SUPPORTING REPORT (2)

ANNEX 8 : PRELIMINARY DESIGN

THE STUDY ON STORM WATER DRAINAGE PLAN
FOR THE COLOMBO METROPOLITAN REGION
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

FINAL REPORT

VOLUME IV : SUPPORTING REPORT (2)

ANNEX 8 : PRELIMINARY DESIGN

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CHAPTER 1 GENERAL

The preliminary design for the Feasibility Study is executed based on the design criteria described in Annex 9 of Volume III: Supporting Report (1).

This report describes the preliminary design for the projects of Weras Ganga Scheme, Bolgoda Canal Scheme, Nugegoda-Rattanapitiya Scheme and Ratmalana-Moratuwa Scheme in Weras Ganga basin, which were selected as priority projects. The general plan of channel improvement reaches in the Weras Ganga basin is shown in Drawing 1.

Work quantities of the proposed Weras Ganga storm water drainage project are presented in Annex 9 of Volume IV: Supporting Report (2).

CHAPTER 2 WERAS GANGA SCHEME

2.1 Dredging of Weras Ganga

The plan of proposed dredging of the Weras Ganga is shown in Drawings 2 to 5. The reaches to be dredged are divided into two sections of WG1 (Maha Ela confluence to North Bolgoda Lake) and WG2 (Northern end of Weras Ganga Swamp to Maha Ela confluence). The lengths of WG1 and WG2 are 3,400 m and 2,100 m, respectively. The total length of dredging is 5,500 m.

The design discharge (50-year return period) is taken as 164 m^3/sec for WG1 and 79 m^3/sec for WG2.

Dredging of channel bed is proposed along the present channel alignment. The design elevation of dredging is set at 1.5 m below MSL based on the elevation of Bolgoda Lake North located in the downstream of the Weras Ganga.

The width of dredging is set at 40 m based on the openings of Kospalana bridge. This dredging width continues up to the downstream end of Weras Ganga Swamp. The openings of the present Borupana bridge, which has two spans of 30 m long, is enough to cross the width of 40 m dredging. The width of dredging in the Weras Ganga Swamp is reduced to 19 m based on the width of proposed channel bed of Bolgoda Canal. The bank slope of dredging is set at 1:3.0 taking into account the stability of slope under water. The proposed longitudinal profile and cross section are shown in Drawings 6 and 7.

The design features of the Weras Ganga Scheme are summarized below.

Design Features of Weras Ganga Scheme

Item	Design Features
1. Channel Improvement	
(1) Design Discharge	WG1: 164 m^3/sec, WG2: 79 m^3/sec
(2) Channel Length	5,500 m (WG1: 3,400 m, WG2: 2,100 m)
(3) Channel Bed Slope	Level (1.5 m below MSL)
(4) Dredging Work	WG1: dredging width of 40 m, bank slope of 1:3.0
	WG2: dredging width of 19 m (in Weras Ganga Swamp) to 40 m, bank slope of 1:3.0
(5) Wet Masonry Dike	Top elevation: 1.2 to 1.4 m above MSL Length: 2,300 m
2. Major Structure	
(1) Sluiceway	Kandawala: 2 m (B) x 1.9 m (H) x 2 cells with flap gates
	Telawala North: 2.5 m (B) x 1.9 m (H) x 2 cells with flap gates
	Telawala South: 2.5 m (B) x 1.9 m (H) x 2 cells with flap gates

2.2 Wet Masonry Dike

The typical section of proposed wet masonry dike is shown in Drawing 26. The freeboard of dike is taken as 0.6 m for WG1 and 0.3 m for WG2. Consequently the elevation of dike top is set at 1.2 m to 1.4 m above MSL. The side drain is designed as a wet masonry channel with 1.0 m wide and 1.0 m high along the dike keeping 2.5 to 3.0 m space for inspection.

The alignment of wet masonry dike is almost along the edge of the housing area to minimize the relocation of houses as much as possible. At the temple located a little downstream of Borupana bridge, the wet masonry dike with side drain is designed so as to avoid affecting existing property.

2.3 Sluiceway in Retention Pond

Construction of a sluiceway is proposed as outlets of retention ponds in Kandawala and Telawala of Ratmalana-Moratuwa urban drainage area. The preliminary design of sluiceway is shown in Drawing 25. The sluiceway is designed as reinforced concrete box culvert with a flap gate. The flap gate is equipped to stop storm water intrusion from the Weras Ganga.

Average water level of the Weras Ganga in rainy season is estimated of 0.4 m above MSL based on the records of water level observation. Present ground level around retention pond is between 0.5 m to 1.0 m above MSL according to the topographic map with the scale of 1:2,000.

The opening size of sluiceway is determined so as to discharge the design flood runoff with 2-year return period keeping water level in the retention pond lower than 0.6 m above MSL. The design feature of the sluiceway are summarized as follows:

Design Features of Sluiceway

Item	Kandawala	Telawala North	Telawala South
(1) Design Discharge	24.0 m^3/sec	24.0 m^3/sec	24.0 m^3/sec
(2) Opening	2 m (B) x 1.9 m (H) x 2 cells	2.5 m (B) x 1.9 (H) m x 2 cells	2.5 m (B) x 1.9 m (H) x 2 cells
(3) Max. Water Level	0.6 m above MSL	0.6 m above MSL	0.6 m above MSL
(4) Sill Elevation	1.0 m below MSL	1.0 m below MSL	1.0 m below MSL

2.4 Periphery Canal for Storm Water Retention Area

The typical design of a periphery canal is shown in Drawing 26. The periphery canal to demarcate the retention area is proposed to be constructed along the boundary of the retention area. The design features of the canals are tabulated below.

Design Features of Periphery Canal

Item	Design Features
(1) Canal Section	Trapezoidal earth channel with bank slope of 1:1.0 Canal bed width: 2 m Channel Depth: 1.5 m Earth dike: 0.5 m height, dike top of 3 (2) m wide
(2) Canal Length	Upper Nugegoda Ela Marsh: 1,780 m
	Lower Nugegoda Ela Marsh: 2,110 m
	Delkanda Ela Marsh: 1,800 m
	Bellanwila-Attidiya Marsh: 4,400 m
	Weras Ganga Swamp: 4,400 m
	Maha Ela Marsh and Lowland: 6,000 m

CHAPTER 3 BOLGODA CANAL SCHEME

The plan of proposed Bolgoda Canal improvement is shown in Drawings 8 and 9. The reaches to be improved are divided into three sections of BC1 (northern end of Weras Ganga Swamp to confluence of Depawa Ela), BC2 (confluence of Depawa Ela to confluence of Rattanapitiya Ela) and BC3 (confluence of Rattanapitiya to Attidiya Pond). The lengths of BC1, BC2 and BC3 are 1,000 m, 400 m and 1,000 m, respectively. Total length of channel improvement is 2,400 m.

The design discharge (10-year return period) is taken as 51 m^3/sec for BC1, 27 m^3/sec for BC2 and 23 m^3/sec for BC3. The proposed channel alignment is mostly along the present channel alignment, but the reaches near Ratmalana Airport are shifted to the Boralesgamuwa side taking into account the future extension plan of Ratmalana Airport runway.

The elevation of existing channel bed varies from 0 to 3 m below MSL, but the channel bed is mostly level. Therefore, the channel bed elevation is set at 1.5 m below MSL which is the same as the Weras Ganga. The proposed longitudinal profile is shown in Drawing 10.

The cross section is designed as a trapezoidal single earth channel with bank slope of 1:2.0. The width of channel beds of BC1, BC2 and BC3 are set at 19 m, 19 m and 15 m, respectively. The proposed cross section is shown in Drawing 11. The design features of Bolgoda Canal Scheme are shown below.

Design Features of Bolgoda Canal Scheme

Item	Design Features
1. Channel Improvement	
(1) Design Flood Discharge	BC1: 51 m^3/sec, BC2: 37 m^3/sec, BC2: 23 m^3/sec
(2) Channel Length	2,400 m (BC1: 1,000 m, BC2: 400 m, BC3: 1,000 m)
(3) Channel Bed Slope	Level (1.5 m below MSL)
(4) Channel Cross Section	BC1 and BC2: Channel bed width of 19 m, bank slope of 1:2.0
	BC3: Channel bed width of 15 m, bank slope of 1:2.0
(5) Maintenance Road	Length: 2,600 m, Laterite pavement (3m wide)
2. Major Structure	
(1) Bridge	BC1: PC girder bridge, 30 (15 m x 2 spans) m (L) x 4.3 m (B)

An maintenance road is to be provided along the channel course. The typical section of the maintenance road is shown in Drawing 26. The maintenance road is designed with 4.0 m wide including 3.0 m wide laterite pavement. The elevation of road surface is taken as 1.1 m to 1.6 m above MSL.

The existing gate for saline water intrusion protection at Elawella road crossing Bolgoda Canal is proposed to be removed and reconstructed as Bridge BC1. A pre-

stressed concrete girder bridge is proposed based on the recommendation of RDA employing an in-situ concrete pile with 600 mm diameter for the foundation. The elevation of supporting layer is assumed to be at 6 m below MSL based on the geo-technical investigation. The preliminary design of proposed bridge is shown in Drawing 23 and structural features are summarized in Table 3.1.1.

CHAPTER 4 NUGEGODA-RATTANAPITIYA SCHEME

4.1 Rattanapitiya Ela Channel Improvement

The plan of proposed Rattanapitiya Ela channel improvement is shown in Drawings 12 and 13. The reaches to be improved are divided into two sections of RE1 (confluence of Bolgoda Canal to boundary of Bellanwila-Attidiya Marsh) and RE2 (boundary of Bellanwila-Attidiya Marsh to confluence of Nugegoda Ela and Delkanda Ela). The lengths of RE1 and RE2 are 890 m and 1,240 m, respectively. The total length of channel improvement is 2,130 m. The upstream end of Rattanapitiya Ela is extended 600 m upstream from the present point because of change of confluence of Nugegoda Ela and Delkanda Ela.

The design discharge (10-year return period) is taken as 25 m^3/sec for RE1 and 53 m^3/sec for RE2. The proposed channel alignment is set along the present one. The proposed channel bed slope of RE1 is set at 1/1,200 against the present slope of 1/1,500, while that of RE2 is set at 1/800 against the present slope of 1/600. The proposed longitudinal profile is shown in Drawing 15.

The cross section is designed as trapezoidal earth channel with bank slope of 1:2.0 for RE1 and rectangular channel with gabion revetment for RE2 to minimize the relocation of houses. The width of channel bed is taken as 19 m for the both sections. The proposed cross section is shown in Drawing 16. The design features of Rattanapitiya Ela channel improvement are tabulated below.

Design Features of Rattanapitiya Ela Channel Improvement

Work Item	Design Features
1. Channel Improvement	
(1) Design Discharge	RE1: 25 m^3/sec, RE2: 53 m^3/sec
(2) Channel Length	2,130 m (RE1: 890 m, RE2: 1,240 m)
(3) Channel Bed Slope	RE1: Level to 1/1,200, RE2:1/800
(4) Channel Cross Section	RE1: Channel bed width of 19 m, bank slope of 1:2.0
	RE2: Channel bed width of 19 m, Gabion revetment
(5) Maintenance Road	Length: 2,130 m, Laterite pavement (3 m wide)
2. Major Structure	
(1) Bridge	RE1: PC girder bridge, 29 (14.5 m x 2 spans) m (L) x 7.4 m (B)
	RE2: PC girder bridge, 19 m (L) x 22 m (B) x 1 span
	RE3: PC girder bridge, 19 m (L) x 4 m (B) x 1 span
	RE4: PC girder bridge, 19 m (L) x 5 m (B) x 1 span
	RE5: PC girder bridge, 19 m (L) x 5 m (B) x 1 span

An maintenance road is to be provided along the channel course. The maintenance road is designed to be 4 m wide including 3 m wide laterite pavement. The elevation of road surface is taken as 1.5 m to 3.6 m above MSL.

The existing crossing structures of bridge and culvert are to be reconstructed due to insufficient span against proposed channel width. A pre-stressed concrete girder bridge is proposed based on the recommendation of RDA. An in-situ concrete pile with 600 mm diameter is applied for the foundation of proposed bridge. The elevation of supporting layer is assumed to be 6 m to 8 m below MSL based on the geo-technical investigation. The preliminary design of proposed bridge is shown in Drawing 23 and structural features are summarized in Table 3.1.1.

4.2 Delkanda Ela Channel Improvement

The plan of proposed Delkanda Ela channel improvement is shown in Drawings 13 and 14. The reaches to be improved are divided into three sections of D1 (confluence of Rattanapitiya to diversion point), D2 (diversion point to Pengiriwatta Road) and D3 (Pengiriwatta Road to upper end point at 150 m downstream of railway crossing). The lengths of D1, D2 and D3 are 280 m, 790 m and 690 m, respectively. Total length of improved section is 1,760 m.

The design discharge (10-year return period) is taken as 29 m^3/sec for D1, 22 m^3/sec for D2 and 14 m^3/sec for D3. The proposed channel alignment is set along the present one, but a diversion channel to the present Nugegoda Ela is proposed to minimize the relocation of many houses along the lower reach of the present Delkanda Ela.

The proposed channel bed slopes of D1 and D2 are set at 1/700, while that of D3 is 1/300. They are almost same as the present channel bed slope. The proposed longitudinal profile is shown in Drawing 15.

The cross sections are designed as a trapezoidal single earth channel with bank slope of 1:2.0 for D1, a rectangular channel with gabion revetment for D2 and a trapezoidal channel with wet masonry revetment with bank slope of 1:0.5 in D3. The proposed cross sections are shown in Drawing 16. The design features of Delkanda Ela channel improvement are tabulated below.

Design Features of Delkanda Ela Channel Improvement

Item	Design Features
1. Channel Improvement	
(1) Design Discharge	D1: 29 m^3/sec, D2: 22 m^3/sec, D3: 14 m^3/sec
(2) Channel Length	1,760 m (D1: 280 m, D2: 790 m, D3: 690 m)
(3) Channel Bed Slope	D1 and D2: 1/700, D3:1/300
(4) Channel Cross Section	D1: Bed width of 13.5 m, bank slope of 1:2.0
	D2: Bed width of 13.5 m, rectangular with gabion
	D3: Bed width of 3 m, bank slope of 1:0.5 with wet masonry
(5) Maintenance Road	Length: 280 m, Laterite pavement (3 m wide)
2. Major Structure	
(1) Bridge	D1: PC girder bridge, 13.5 m (L) x 7 m (B) x 1 span
	D2: PC girder bridge, 13.5 m (L) x 4.2 m (B) x 1 span
	D3: PC girder bridge, 13.5 m (L) x 3 m (B) x 1 span
	D4: PC girder bridge, 13.5 m (L) x 19.8 m (B) x 1 span
	D5: PC girder bridge, 13.5 m (L) x 6 m (B) x 1 span
(2) Culvert	D6: 4.6 m (L) x 3 m (B) x 2.1 m (H)
	D7: 5.6 m (L) x 3 m(B) x 1.8 m (H)

A maintenance road is to be provided along the channel course. However, Old Kesbewa Road which goes alongside Delkanda Ela can be used as an maintenance road for D2. There is insufficient space to provide a maintenance road for D3 due to many houses along the channel course. The construction of a maintenance road is proposed for D1, designed to be 4 m wide including 3 m wide laterite pavement. The elevation of road surface is taken as 3.6 m to 3.8 m above MSL.

The existing crossing structures of bridge and culvert are to be reconstructed due to insufficient span of present structure against proposed channel width. A pre-stressed concrete girder bridge is proposed based on the recommendation of RDA. An in-situ concrete pile with 600 mm diameter is applied for the foundation of proposed bridge. The proposed culvert is designed as a reinforced box culvert with a driving pile 350 mm square applied for the foundation. The elevation of supporting layer is assumed to be 6 m below MSL based on the geo-technical investigation. The preliminary design of proposed bridge and culvert are shown in Drawings 23 and 24, and structural features are summarized in Table 3.1.1.

4.3 Nugegoda Ela Channel Improvement

The plan of proposed Nugegoda Ela channel improvement is shown in Drawing 17. The reaches to be improved are divided into three sections of NE1 (confluence of Rattanapitiya Ela to boundary of Lower Nugegoda Ela Marsh) and NE2 (boundary of Lower Nugegoda Ela Marsh to Pepiliyana Road) and NE3 (Pepiliyana Road to upper end at 200 m downstream of Hospital Road crossing). The lengths of NE1, NE2 and

NE3 are 940 m, 280 m and 360 m, respectively. Total length of improved section is 1,580 m.

The design discharge (10-year return period) is taken as 24 m^3/sec for NE1, 22 m^3/sec for NE2 and 10 m^3/sec for NE3. A diversion channel is proposed for NE2 and NE3, respectively. The diversion channel for NE2 is proposed to improve the present bent alignment. The diversion channel for NE3 is proposed to collect storm water runoff from the residential area located in the lowland area. The proposed alignment of the remaining reaches is set along the present one.

The proposed channel bed slopes of NE1 and NE2 are taken as 1/700 which is the same as at present, while that of NE3 is set at 1/450 against the present slope of 1/300 to lower the channel bed by about 1 m. The proposed longitudinal profile is shown in Drawing 18.

The proposed cross sections are designed as a trapezoidal earth channel with bank slope of 1:2.0 in NE1, and rectangular channels with gabion revetment in NE2 and NE3 to minimize the relocation of houses along the channel. The widths of proposed channel bed are taken as 13 m for NE1, NE2 and 5 m for NE3. The proposed cross sections are shown in Drawing 19. The design features of Nugegoda Ela channel improvement are tabulated below.

Design Features of Nugegoda Ela Channel Improvement

Item	Design Features
1. Channel Improvement	
(1) Design Flood Discharge	NE1: 24 m^3/sec, NE2: 22 m^3/sec, NE3: 10 m^3/sec
(2) Channel Length	1,580 m (NE1: 940 m, NE2: 280 m, NE3: 360 m)
(3) Channel Bed Slope	NE1 and NE2: 1/700, NE3: 1/450
(4) Channel Cross Section	NE1: Channel bed width of 13 m, bank slope of 1:2.0
	NE2: Channel bed width of 13 m, rectangular with gabion
	NE3: Channel bed width of 5 m, rectangular with gabion
(5) Maintenance Road	Length: 1,580 m, Laterite pavement (3 m wide)
2. Major Structure	
(1) Bridge	NE1: PC girder bridge, 18 m (L) x 4.6 m (B) x 1 span
	NE2: PC girder bridge, 13 m (L) x 2.3 m (B) x 1 span, Pedestrian bridge
	NE3: PC girder bridge, 13 m (L) x 4.4 m (B) x 1 span

A maintenance road is to be provided along the channel course. The maintenance road is designed with 4 m width including 3 m wide laterite pavement. The elevation of road surface is taken as 3.6 m to 5.8 m above MSL.

The existing crossing structures are to be reconstructed due to insufficient span against proposed channel width. A pre-stressed concrete girder bridge is proposed based on the recommendation of RDA. An in-situ concrete pile with 600 mm diameter is applied for the foundation of proposed bridge. The elevation of supporting layer is

assumed to be 6 m below MSL based on the geo-technical investigation. The preliminary design of proposed bridge is shown in Drawing 23, and structural features are summarized in Table 3.1.1.

CHAPTER 5 RATMALANA-MORATUWA SCHEME

The plan of the proposed improvement of Ratmalana-Moratuwa urban drainage system is shown in Drawings 20 and 21. In the Ratmalana-Moratuwa Scheme, major drains are to be improved. Considering limited space for construction, a type of concrete flume with cover is largely adopted to effectively use the open space on the concrete flume after construction. A wet masonry channel and a gabion channel is designed where sufficient space is available. An earth channel is applied for the lower reach of Kandawala Tributary and Telawala Tributary. The total length of main drains to be improved is 11,120 m. The widths of drains vary from 0.8 m to 6 m. The typical sections of proposed main drains are shown in Drawing 22.

At the ends of the drainage system, two ponds are provided to retard storm water. The total pond area is 13 ha and bottom elevation of ponds is taken as 1.0 m below MSL. The pond water is discharged through sluiceways with flap gates. The design features of Ratmalana-Moratuwa Scheme are tabulated below.

Design Features of Ratmalana-Moratuwa Scheme

Type	Breath (mm)	Height (mm)	Length (m)
1. Concrete Flume with Cover	800	800	490
	900	900	660
	1,000	1,000	555
	1,100	1,100	835
	1,200	1,200	1,790
	1,300	1,300	855
	1,400	1,400	465
	1,500	1,500	590
	2,000	1,500	150
2. Wet Masonry Channel along Wet Masonry Dike	1,000	1,000	950
	1,500	1,000	200
3. Open Channel with Wet Masonry Revetment	1,000	1,000	125
	1,500	1,000	525
	1,500	1,500	655
	2,000	1,500	215
	3,000	1,500	130
4. Open Channel with Gabion Revetment	3,000	1,500	45
	5,000	1,500	645
	6,000	1,500	100
5. Earth Channel	2,000	1,500	320
	5,000	1,500	105
	6,000	1,500	715
Total			11,120

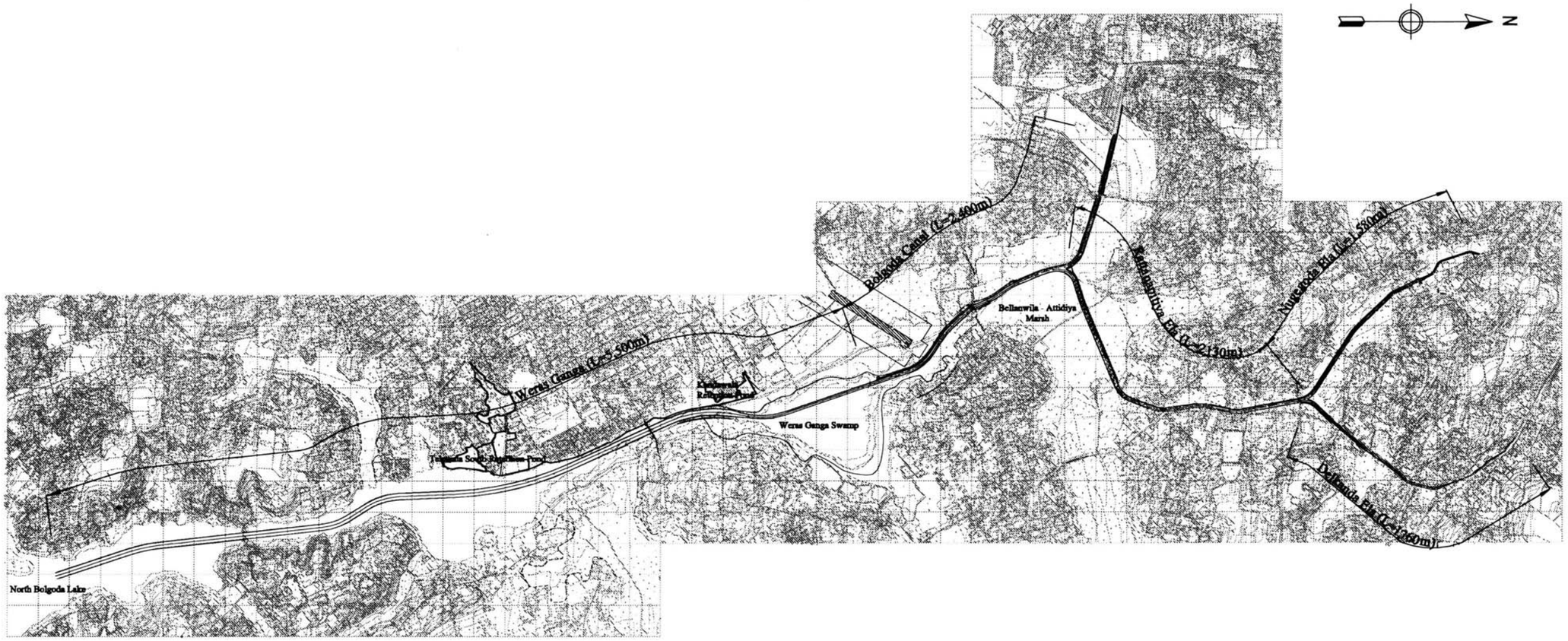
Tables

Table 3.1.1 Principal Features of Proposed Bridges and Culverts

Basin	Channel	Code	Present Structures		Proposed Structure	
			Type	Dimension	Type	Dimension
Weras Ganga Basin	Bolgoda Canal	BC1	Concrete Culvert	B x H = 1.7m x 2.9m x 6cell	PC girder Bridge	L = 30 m, B = 4.3 m, 2 span
	Rattanapitiya Ela	RE1	Concrete Girder Bridge	L = 10 m, B = 6 m, 1 span	PC girder Bridge	L = 29 m, B = 7.4 m, 2 span
		RE2	Concrete Girder Bridge	L = 6 m, B = 8 m, 1 span	PC girder Bridge	L = 19 m, B = 22 m, 1 span
		RE3	Concrete Girder Bridge	--	PC girder Bridge	L = 19 m, B = 4 m, 1 span
		RE4	Concrete Culvert	--	PC girder Bridge	L = 19 m, B = 5 m, 1 span
		RE5	Concrete Culvert	--	PC girder Bridge	L = 19 m, B = 5 m, 1 span
	Delkanda Ela	D1	Concrete Girder Bridge	--	PC girder Bridge	L = 13.5 m, B = 7 m, 1 span
		D2	Concrete Girder Bridge	L = 6 m, B = 5 m, 1 span	PC girder Bridge	L = 13.5 m, B = 4.2 m, 1 span
		D3	Concrete Girder Bridge	L = 6 m, B = 2.5 m, 1 span	PC girder Bridge	L = 13.5 m, B = 3 m, 1 span
		D4	Concrete Girder Bridge	L = 5.5 m, B = 13.2 m, 1 span	PC girder Bridge	L = 13.5 m, B = 19.8 m, 1 span
		D5	Concrete Girder Bridge	L = 5.5 m, B = 6 m, 1 span	PC girder Bridge	L = 13.5 m, B = 6 m, 1 span
		D6	Concrete Culvert	B x H = 2.5m x 1.5m	PC girder Bridge	L = 9 m, B = 4.6 m, 1 span
		D7	Concrete Culvert	B x H = 2m x 1.5m	RC box Culvert	B x H = 5m x 2.5m
	Nugegoda Ela	NE1	Concrete Culvert	B x H = 2m x 1m	PC girder Bridge	L = 18 m, B = 4.6 m, 1 span
		NE2	Temporary Bridge	--	PC girder Bridge	L = 13 m, B = 2.3 m, 1 span
		NE3	Concrete Culvert	Dia.1,200 mm x 2 nos	PC girder Bridge	L = 13 m, B = 4.4 m, 1 span

Note: L means length, B means width, H means height

Drawings



Scale
0 200 400 600 800 1,000 2,000m

The Study on Storm Water Drainage Plan for the Colombo Metropolitan Region in the Democratic Socialist Republic of Sri Lanka

JAPAN INTERNATIONAL COOPERATION AGENCY

Drawing 1
General Plan of Proposed Channel Improvement Reaches in Weras Ganga Basin

A8 - D1

Scale
0 50 100 200 m

The Study on Storm Water Drainage Plan for the Colombo Metropolitan Region in the Democratic Socialist Republic of Sri Lanka

JAPAN INTERNATIONAL COOPERATION AGENCY

Drawing 2
Plan of Proposed Weras Ganga Dredging (1/4)

A8 - D2

Katubedda Tributary
Marsh

Weras Ganga (WG1) L = 3,400,000

Dredging (B = 40,000)

Telewala South Retention Pond

N

ST1+378

ST1+482

ST1+747

ST1+932

ST1+115

ST2+293

ST2+521

ST2+560

ST2+765

KEY MAP

Scale
0 50 100 200 m

The Study on Storm Water Drainage Plan for the Colombo Metropolitan Region in the Democratic Socialist Republic of Sri Lanka

JAPAN INTERNATIONAL COOPERATION AGENCY

Drawing 3
Plan of Proposed Weras Ganga Dredging
(2/4)

A8 - D3