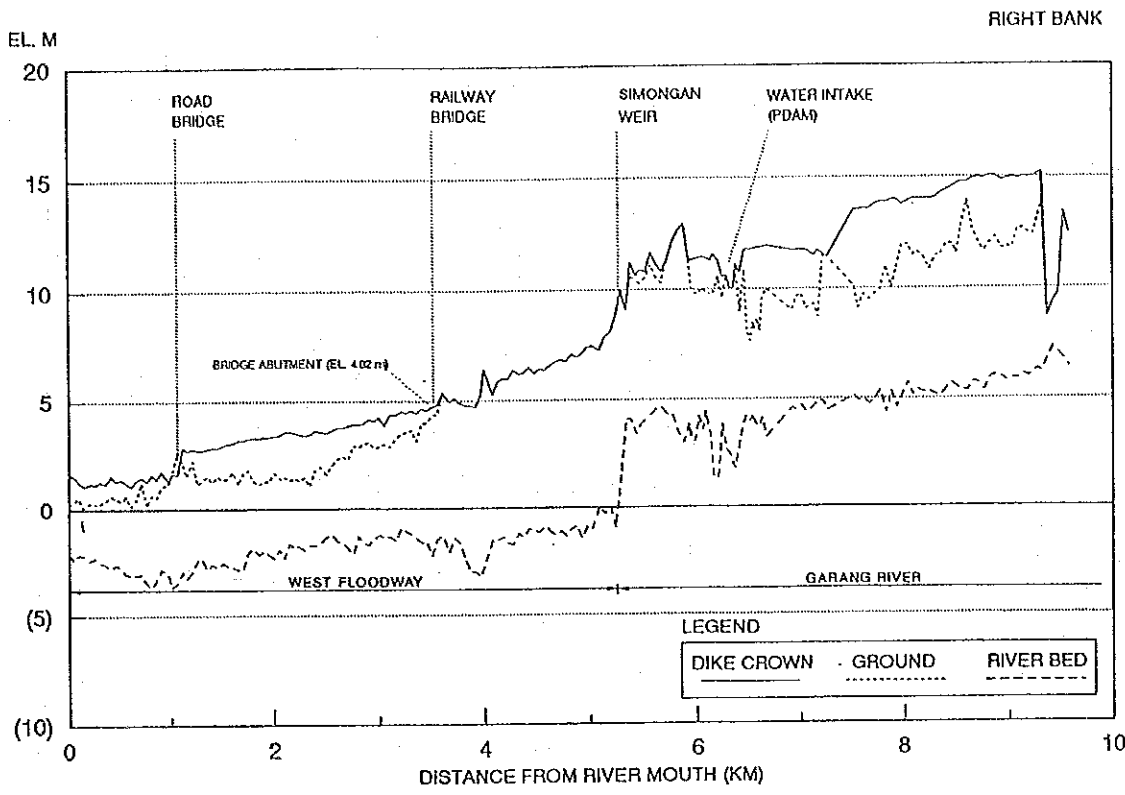
STANDARD AND DESIGN FLOOD DISCHARGE ON THE DOWNSTREAM RIVER IMPROVEMENT STRETCH





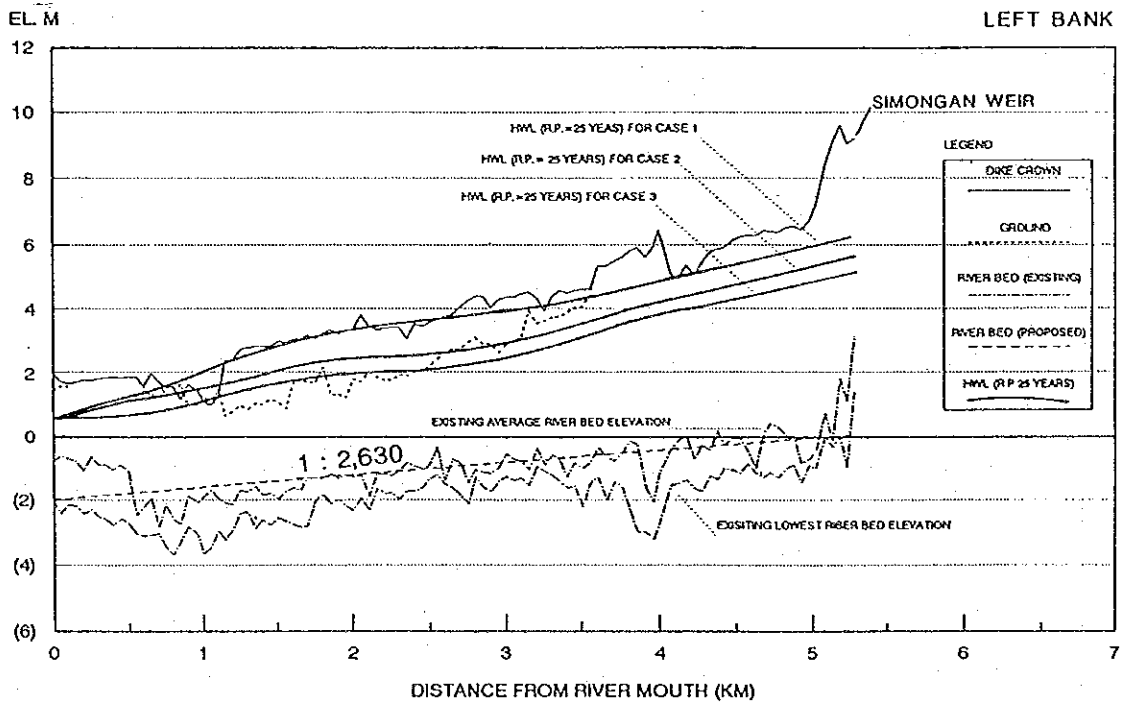
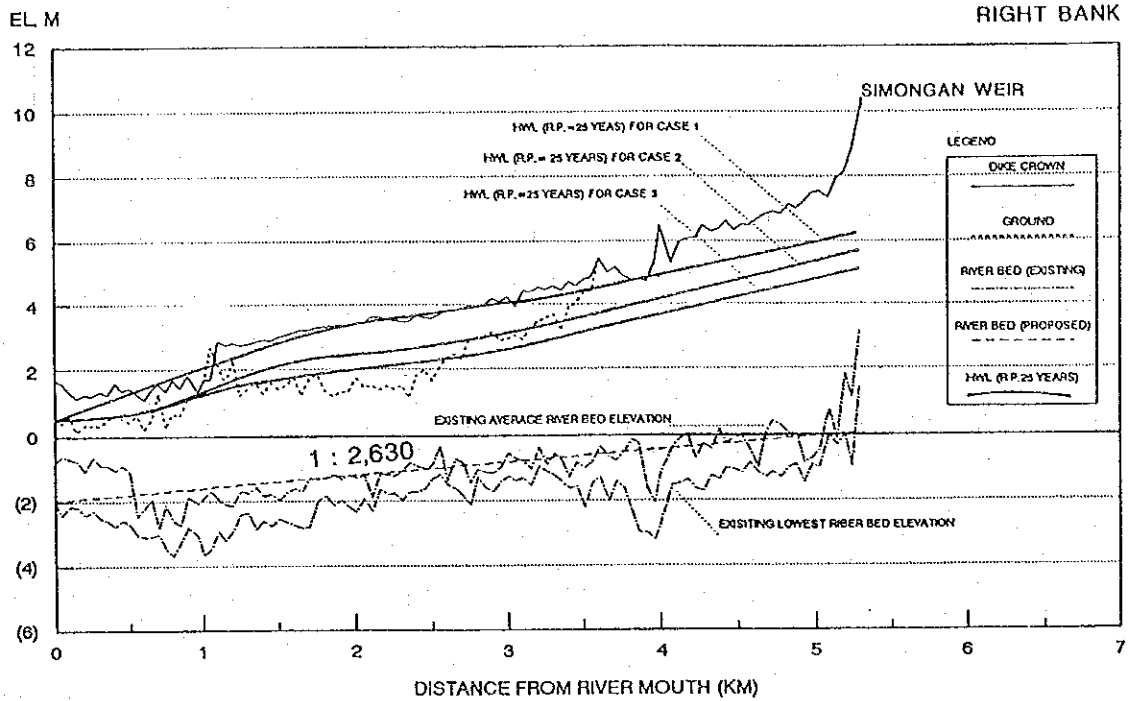
MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
 FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.4.1  
 COST RELATION CURVE FOR FLOOD  
 CONTROL DAM AND RIVER IMPROVEMENT



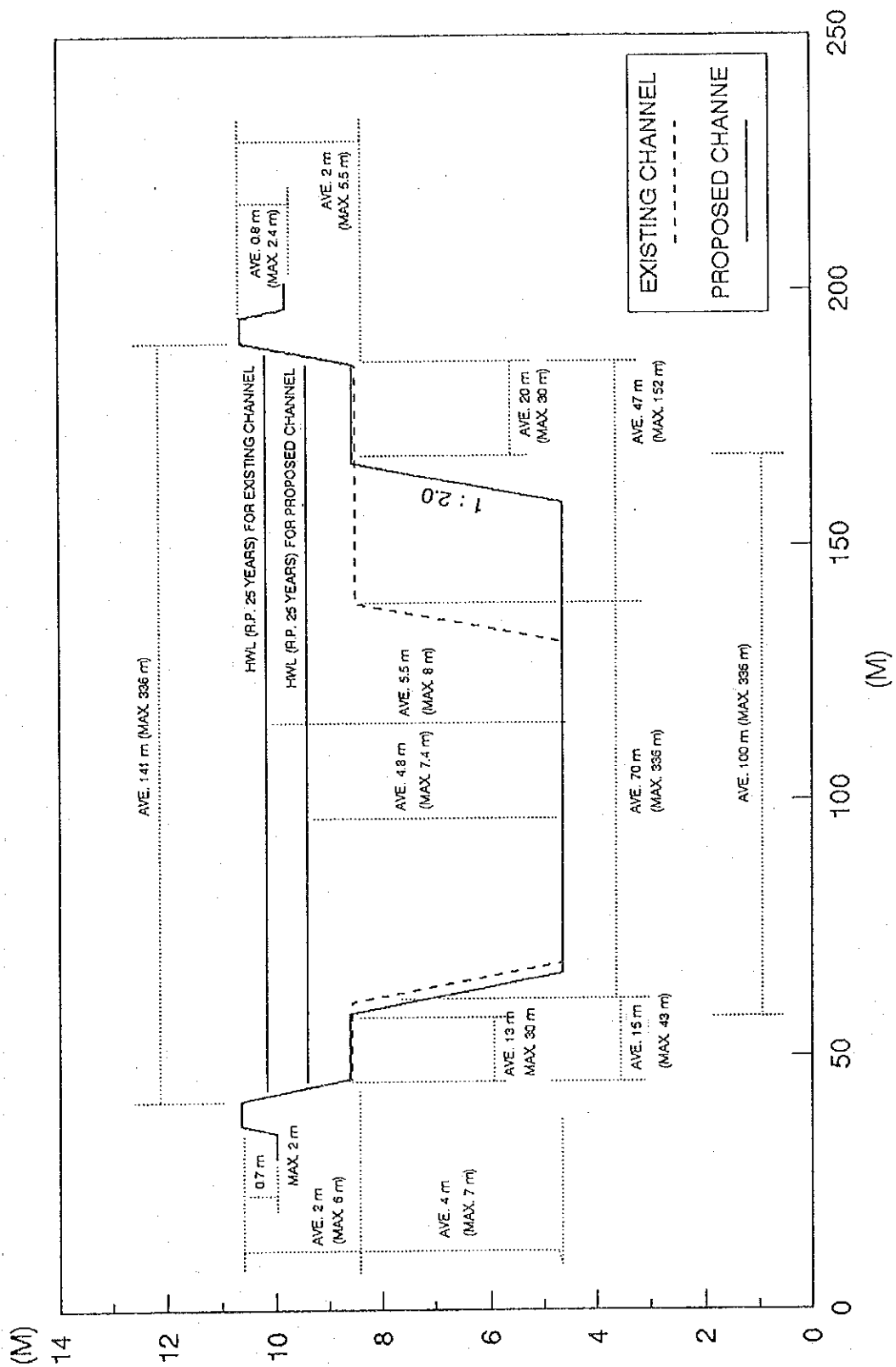
MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
 FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
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Fig. V.5.1  
 EXISTING LONGITUDINAL PROFILE  
 OF WEST FLOODWAY/GARANG RIVER



Note Case 1 : No Improvement Work (Existing Condition)  
 Case 2 : Excavation of High-Water Channel to be 20 m Wide on an Average  
 Case 3 : Excavation of High-Water Channel to be 0 m Wide

# CROSS SECTION FROM RIVER MOUTH TO SIMONGAN WEIR

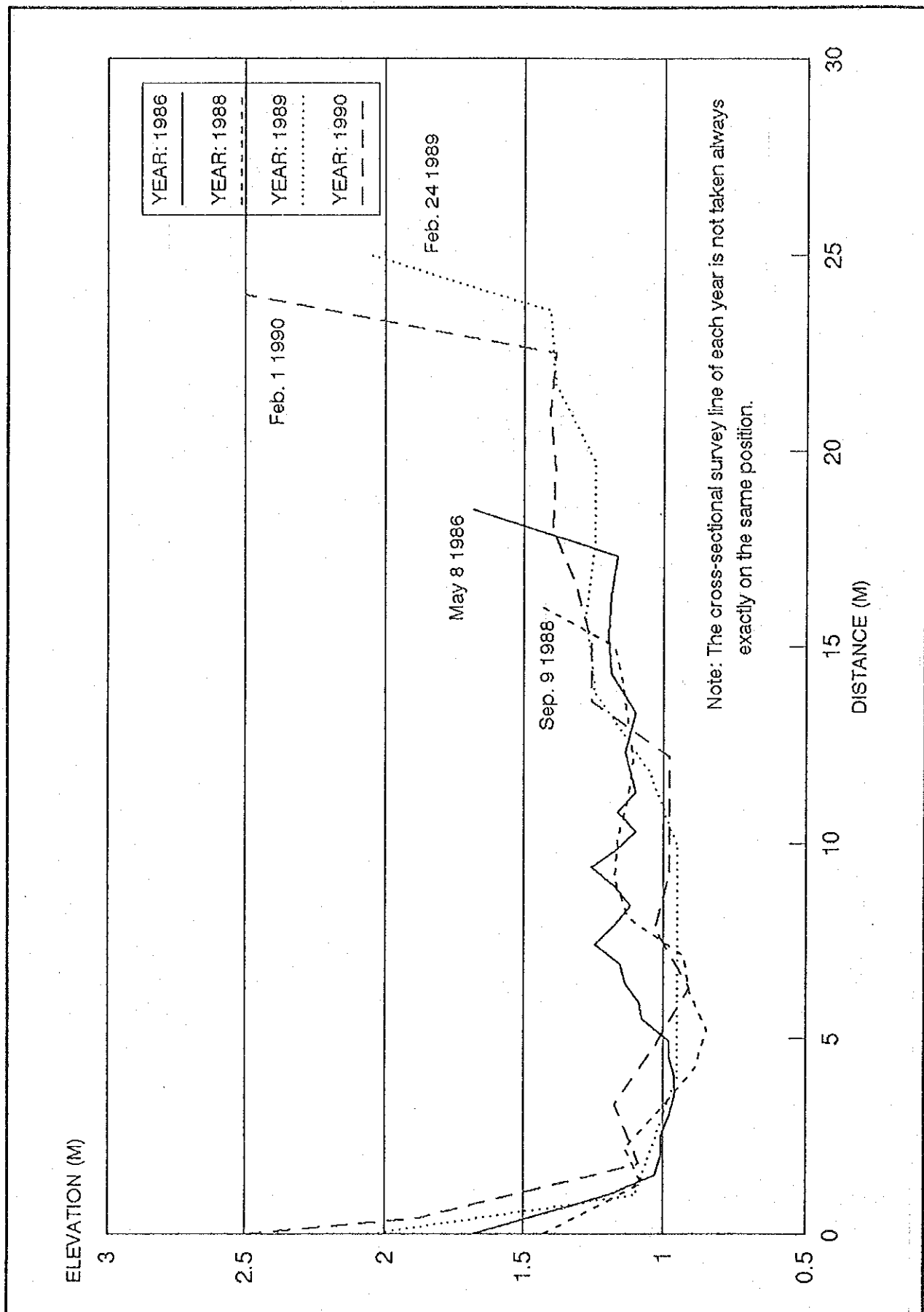


MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND  
 FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND  
 URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
 JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V.5.3

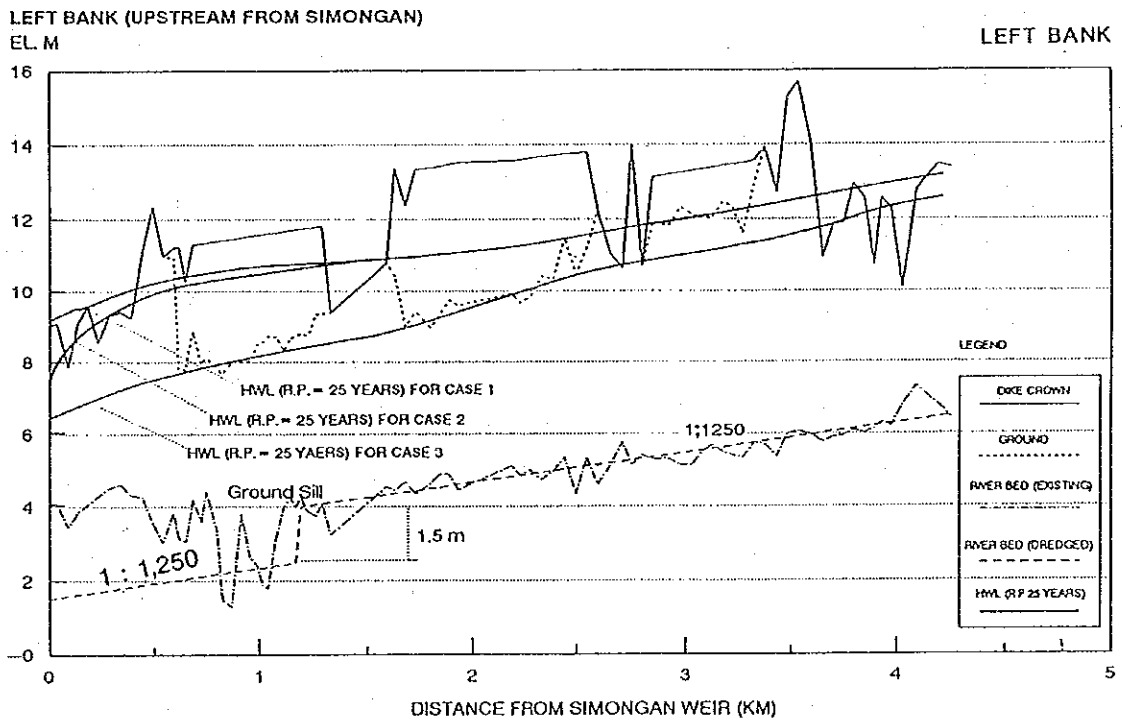
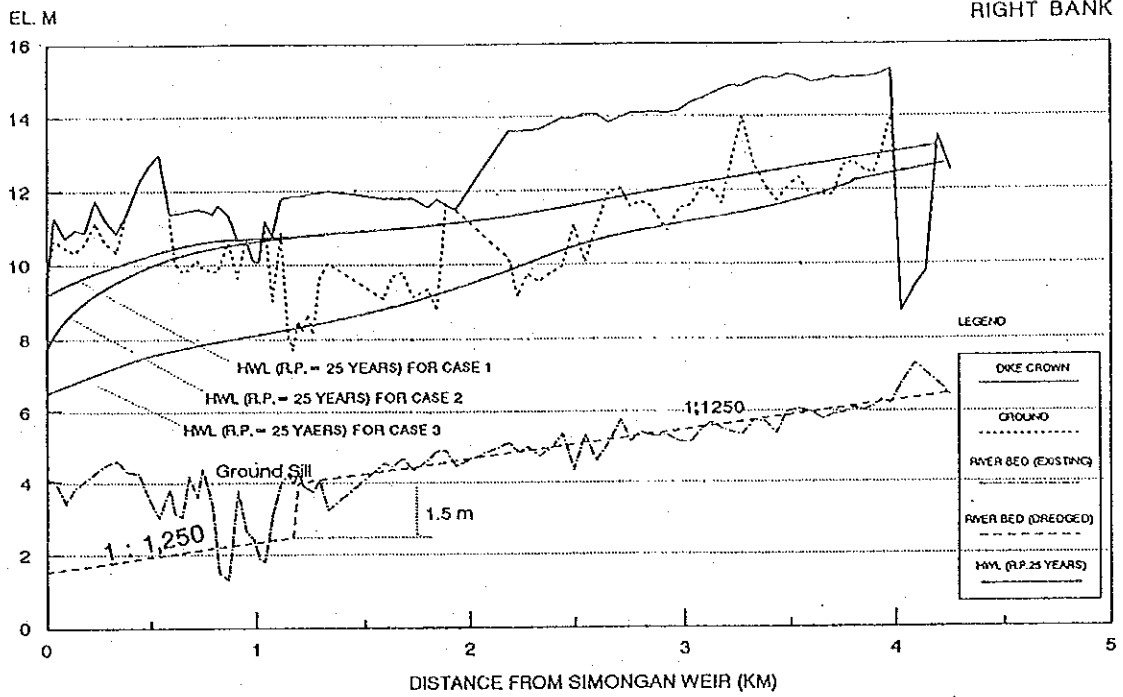
TYPICAL CROSS SECTION OF  
 WEST FLOODWAY





MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS  
 JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. V.5.4 CHANNEL CROSS-SECTION SURVEYED AT GARANG RIVER WATER LEVEL GAUGING STATION



- Note Case 1 : No Improvement Work (Existing Condition)  
Case 2 : Reconstruction of Simongan Weir (to be Fixed Weir) without River Dredging Work  
Case 3 : Reconstruction of Simongan Weir (to be Movable Gate) with River Dredging Work