occur. In addition, improper drainage connections to the creek are also aggravating the inundation conditions.

(3) Ingore Upstream Inundation Area

The Ingore upstream area was developed as a residential area in recent years where Ingore Creek drains. Ingore Creek was originally used as drainage channel for the Aganan Irrigation System. Since the drainage capacity of the creek has been reduced by sedimentation, and runoff has increased due to urbanization, frequent flooding occurs in this low-lying area. Furthermore, inundation lasts for a few days due to the bottleneck. at the Jaro-Balobago road crossing, which was brought by road construction.

3.2 Cebu City

Habitual flood areas in Cebu City due to inadequate drainage systems are identified by the DPWH District Engineering Office in some 30 places with 90 ha in total, as shown in Table 3.1 and Fig. 3.2. The major inundation areas and conditions are summarized below.

Location of Inundation	Inundation Condition			
	Area (ha)	Depth (m)	Duration (hours)	Frequency (times/yr)
(1) Mabolo Creek	14.0	0.5	2	2 - 3
(2) Lahug Tributary	8.0	0.3 - 0.6	1 - 3	2
(3) Tinago Creek	7.2	0.3 - 0.5	1 - 2	2 - 3
(4) Sta. Teresita Village	10.0	0.5 - 1.2	1 - 2	2 - 3
(5) Sto. Niño Creek	18.0	0.2 - 0.3	1	3 - 4
Total	57.2			

(1) Mabolo Creek Inundation Area

The inundation area is situated along the coastal swampy area of Mabolo. Due to the establishment of the Cebu North Reclamation Area some 25 years ago, the drainage outlet of the watercourse was extended and realigned by providing Mabolo Creek along the perimeter of the reclamation area connecting to the Subang Daku river estuary.

The accumulation of silt, garbage and refuse, and the construction of culverts have reduced the flow capacity of Mabolo Creek, causing frequent inundations in low-lying areas.

(2) Lahug Tributary Inundation Area

The inundation area along the coastal swampy area is under the same situation as the Mabolo Creek inundation area in view of flood conditions and causes. These low lying areas are easily inundated due to insufficient discharge capacity of the right tributary of Lahug River (Lahug Tributary), which serves as the main drain of the areas. The insufficient capacity of the Lahug Tributary is caused by siltation, garbage disposal accumulation and bottlenecks of the pipe culverts at several road crossings.

(3) Tinago Creek Inundation Area

The area is the most serious starting at Colon, Junquera and Sanciangco streets where the central commercial areas of Cebu City is situated. Drainage pipes installed along the roads are not functioning properly, which may be caused by structural damage and/or garbage clogging. Furthermore, Tinago Creek as the recipient channel has become shallow through siltation and garbage accumulation.

(4) Sta. Teresita Village Inundation Area

Inundation problems in Sta. Teresita Village has been raised on account of the fact that the villages are developing in a disorderly manner without any comprehensive drainage system. This inundation area is situated along the mountain stream which is already denuded. The village roads and open yards become watercourses of flood discharge and frequent flood occurs during rainy season. To mitigate the inundation in the village, a 1,200 mm pipe was installed along the village roads in 1988, while the capacity of the pipe was not adequate to drain stormwater.

The upstream area of Sta. Teresita Village has been developed as a residential area. However, the stormwater and sewage of the area are only drained by the unlined and intermitted ditches passing through low-lying open yards, roads, etc.

(5) Sto. Niño Creek Inundation Area

The area has been rapidly and disorderly developed as a residential area in recent years with no systematic drainage system. The stormwater is generally drained with overland flow on the ground surface and passed through natural streams, intermitted ditches, roads, yards, etc.

Along the Pardo Highway which divides Sto. Ni ño catchment into two, upstream and downstream drainage areas, there exists open channels serving as the main recipient for the upstream drainage area of 4.6 km^2 leading to the sea. Due to the siltation and encroachment of houses from the road, the flow capacity of the side channel is drastically reduced.

At the immediate downstream of the highway, there is an open drainage channel approximately 150 m long. The runoff frequently overflows and jumps out from the channel because of the inadequate channel capacity.

3.3 Ormoc City

There is no serious drainage inundation problem, except partial water stagnation in some places due to inadequate drainage capacity as shown in Table 3.1 and Fig. 3.3. In the new residential areas adjoining north and west of the city proper, however, urban drainage system has not been developed sufficiently to cope with the rapid urbanization. Frequent inundation problems in the area occurs during the rainy season.

The major inundation areas due to inadequate drainage systems are as follows:

Location of Inundation	Inundation Condition			
	Area (ha)	Depth (m)	Duration (hours)	Frequency (times/yr)
(1) Government Center	9.5	0.2 - 0.4	1	2 - 3
(2) Punta	6.8	0.2 - 0.4	24 - 48	5
(3) Lotao Creek	17.1	0.5 - 1.0	6 - 12	5
(4) Rizal Extension	4.1	0.2 - 0.4	2 - 6	2 - 3
Total	37.5			

(1) **Government Center Inundation Area**

The inundtion area is the most serious at Camagong, Apitong and Anubing streets. The unlined open drainage ditches provided along the roads has limited capacity and are intermittently blocked by passages used by residents. The constructed pipe culverts at the Apitong and Anubing road crossing, moreover, become bottlenecks with their small openings.

(2) **Punta Inundation Area**

The inundation area is situated along the coastal swampy area and is enclosed by roads in the subdivisions and Alegria-Punta Road, which have no provision for proper drainage outlets. Therefore, inundation problems occur frequently in this area, but there is no serious flood damage report since the place is presently not densely urbanized.

(3) Lotao Creek Inundation Area

The coastal swampy area is situated in the same condition as the Punta inundation area, but the inundation problem is not serious. However, increase of inland flood damage in the near future is anticipated, because this area is located along the National Road and is expected to be urbanized.

(4) Rizal Extension Inundation Area

The area is bounded by the Malbasag river bank and Rizal Extension Road which has suffered from frequent inundation because there is no drainage channel for stormwater. Isla Verde Creek traversing the northern part of this area and functioning as an irrigation channel frequently overflows due to heavy siltation and bottlenecks at Rizal Avenue road crossing.

The stormwater flow runs into the city proper through the open passage between San Miguel and DOTC tower compound. Some drainage systems in the city proper are developed, however, the inundation problems occur during heavy downpour.

3.4 Tacloban City

Tacloban City is situated in a low-lying area along the coast varying in elevation from 0.5 m to 4 m above mean sea level. The city suffers from habitual inundation due to lack of coverage of drainage system and inadequate capacity of the existing watercourses as shown in Table 3.1 and Fig. 3.4. Major inundation areas and conditions in the urban area are as follows:

Location of Inundation	Inundation Condition			
	Area (ha)	Depth (m)	Duration (hours)	Frequency (times/yr)
(1) Abucay River	16.6	0.3 - 0.5	5 - 6	4 - 5
(2) Naga-Naga Creek	7.8	0.3 - 1.0	2 - 4	1 - 2
(3) Mangonbangon River	40.0	0.3 - 1.0	2 - 72	3 - 5
(4) Langhas Lirang Creek	24.4	0.2 - 1.0	2 - 24	3 - 5
(5) Old Sagkahan Creek	1.2	0.2 - 0.5	4 - 5	3 - 5
(6) Pleasantville Creek	18.2	0.5 - 0.8	12 - 24	3 - 4
(7) Burayan River	97.6	0.1 - 0.6	1 - 36	3 - 5
Total	205.8			

(1) Abucay River and Naga-Naga Creek Inundation Areas

The inundation areas are limited to the upstream low-lying area of the Maharlika Highway and Naga-Naga Road. The culvert openings at the Highway and Naga-Naga Road are inadequate to carry the stormwater, as well as the channel lacks adequate drainage capacity. This causes considerable backwater and aggravates the flood situation. The stormwater remains stagnant for several days and continues throughout the rainy season, and sometimes overtop the Highway and Naga Road during heavy downpours.

(2) Inundation Areas Along the Watercourses of Mangonbangon, Langhas-Lirang, Pleasantville, and Old Sagkahan

The channel bed elevations are almost equivalent to the ground elevation of low-lying areas or only slightly higher due to heavy siltation and accumulation of garbage, resulting in flood waters that easily overflow from the channel banks. Much nipa and grass in the watercourses reduce their discharge capacities and aggravate the flood condition.

In the middle and upstream reaches of watercourses, pipe culverts provided at the crossing become the bottlenecks of water flow and cause flood waters to remain longer. At each road crossing, a few pipes with 600 mm to 1,000 mm diameter are installed although its drainage area is 1 km^2 to 3 km^2 or more. The severe bottlenecks are found at National Diversion Road, Maharlika Highway, Taboan V and G Road, and Pical Road.

Along Mangonbangon River and Langhas-Lirang Creek, there exist confining revetments made of wet masonry or rubble concrete. It is, however, only protruding from the low-lying grounds and many sections have already deteriorated.

(3) Burayan River Inundation Area

The area is situated at the upstream stretch from the National Diversion Road and covers almost the whole of the B & G residential subdivision. Since it was originally situated in a low-lying area along Burayan River, the B & G subdivision had been elevated prior to development. However, this measure has been insufficient due to rising flood water levels caused by heavy siltation, accumulation of garbage and bottleneck of the watercourses in addition to the increase of runoff generated by the development.

4. MASTER PLAN

4.1 Project Area

The drainage areas, which are presently urbanized or to be urbanized in the near future having frequent floods in larger scale, are designated to constitute the area of the Master Plan Study for four cities; Iloilo, Cebu, Ormoc and Tacloban. However, minor and secondary drainages including surface drains for roads and highways, which are to be undertaken by local authorities, are not included in the Study. Less severe problems and inconveniences shall be deferred for later actions together with the sewage collection and disposal systems, and adequate drainage systems should be undertaken considering the orderly functioning and growth of the urbanized area.

Based on the concept mentioned above, 21 drainage areas with a total area of approx. 52 km^2 are proposed for the Master Plan y. They are the three drainage areas in Iloilo, nine in Cebu, two in Ormoc and seven in Tacloban including the three river basins of Abucay, Mangonbagon and Burayan.

No.	Drainage Basin	Area (km^2)	No.	Drainage Basin	Area (km^2)
	ILOILO CITY			ORMOC CITY	
SB-1	Ingore Creek	8.02	SB-2	City Proper Creek	0.32
SB-4	Bo. Obrero Creek	3.89	SB-1	Lotao Creek	1.03
SB-5	Rizal Creek	0.50		TACLOBAN CITY	
	CEBU CITY		SB-1	Abucay River	2.38
SB-2	Mabolo Creek	2.78	SB-2	Naga-naga Creek	1.21
SB-3	Lahug Tributary	0.65	SB-4	Mangonbangon River	5.12
SB-5	Tinago Creek	1.10	SB-6	Langhas-Lirang Creek	4.38
SB-7	Pahina Central-Kalubihan	1.00	SB-7	Sagkahan Creek	0.14
SB-9.	Sta. Teresita Village	3.80	SB-8	Pleasantville Creek	1.25
SB-10	Calamba	0.79	SB-10	Burayan River	6.90
SB-14	Basak-San Nicolas	0.67			
SB-17	Sto. Niño Creek	5.11			
SB-19	Barangay Inayawan	1.29		Total	52.33

4.2 Project Scale

The previous studies and projects conducted for the four cities as well as Metro Manila as the reference city, had adopted a 1 to 10-year return period for hydrological service level in planning and design of urban drainage system improvement, as shown in the table below.

A higher return period is applied to major drainage system and/or commercial and industrial land use areas, while a lower return period is adopted for the minor system and/or the residential area. These could be assessed with reasonable magnitude since other Southeast Asian countries having similar planning and design conditions as the Philippines have adopted the same magnitude.

City	Study/Project	Design Scale (Year Return Period)		Remarks
		Primary Channel	Secondary Drainage	
Iloilo	Regional City Development Project, Iloilo City, 1980-92	-	1 - 2	IBRD DPWH
Cebu	Central Visayas Urban Project - Metro Cebu Drainage Study, 1983	-	1 - 2	NEDA DPWH
Ormoc	Flood Control and City Drainage Improvement Program, 1992	-	1 - 2	DPWH
Tacloban	Overall Drainage Master Plan Study, 1987	10	10	IBRD PREMIUMED
Manila	Flood Control and Drainage Project in Metro Manila,1990	10* 3 - 5**	-	JICA DPWH
Manila	Master Plan Study on Manila and Suburbs, 1952	10	-	DPWH

* For the Framework Plan

** For the Master Plan

This Master Plan for the drainage improvement, identical with the previous concept, adopts a 3 to 5-year return period for the drainage design scale reflecting primary channel improvement, culvert construction and planning of reclamation in swampy areas. The 5-year return period is applied to major drainage systems with drainage area of more than 50 ha, while the 3-year return period is adopted for those with less than 50 ha. Design discharge for each drainage channel, corresponding to the project scales proposed is shown in Table 4.1 and Fig 4.1.

4.3 Drainage Improvement Plan

The improvement plan of urban drainage consists of structural and non structural measures to establish an effective plan in correlation with rapid urban progress. The structural measures basically adopt channel improvement to increase the flow capacities by widening and deepening drainage channels. Non-structural measures introducing the land use regulation is applied to the coastal low-lying areas to reduce flood damage potential.

Improvement Measure

(1) Structural Measure

The drainage channel improvement plans are prepared using the existing drainage system as much as possible. The improvement works consist of widening and deepening the drainage channels with removal of acute bends and constrictions, clogging with sediment and garbage disposal, and reconstruction of bottleneck culverts and bridges.

Embankment, in principle, is not adopted for the channel improvement, since the inundation areas could be drained by gravity. In partial low-lying areas where drainage by gravity is difficult, however, it is recommended to raise the ground elevation at least to the topmost channel level, instead of the embankment with pumping system, to avoid high costs of operation and maintenance works.

Construction of pumping station is not physically required for the objective drainage areas of the four cities since the inundation areas could be drained by gravity.

Considering the ease of operation of drainage systems, the existing drainage channels are, principally, to remain as open watercourses, not to be enclosed by box culvert. As for the improvement of the existing four drainage mains in Cebu, however, the box culvert type of drain is proposed as they are located under the existing roads.

(a) Longitudinal Profile

Channel bed slope in the improvement plan is principally planned to be almost the same as the existing slope or the ground slope. To avoid frequent maintenance works caused by erosion of channels, limiting of maximum velocity or gradient for each type of channel is planned as shown in the table below. In case the existing ground and/or bed slope results in velocities exceeding these values, milder gradients with provision of drop structures are proposed.

Channel Type	Max. Velocity m/s	Roughness Coefficient
Unlined Channel	1.5	0.030
Slope Lined Channel (both banks)	3.0	0.023
Full Lined Channel (bed and both banks)	4.5	0.015

Roughness coefficient for determining the velocity using Manning's formula for each type of channel are also shown on the above table. The coefficient values are assumed based on the assessment of anticipated future conditions.

In determining the design flood levels of the improved reaches of drainage channel, initial water levels (design flood levels at the channel outlets) are selected at both sea and river outlets as shown in the table below. Initial water levels at the sea outlets are determined to be the same as the mean monthly highest tide water levels, selected from the latest available tidal tables of 1992 and 1993 issued by the Philippine Ports Authority.

City	Drainage Outlet	Initial Design Water Level	
		Tide	River Flood
Iloilo	Iloilo Strait	+1.10	-
	Jaro River	-	+1.50
	Iloilo River	-	+1.20
Cebu	Cebu Port	+1.00	-
Ormoc	Ormoc Bay	+1.10	-
	Anilao River	-	+1.10
Tacloban	Tacloban Bay	+0.50	-

Based on the initial water levels at drainage outlets, design flood levels along the objective channel reaches are determined by uniform flow analysis.

(b) Cross Section

Single trapezoidal shape section with slope protection is generally applied for underdeveloped reaches, while rectangular shape section formed by retaining facilities is applied for densely urbanized reaches in consideration of difficulties in land acquisition and house compensation/settlement.

The bank slope for trapezoidal shape section take into three grades; 1:0.5, 1:1, 1:2 depending on the progress of urbanization. Summary of the cross section types applied in this study are shown below.

Type of Shape		Bank Slope	Slope Protection	Land Use
I	Rectangular	Vertical	Retaining Wall	Densely urbanized
II	Trapezoidal	1 : 0.5	Lining	Medium urbanized
III	Trapezoidal	1 : 1	Lining	Scattered urbanized
IV	Trapezoidal	1 : 2	Sodding	Open space

Freeboard of proposed cross sections is 20% and 10% of design water depth respectively for the open channel and closed conduit (box culvert). The minimum freeboard of 0.2 meter is applied.

(c) Proposed Structures

The drainage improvement works consists of channel improvement and construction of drainage mains. The channel improvement works are composed of excavation/dredging, construction of retaining wall, slope/bed protection and drop structure, and reconstruction of bridges. The retaining wall is proposed only for part of Mabolo and Tinago creeks in Cebu. These are urbanized areas including commercial development. Therefore, expantion of channel width is very difficult. The slope protection is proposed for channel section with steep bank slopes of 1:0.5 and 1:1. While the bed protection is proposed along steep channel expecting the flow velocity of more than 3.0 m/s. At the locations of abrupt changes of proposed river beds and along the reaches required milder gradient than the existing one, the drop structure is proposed to stabilize channel beds. As the compensation works, the bridges are reconstructed at least to maintain the existing functions of the bridge facilities. The drainage mains, RC-box culvert, is proposed only under the existing roads in Cebu.

(2) Non-Structural Measures

Land use regulation to reduce flood damage potential is applicable to the coastal low-lying areas and along the steep channels in Cebu and Ormoc. The areas are identified as flood-prone areas urbanizing rapidly in recent years without any countermeasure against flooding problems.

<u>Drainage Improvement Plan</u>

Based on the structural measures for drainage improvement, the Urgent Plan of drainage improvement is composed of channel improvement such as widening/deepening, revetment works, and construction/reconstruction of bridges and drops. The hydraulic conditions for the improvement works are proposed for the 21 drainage channels/pipes as given in Table 4.2. The proposed alignment, longitudinal profile and typical cross-section of each channel are shown in Figs. 4.2 to 4.22.

The proposed improvement works are summarized as follows:

City/Drainage Channel	Improvement Length (m)	Channel Type & Length (m)	Revetment (m)	Bridge (No.)	Drop (No.)
Iloilo City	**10,020**				
Ingore Creek	5,000	Trp : 5,000	-	9	-
Bo. Obrero Creek	4,400	Trp : 4,400	-	4	1
Rizal Creek	620	Trp : 620	-	2	-
Cebu City	**10,850**				
Mabolo Creek	1,930	Trp : 1,600	1,600	2	-
		Rct : 330			
Lahug Tributary	1,680	Trp : 1,680	1,680	3	1
Tinago	1,220	Trp : 1,000	1,000	8	1
		Rct : 70			
		BC : 150			
Pahina-Central	1,100	BC : 1,100	-	-	1
Calamba D.M.	830	BC : 830	-	-	1
Sta. Teresita D.M.	530	BC : 530	-	-	-
Basak-San Nicolas	860	BC : 860	-	-	5
Sto. Niño Creek	1,200	Trp : 1,200	600	1	3
Brgy. Inayawan	1,500	Trp : 1,500	1,500	2	4
Ormoc City	**1,830**				
Lotao	1,200	Trp : 1,200	300	2	-
City Proper	630	Trp : 630	630	8	-
Tacloban City	**15,930**				
Abucay River	1,700	Trp : 1,700	-	2	-
Naga-Naga River	1,000	Trp : 1,000	-	1	1
Mangonbangon River	4,000	Trp : 4,000	3,100	5	-
Langahs-Lirang River	3,750	Trp : 3,750	3,750	6	-
Sagkahan River	380	Trp : 380	380	1	-
Pleasantville River	1,600	Trp : 1,600	1,600	2	1
Burayan River	3,500	Trp : 3,500	3,500	2	-
Total	**38,630**		**19,640**	**60**	**19**

Trp: Trapezoidal Section
Rct: Rectangular
BC : Box Culvert

5. URGENT PLAN

5.1 Project Area

The project area for drainage improvement in Iloilo and Ormoc covers 13.72 km^2 in total encompassing 4 drainage basins; 3-basins in Iloilo and 1-basin in Ormoc as shown in below table. The basins are identified as the priority areas for urgent implementation, since they are at present highly urbanizing and suffering from frequent flood. Figs. 5.1 and 5.2 show the locations of these objective basins.

City	Drainage Basin	Catchment Area (km^2)
Iloilo	Ingore Creek	8.57
	Bo. Obrero Creek	3.71
	Rizal Creek	0.41
Ormoc	Lotao Creek	1.03
Total		13.72

The improvement of City Proper Creek in Ormoc is not included in this Urgent Plan, though it is proposed in the Master Plan. While there exist a few portions with bottlenecks in the upstream stretch, the capacity of the creek is evaluated as that of nearly a 2-year return period. Furthermore, the other stretches have the capacity of more than the design discharges. The improvement works required for this basin have been undertaken by the City Engineer's Office of Ormoc.

5.2 Planning Conditions

The planning conditions for urban drainage are as follows:

(1) Project Scale

The design scale for drainage improvement adopted is a 5-year return period for major drainage system with an area of more than 50 ha and a 3-year return period for those with less than 50 ha, as proposed in the Master Plan. The basins have been affected by rapid urbanization in recent years and it would be difficult to enlarge the drainage channel in the near future. Furthermore, the cost estimation of drainage improvement shows that the construction costs are little sensitive to the design return period. The costs decrease by only 7% or 4% for changes of design return period from 5- to 3-year or 3- to 2-year, respectively, as shown in Table 5.1. Therefore, it is proposed that the channel improvement coping with the targeted design scale in the Master Plan be implemented in the Urgent Plan.

(2) Objective Stretch of Drainage Improvement

As the priority stretches of 4 drainage basins, the following main channel sections are proposed to be improved to cope with the design discharges, which are delineated by flood damage records, drainage conditions, present/future land use. Figs. 5.1 and 5.2 show the location of these stretches.

City	Creek		Objective Stretch
Iloilo	Ingore Creek	4,870 m	(Jaro-Lebanes Road Bridge to Jaro River)
	Bo. Obrero Creek	4,220 m	(Burgos St. to Iloilo Strait)
	Rizal Creek	560 m	(Luna St. to Iloilo River)
Ormoc	Lotao Creek	1,200 m	(Osmeña Ext. to Ormoc Bay)
Total		10,850 m	

Aiming at mitigation of a larger scale of drainage inundation damages in the basins, the improvement of primary channels including some secondary drains is proposed in the Urgent Plan. The improvement of other secondary and tertiary drains causing localized and confined inundation is not included.

(3) Channel Improvement

The drainage channel improvement basically involves widening and deepening rather than diking, to allow flood discharge by gravity in the objective areas. The improvement works remove acute bends and constrictions, bottleneck culverts and bridges, thereby increasing discharge capacities of the channels. In addition, to establish an efficient improvement plan, construction of a new diversion channel is proposed for Ingore Creek and Bo. Obrero Creek in Iloilo. An alternative study of the diversion schemes is discussed in Section 5.3.

(4) Open Channel and Inspection Road

Considering the ease of operation and maintenance of drainage systems, the existing channels to be improved are principally to remain as open watercourses, except under roads and sidewalks where channels require to be enclosed by a box culvert. In addition, provided that there are no existing access roads to the channel for operation and maintenance activities, the construction of an inspection road is proposed with a width of 3 m on one side of the channel as shown in Fig. 5.3.

(5) Design High Water Level

Design high water level along the main channel is, in principle, set below ground level taking the freeboard of 0.30 m to 0.50 m into consideration, so as to allow gravity flow and to minimize inundation damage potentials in secondary drainage areas as shown in Fig. 5.3. In partial low-lying areas along the channel, however, the design water level would be higher than the ground level, due to unavoidable topographic conditions.

Initial water level at the channel mouth for calculation of design high water level is proposed to employ the mean spring highest high water level (MSHHW) at sea outlets and design flood level in 5-year frequency at river outlets. The proposed initial water levels for the objective creeks are shown below.

City	Channel	Tide (MSHHW)	Design River Flood Level (5-year return period) (At Original Outlet)	(At Diversion Outlet)
Iloilo	Ingore Creek	-	+1.14 (Jaro Sta. 2+590)	+1.11 (Jaro Sta. 2+180)
	Bo. Obrero Creek	+1.07	-	+1.08 (Iloilo Sta. 1+100)
		+1.07	-	+1.10 (Iloilo Sta. 3+320)
	Rizal Creek	-	+1.10 (Iloilo Sta. 3+320)	-
Ormoc	Lotao Creek	+1.15	-	-

Note: Elevation is above mean sea level (MSL).

In case the ground elevation of the estuary of the drainage channel is lower than the design flood level of river with 20-year return period including its freeboard, construction of a dike to meet the planned river improvement shall be considered.

(6) Alignment

The proposed alignment of the channel improvement is intended to be as smooth as possible with minimal land acquisition and house evacuation. The provision for a smooth curve alignment in an urbanized area is deemed to be difficult due to land acquisition and compensation problems; thus, the proposed alignment follows the existing one with revetment protection to be provided to avoid erosion damages and to fix the watercourse. As practically as possible, receding the inside alignment of the curve is also proposed. The alignment of diversion channel is also set as smooth as possible with less meandering and far away from congested residential areas.

(7) Longitudinal Profile

The channel profile is principally planned to be nearly the same as the existing bed slope or the ground slope, changing gradually from steep to gentle toward downstream to maintain stability of the channel. In the stretch where the channel system is changed by the diversions of Ingore Creek and Bo. Obrero Creek, the slope before the diversion point is determined to be steeper than the existing one.

(8) Cross Section

A single trapezoidal section with slope protection is generally applied for under-urbanized areas, while a rectangular section formed by box culvert is applied in stretches under road and sidewalk as shown in Fig. 5.3.

The bank slope for a trapezoidal section employs either 1: 0.5 or 1: 2 depending on the land use in the channel alignment. A summary of the cross-sections applied in the Urgent Plan is given below.

Type	Shape	Bank Slope	Slope Protection	Bed Lining	Land Use
I	Rectangular	Vertical	Retaining Wall	Concrete	Under Sidewalk
II	Trapezoidal	1:0.5	Revetment	Concrete	Urbanized Area
III	Trapezoidal	1:0.5	Revetment	None	Urbanized Area
IV	Trapezoidal	1:2	Sodding	None	Open space

(9) Related Structures for Drainage Improvement

(a) Bridge and Box Culvert

Although the existing structures along the channels are utilized as much as possible in the improvement plan, bridges and box culverts crossing roads over channels are required to be replaced with the channel enlargement.

(b) Revetment and Bed-lining

Revetment for bank protection is provided in whole stretches with a bank slope of 1 : 0.5 and at acute bend portions with the bank slope of 1 : 2. Upstream of Bo. Obrero Creek where right-of-way is limited and land acquisition and house evacuation is very difficult, bed-lining of channel is provided to increase flow capacity in the confined flow section.

(10) Environmental Consideration

A drainage channel performs the combined function of sewage and stormwater collection. During the dry season, stagnant wastewater in the uneven bed of an open channel spreads a nasty smell in the vicinity. To minimize these unhealthy and unfavorable environmental situations, an exclusive maintenance flow ditch is provided in the middle of the channel bed as shown in Fig. 5.3. The ditch is located in the upstream stretch of Bo. Obrero Creek where the channel bed is lined with concrete and dried up in the dry season because the stretch is not affected by the tide.

5.3 Drainage Improvement Plan

Based on the planning conditions mentioned above, the drainage improvement plan is proposed as follows:

(1) Ingore Creek

Ingore Creek having a drainage area of some 8.57 km^2 has been utilized as a drainage canal in the east-south end of Sta. Barbara Irrigation System, which adjoins the north of the urban center of Iloilo. Due to the increase in runoff caused by recent urbanization expanding northward of the city, the capacity of the drainage channel has become insufficient and a large-scale channel improvement is required.

In the improvement plan of Ingore Creek, the diversion scheme as shown in Fig. 5.4 is proposed to take the advantages of reducing total construction cost as well as land acquisition and house compensation. The alternative design discharge and hydraulic design are shown in Tables 5.2 and 5.3, and the alternative alignment, profile and width of channel improvement are shown in Figs. 5.4 to 5.6.

Alternative I-a: A 4,870 m channel improvement of Ingore Creek under the present drainage system.

Alternative I-b: A 2,470 m channel improvement upstream of Ingore Creek and construction of a new 580 m diversion channel.

Item	Unit	Alternative I-a	Alternative I-b	Ratio(Ib/Ia)
(1) Construction Cost	Peso	54,487,000	45,851,000	0.84
(2) Land Acquisition	m^2	73,200	49,300	0.67
(3) House Evacuation	No.	21	17	0.81

Note : Tables 5.4 and 5.5 show the breakdown of alternative costs.

It is noted that the diversion channel of 580 m avoids a large-scale improvement in the downstream stretch of 2,400 m and reduces the width of the channel improvement from 25.5 m (Alternative I-a) to 19.5 m in the middle stretch of 1,150 m where it has been developing as a residential area. The diversion channel is located in farm land where no house evacuation is involved. Therefore, social impacts brought by the construction of the channel are minimized.

With the earth dike closing the existing channel at the diversion point of Sta. 2+400, all the runoff from upstream is discharged into the diversion channel, therefore, the downstream stretch of the existing channel has only the function of discharge from its own sub-drainage area.

In principle, alignment of the improvement follows the existing one to utilize the existing drainage systems. However, a cutoff of approximately 120 m along the north side of Jaro-Barobago Road is proposed, because the existing channel between Sta. 3+510 and Sta. 3+630 lies in a private land of the St. Joseph Seminary. The area has been reclaimed with 3 concrete pipes of 1,200 mm in diameter, and it would be costly to enlarge this covered channel.

For the improvement of upstream stretch of 1,320 m from Sta. 3+550 to Sta. 4+870 lying in residential area, Type III of trapezoidal section is proposed to avoid land acquisition problems.

A new bridge on the proposed route of the diversion channel has to be constructed at the crossing of Ticud-Hinactacan Road and the existing nine (9) bridges at road crossings over the objective stretch of 4,870 m have to be replaced.

Figs. 5.9 and 5.10 show the designed alignment, profile and cross section of the improvement, respectively. Table 5.6 gives a summary of the proposed improvement works.

(2) Bo. Obrero Creek

On account of the existing alignment of the channel in which the middle stretch runs close to Iloilo River, three (3) alternative schemes for the improvement are studied including construction of the diversion channel. The alternative design discharge and hydraulic design are shown in Tables 5.2 and 5.3, and the alternative alignments, profile and width of channel improvement are shown in Figs. 5.6 to 5.8. As a result, Alternative II-b is proposed for the Bo. Obrero Creek channel improvement taking the lowest construction cost and land acquisition among the alternatives into account. Along the proposed route of the diversion channel, one bridge construction at the road crossing and approximately 12 house evacuations are required.

Alternative II-a: A 4,220 m channel improvement of Bo.Obrero Creek under the present drainage system.

Alternative II-b:	A 1,400 m channel improvement at upstream stretch of Bo. Obrero Creek and construction of a new 200 m diversion channel at Sta. 2+820.
Alternative II-c:	A 2,920 m channel improvement at upstream and middle stretches of Bo. Obrero Creek and construction of a new 90 m diversion channel at Sta. 1+300.

Item	Unit	Alternative II-a	Alternative II-b	Alternative II-c
(1) Construction Cost	Peso	41,157,000	33,100,000	39,241,000
(2) Land Acquisition	m^2	17,500	8,600	12,000
(3) House Evacuation	No.	54	57	56

Note: Tables 5.4 and 5.5 show the breakdown of alternative costs.

The construction of a 200 m long diversion channel will avoid a large-scale improvement in the downstream stretch of 2,820 m and reduce the width of the channel improvement from 5 m (Alternatives II-a and II-c) to 4.5 m in the upstream stretch of 650 m from the diversion point.

The runoff from the upstream stretch is diverted at Sta. 2+820 to Iloilo River through the proposed diversion channel and its outlet is joined to Rizal Creek at the immediate upstream of Rizal Road crossing. The downstream stretch has only the function of draining the runoff from its vicinity.

For the improvement of the upstream stretch from the diversion point, Type II of trapezoidal section is proposed, which has a steeper side slope of 1 : 0.5 with revetment and bed lining.

Figs. 5.11 and 5.12 show the designed alignment, profile and cross section of the improvement, respectively. Table 5.6 gives a summary of the proposed improvement works.

(3) Rizal Creek

Enlargement scheme by widening and deepening is applied for the improvement of Rizal Creek to increase the drainage capacity corresponding to the design discharge.

The existing channel is, in principle, to remain as an open watercourse. However, the box culvert type of drain is employed upstream of Rizal Creek for a length of 190 m from Sta. 0+370 to Sta. 0+560, since it is located under the existing sidewalk in La Paz Public Market. In the middle stretch of 180 m from Sta. 0+190 to Sta. 0+370 with a densely urbanized area, Type III of trapezoidal section is proposed to minimize land acquisition problems.

At the downstream end of Sta. 0+030, the channel joins with the diversion channel of Bo. Obrero Creek. Therefore, the channel width is widened for the design discharge from both creeks.

Figs. 5.13 and 5.14 show the designed alignment, profile and cross section of the improvement, respectively. Table 5.6 gives a summary of the proposed improvement works.

(4) Lotao Creek

The enlargement scheme of channel improvement is applied for this creek.

In the upstream stretch of 600 m from Sta. 0+600 to 1+200, side ditches of Anubing Street and Camagong Street are improved as main drains applying the Type III cross section for the upstream subbasin. As for the Anubing Street ditch, the northeast side ditch is enlarged to directly collect the upstream runoff, while the southeast ditch is provided along Camagong Street. Some culverts at road crossings are to be replaced with larger sized box culverts.

Figs. 5.15 and 5.16 show the designed alignment, profile and cross section of the improvement, respectively. Table 5.6 gives a summary of the proposed improvement works.

ANNEX

ANNEX: PREVIOUS STUDIES AND PROJECTS

The following studies and projects related to stormwater drainage improvement for the four (4) urban centers selected, namely Iloilo, Cebu, Ormoc and Tacloban are briefly explained in this Annex.

ILOILO CITY

The Department of Public Works and Highways (DPWH), through the financial assistance from the World Bank, implemented the Regional Cities Development Project in 1980 to 1992, on seven (7) urban development, namely, the upgrading of slum areas, road networks, stormwater drains, solid waste, traffic management and expansion of public markets and bus terminals for the four (4) cities of Iloilo, Davao, Bacolod and Cagayan de Oro.

In 1983, a local consulting firm was hired to undertake a study on stormwater drainage improvement for Iloilo City. The study intending for the construction of seven (7) major drainages totaling 880 m in length for the urban core of Iloilo City was carried out applying the design scale of 1 to 2 years return period.

Project Component of Drainage Works

Item No.	Project Works	Place	Catchment Area (ha)	Drains (mm)	Length (m)
1.	Outfall A	Infante St.	18.0	RCP 2 X 1050	125
2.	Outfall B	Ledesma St.	8.5	RCP 1200	203
3.	Outfall C	Jalandini St.	10.0	RCP 1200	123
4.	Outfall D	Fuentes St.	9.0	RCP 2 x 1050	100
5.	Outfall E	Diversion line of Fish Marilet	14.0	RCP 1200	55
6.	Interception Line	-	-	RCP 1200	180
7.	Main Drainage for Outfall C,D, & E	-	-	RCP 2 x 1200	92
Total					878

Implementation of the works was initially proposed for a two-year period starting in 1983 but due to some problems and difficulties, the proposal did not materialize and was only completed in 1992.

CEBU CITY

Norconsult in association with Philnor Consultants, presented a study report entitled "Central Visayas Urban Project (CVUP) - Metro Cebu Drainage Study" in April 1983, under the auspices of the National Economic Development Authority (NEDA). The Central Visayas Urban Project was divided into five (5) major aspects of development which were the roads, drainage, sewage disposal and solid waste management for Metro Cebu and chartered cities of Dumaguete and Tagbilaran.

The drainage improvement study for Metro Cebu encompassing masterplan study, feasibility study and preliminary engineering as well as operation and maintenance program was conducted as a project preparation work for implementation.

The master plan applied in the study was appropriately termed as a strategy for future development and it was interpreted in 3 staging implementations, towards the year 2000.

- First Phase (1984-1987) : for priority secondary drainage projects
- Second Phase (1988-1993) : for primary drainage projects
- Third Phase (1994-2000) : for additional expansion and upgrading of secondary drainage networks.

The project proposals for the first phase implementation were clearly identified as priority secondary drainage development and subjected to preliminary engineering. For the second and third phase considerations, however, only the project concept was discussed and no specific recommendations were made in accordance with the Terms of Reference.

As for the first phase implementation, 55 construction and/or replacement works for secondary drains totaling 14.5 Km in length were studied based on the design flood of 1 to 2 year flood design return period.

Of the 40 hydrologically independent drainage basins and subbasins identified in this report, only 20 were given priority. The proposed drainage projects categorizing various drain sizes are summarized in the table below and the detailed breakdown is shown in Table A.1.

Proposed Drainage Project in First Phase Implementation

Structure	Length
RC Pipe	13.3 km
RC Box Culvert	1.0 km
Open Channel	0.2 km
Total	14.5 km

The total project cost for the construction including land acquisition costs, for the above-mentioned projects, was estimated at 48.5 million pesos using the 1983 price level and the implementing period was proposed for four (4) years starting 1984. Among the proposed 55 construction and/or replacement works of secondary drainage systems, only few were implemented.

ORMOC CITY

Immediately after the Ormoc tragedy brought by Typhoon Uring in November 5, 1991, a committee on Rehabilitation and Development for Ormoc City was established by the City Disaster Coordinating Council. The committee, in cooperation with various agencies concerned, compiled a "Special Rehabilitation Plan for Ormoc City.

The plan covering social services, infrastructure rehabilitation and economic development aspects, was staged into two (2) phases of development which includes urgent work programs in one year and intermediate programs in the following six (6) years.

Flood control and drainage improvement programs under the infrastructure sector was undertaken in the second phase of the plan and also proposed rechanneling of rivers, reinstallation of drainage, construction of revetments and reforestration at the upstream portion of Ormoc City to minimize if not totally avoided the recurrence of the same tragedy experienced thereat.

With the financial and technical assistance of the Asian Development Bank (ADB) as well as various agencies and the private sector, rehabilitation and improvement works for Anilao and Malbasag Rivers consisting of dredging and gabion revetment installation were implemented and completed in 1993 by the Ormoc City Engineering Office.

In addition, using the National Government funds of 10 million pesos, major urban drainage rehabilitation works in the city proper are being undertaken and expected to be completed by August 1993. The major drainage rehabilitation works are summarized below.

Location	Length	Type
(1) Rizal St.	L=110 m	RC-Box Culvert
(2) Real St.	L= 60 m	RC-Box Culvert
(3) Mabini St.	L= 90 m	RC-Box Culvert
(4) Carlos Tan	L=100 m	RC-Box Culvert
TOTAL	L=360 m	

TACLOBAN CITY

In January 1986, a local consulting firm was commissioned by the Tacloban City Government and Program for Essential Municipal Infrastructures, Utilities, Maintenance and Engineering Development (PREMIUMED), to formulate an Overall Drainage Master Plan for the City of Tacloban. The Study was financed by the International Bank for Rehabilitation Development (IBRD) and the final report was completed/submitted in March 1987.

The scope covered by the report were the formulation of an Overall Drainage Master Plan (ODMP) for the Tacloban City Urban Core with an estimated area of 28.8 sq. Km and the identification of an Immediate Action Program (IAP) for the provision of an urgent solutions to relief the periodic flooding problems in the Urban Core, thereat.

The overall drainage master plan was based on a 10 - years return period peak flows at 2000 land use development level. The study proposes drainage improvement works were as follows:

(1) Improvement of 16.6 km for 8 main channels;

(2) Construction of 0.6 km for 2 outfalls;

(3) Installation of 47.7 km for drainage mains; and

(4) Rehabilitation and sustained periodic maintenance of existing drainage facilities.

However, the Immediate Action Program (IAP) was outlined with the improvement of five (5) main drainage way components with a total length of 14.9 km as listed below.

- Mangonbangon River : 4.2 km
- Tanghas-lirang Creek : 3.8 km
- Burayan River : 3.7 km
- Abucay River : 1.6 km
- Pleasantville Canal : 1.6 km
- TOTAL : 14.9 km

The total construction cost was estimated in 1986 price amounting to 73.6 million pesos for the overall drinage master plan and 22.1 million pesos for the immediate action program, excluding the land acquisition cost.

The project implementation period was proposed to twelve (12) years for the overall plan, starting 1987 up to the year 2000, though initial two (2) years was for the implementation of immediate action programs. However, as of May 1993, instead of the priority channel improvement works as proposed in the immediate action program, only 3.5 km of drainage pipe line were constructed.

Table A.2 gives a summary of proposed drainage improvement works as identified in the Overall Drainage Master Plan Study for Tacloban City.

A - i

Table A - 1 METRO CEBU DRAINAGE PROJECT SUMMARY FOR PROPOSED FIRST PHASE PROJECT

Basin	Drainage Area	Reach	Length	RCP <1000 mm	RCP 1000 mm<	RCB	OC	Cap. Costs	Mun/City (Fig. No.)
	(ha)		(m)	(mm)	(mm)	(mm)	(mm)	(P 1000)	
HE	53.1	(1) (1-2)	50		1500			154.1	Cebu City
		(2) (2-3)	320		1200			1084.1	(9.2-VA)
		(3) (3-4)	200		1200			857.6	
HA	44.8	(1) (1-2)	255	675				484.6	Cebu City
		(2) (3-4)	390	525				1728.1	(9.3-VA)
		(3) (4-5)	320		1500			313.3	
		(4) (5-6)	180	750				389.9	
		(5) (18-19)	400			3000x2200		5357.0	
GA	106.3	(1) (1-2)	300		1200			1177.3	Cebu City
		(2) (2-3)	290		1200			1075.1	(9.5-VA)
		(3) (6-7)	140		1050			596.1	
		(4) (7-8)	150		1050			1014.8	
		(5) (9-10)	325	750				507.4	
		(6) (11-12)	390	675				283.4	
		(7) (25-26)	240	825				380.9	
		(8) (26-27)	275	825				408.2	
		(9) (31-32)	130	900				565.8	
		(10)(32-33)	140		1200			474.5	
		(11)(33-34)	280		1200			543.8	
GD		(1) (7-8)	175		1050			586.7	Cebu City
		(2) (8-12)	180	900				392.5	(9.6-VA)
GB	105.2	(1) (9-11)	80			2x2000x1000		118.0	Cebu City
		(2) (11-15)	400	750				589.2	(9.9-VA)
		(3) (15-27)	100	600				1607.4	
		(4) (5-35)	80		1050			113.9	
LA	167.4	(1) (9-11)	200	825				1235.2	Cebu City
		(2) (10-36)	400	900				982.4	(9.10-VA)
		(3) (12-56)	200		1350			370.9	
		(4) (30-31)	190	825				368.9	
		(5) (31-32)	170	900				334.6	
		(6) (36-38)	200	900				269.8	
		(7) (38-39)	160	750				270.5	
		(8) (49-50)	300		1350			823.9	
SA	173.0	(1) (4-5)	80		1350			369.4	Cebu City
		(2) (5-6)	310	675				514.0	(9.12-VA)
		(3) (9-11)	360		1200			543.7	
		(4) (12-13)	150		1200			1304.8	Mandaue City
		(5) (14-13)	220		1050			1148.8	
		(6) (14-15)	660	750				598.7	
SB	37.6	(1) (1-2)	250				2000x1600	1834.6	Cebu City
		(2) (2-5)	420		1350			336.3	(9.15-VA)
		(3) (2-6)	220	675				208.7	
		(4) (6-7)	150	600				1726.3	
		(5)(Outlet)						323.5	
MA-2	46.6	(1) (1-2)	580		1350			2842.6	Talisay
		(2) (2-3)	320		1350			1397.8	(9.21-VA)
		(3) (3-4)	175		1050			476.2	
		(4) (4-5)	335	900				696.4	
		(5) (2-6)	185	750				359.6	
MA-4	95.5	(1) (1-2)	645		1200			2387.8	Talisay
CB	2.7	(1) (1-2)	380	600				529.6	Talisay (9.24-VA)
CG	53.4	(1) (1-2)	220			1500x1300		1845.3	Talisay
		(2) (2-3)	260			1500x900		905.6	(9.25-VA)
		(3) (2-4)	450	900				1623.1	
CA	12.6	(1) (1-2)	480	825				949.1	Talisay (9.26-VA)
Total Conduit Lengths (m)			14,460 m	7,355 m	5,895 m	960 m	250 m	-	-
Total Cap. Cost (MP)								P 48.5 Million (1983 price)	

Note: . RCP = Reinforced Concrete Pipe
. RCB = Reinforced Concrete Box Culvert
. OC = Open Channel

Table A - 2 OVERALL DRAINAGE MASTER PLAN STUDY FOR CITY OF TACLOBAN SUMMARY OF PROPOSED DRAINAGE IMPROVEMENT WORKS

Watershed	Drainage Area	Primary Channel	Proposed Works Drainage Main: In Developed Area	In Future Developing Area	Total	Outfall (m)	Wall/Revet. (m)	Flap Gate (places)	Construction Cost: Urgent: Primary Channel	Urgent: Drainage Main	Future	Total
	(ha)	(m)	(m)	(m)								
1. Nula Tula Creek	136	350	-	980	980	-	-	-	-	-	371	371
2. Abucay River	383	1,600	1,500	3,560	5,060	-	-	-	2,698	-	2,314	5,012
3. Naga-Naga River	125	760	-	3,860	3,860	-	-	-	-	-	2,049	2,049
4. City Proper	174	-	4,180 m (60-1500 mm)	-	4,180	-	-	-	-	300	9,638	9,938
5. Mangonbangon River	533	4,150	3,250	9,150	12,400	360 m (1.80x1.80 m)	3,763 m	18	7,700	-	14,877	22,577
6. Tanghas-Lirang Creek	347	3,800	2,880	3,245	6,125	240 m (2.20x2.20 m)	5,948 m	24	7,981	50	6,844	14,875
7. Pleasantville Canal	150	1,625	1,970	925	2,895	-	-	-	528	-	5,025	5,553
8. Burayan River	585	3,700	1,510	5,310	6,820	-	-	-	3,151	-	7,050	10,201
9. Kanpayapay River	102	650	-	1,205	1,205	-	-	-	-	-	1,056	1,056
10.San Jose Bay Front	128	-	-	2,780	2,780	-	-	-	-	-	1,433	1,433
11.Airport Area	216	-	-	1,435	1,435	-	-	-	-	-	535	535
Total	2,879 ha	16,635 m	15,290 m	32,450 m	47,740 m	600 m	9,711 m	42 pcs.	22,058	350	51,192	73,600

TABLES

Table 2.1 (1/4) Hydraulic Features of Existing Drainage Channels in Iloilo City

Ingore Creek Roughness Coef. n = 0.030

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+ 000	0	2.3	1/1,600	29.1	24.8	18.9	1.445	1.1	31.0
0+ 050	50	2.8	1/1,600	35.9	-1.9	18.8	1.853	1.3	45.2
0+ 100	100	2.8	1/1,600	31.6	-2.9	16.5	1.906	1.3	40.5
0+ 150	150	2.9	1/1,600	35.4	-0.5	17.3	1.943	1.3	45.9
0+ 200	200	2.4	1/1,600	31.4	18.4	19.4	1.611	1.1	36.0
0+ 250	250	2.5	1/1,600	19.7	-5.0	15.8	1.298	1.0	19.5
0+ 300	300	2.1	1/1,600	27.0	-2.0	18.6	1.477	1.1	29.2
0+ 350	350	2.1	1/1,600	21.0	-0.8	15.0	1.409	1.0	22.0
0+ 400	400	2.0	1/1,600	20.8	15.4	14.1	1.417	1.1	21.9
0+ 450	450	2.0	1/1,600	24.1	-0.2	16.6	1.386	1.0	25.0
0+ 500	500	2.0	1/1,600	20.6	-0.5	12.8	1.474	1.1	22.3
0+ 550	550	2.3	1/1,600	19.2	-0.5	15.1	1.247	1.0	18.5
0+ 600	600	1.7	1/1,600	19.7	-2.5	13.2	1.484	1.1	21.3
0+ 650	650	1.8	1/1,600	30.0	-3.0	20.4	1.634	1.2	34.7
0+ 700	700	2.1	1/1,600	19.8	-3.2	12.1	1.609	1.1	22.6
0+ 750	750	1.9	1/1,600	18.0	-3.4	12.2	1.485	1.1	19.6
0+ 800	800	2.3	1/1,600	21.2	-1.0	13.5	1.440	1.1	22.5
0+ 850	850	2.5	1/1,600	25.0	-0.2	15.5	1.521	1.1	27.5
0+ 900	900	2.4	1/1,600	24.7	-0.6	17.2	1.410	1.0	25.8
0+ 950	950	3.1	1/1,600	32.1	-0.1	18.0	1.668	1.2	37.6
1+ 000	1,000	2.3	1/1,600	20.4	-0.4	15.3	1.298	1.0	20.3
1+ 050	1,050	2.8	1/1,600	25.7	-2.2	18.4	1.495	1.1	28.0
1+ 100	1,100	3.0	1/1,600	29.3	-1.6	16.7	1.780	1.2	35.9
1+ 150	1,150	2.7	1/1,600	28.0	2.1	17.6	1.344	1.0	28.4
1+ 200	1,200	2.7	1/1,600	28.7	-0.8	15.3	1.739	1.2	34.6
1+ 250	1,250	2.6	1/1,600	39.8	-0.4	15.9	2.343	1.5	58.5
1+ 300	1,300	2.0	1/1,600	29.5	-1.2	18.7	1.555	1.1	33.0
1+ 350	1,350	2.3	1/1,600	14.9	-1.3	10.1	1.341	1.0	15.1
1+ 400	1,400	2.2	1/1,600	14.3	-0.6	10.7	1.286	1.0	14.1
1+ 450	1,450	2.1	1/1,600	14.8	-0.7	8.8	1.406	1.0	15.5
1+ 480	1,480	1.0	1/1,600	4.6	-3.2	4.6	0.697	0.7	3.0
1+ 500	1,500	1.5	1/1,600	12.7	-0.9	11.3	1.068	0.9	11.1
1+ 550	1,550	1.9	1/1,600	16.3	-0.7	11.0	1.312	1.0	16.2
1+ 600	1,600	1.8	1/1,600	15.8	-0.9	10.5	1.392	1.0	16.4
1+ 650	1,650	1.7	1/1,600	12.8	-0.4	9.1	1.229	1.0	12.3
1+ 690	1,690	1.9	1/1,600	14.1	-0.1	9.4	1.311	1.0	14.1
1+ 750	1,750	1.8	1/1,600	9.9	-2.0	10.8	0.962	0.8	8.1
1+ 800	1,800	2.1	1/1,600	12.2	-0.7	9.8	1.146	0.9	11.1
1+ 850	1,850	2.5	1/1,600	13.5	-0.1	9.6	1.247	1.0	13.0
1+ 900	1,900	2.4	1/1,600	8.7	-0.3	9.3	0.834	0.7	6.4
1+ 950	1,950	2.5	1/1,600	11.2	-1.1	10.7	0.933	0.8	8.9
2+ 000	2,000	1.9	1/1,600	7.5	-0.8	4.9	1.154	0.9	6.9
2+ 050	2,050	2.2	1/1,600	11.3	-0.6	10.0	1.068	0.9	9.8
2+ 100	2,100	2.2	1/1,600	16.3	-0.9	15.0	1.099	0.9	14.4
2+ 150	2,150	2.7	1/1,600	15.5	-0.7	10.0	1.385	1.0	16.1
2+ 200	2,200	1.6	1/1,600	4.9	-1.4	6.0	0.791	0.7	3.5
2+ 245	2,245	1.7	1/1,600	8.7	-1.0	9.0	1.000	0.8	7.2
2+ 285	2,285	2.1	1/1,600	8.7	0.0	9.5	0.829	0.7	6.4
2+ 325	2,325	1.0	1/1,600	17.4	13.2	15.0	1.262	1.0	16.9
2+ 375	2,375	1.6	1/1,600	3.2	1.0	2.0	0.615	0.6	1.9
2+ 400	2,400	1.4	1/700	14.9	-1.0	10.5	1.361	1.5	23.0
2+ 470	2,470	1.7	1/700	15.4	11.1	11.3	1.281	1.5	22.9
2+ 510	2,510	1.5	1/700	12.0	0.0	8.0	1.091	1.3	16.0
2+ 530	2,530	2.0	1/700	31.3	0.0	21.8	1.394	1.6	49.2
2+ 580	2,580	2.2	1/700	37.4	-0.2	28.0	1.326	1.5	56.9
2+ 630	2,630	1.8	1/700	43.8	-1.0	29.0	1.482	1.6	71.7
2+ 670	2,670	1.8	1/700	49.4	-0.2	33.8	1.432	1.6	79.0
2+ 720	2,720	2.0	1/700	27.8	0.0	19.9	1.352	1.5	42.9
2+ 770	2,770	1.5	1/700	12.0	0.0	8.0	1.091	1.3	16.0
2+ 820	2,820	1.4	1/700	39.0	-1.8	26.2	1.487	1.6	64.0
2+ 870	2,870	1.7	1/700	43.3	-1.2	33.6	1.266	1.5	63.8
2+ 920	2,920	1.3	1/700	21.6	0.0	20.5	1.019	1.3	27.5
2+ 970	2,970	1.8	1/700	12.7	-0.8	16.7	0.771	1.1	13.4

Table 2.1 (2/4) Hydraulic Features of Existing Drainage Channels in Iloilo City

Ingore Creek (Continued) Roughness Coef. n = 0.030

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
3+ 020	3,020	1.8	1/700	19.1	-0.1	14.5	1.257	1.5	28.1
3+ 070	3,070	1.4	1/700	15.4	3.6	20.9	0.795	1.1	16.6
3+ 120	3,120	1.4	1/700	6.5	6.6	7.0	0.864	1.1	7.4
3+ 170	3,170	1.6	1/700	6.3	11.6	9.4	0.503	0.8	5.0
3+ 220	3,220	1.8	1/700	6.6	-2.6	5.0	0.980	1.2	8.2
3+ 270	3,270	1.7	1/700	8.6	11.0	9.4	0.805	1.1	9.4
3+ 320	3,320	1.5	1/700	9.4	11.0	12.1	0.832	1.1	10.5
3+ 360	3,360	1.8	1/700	9.4	9.7	10.3	0.900	1.2	11.0
3+ 400	3,400	1.4	1/700	6.8	8.7	9.7	0.774	1.1	7.2
3+ 450	3,450	1.6	1/700	7.6	8.2	8.5	0.778	1.1	8.1
3+ 510	3,510	2.3	1/700	34.0	3.5	10.1	1.681	1.8	60.5
3+ 550	3,550	1.6	1/700	7.7	2.4	4.9	0.957	1.2	9.4
3+ 600	3,600	1.2	1/700	5.8	0.0	4.8	0.800	1.1	6.3
3+ 630	3,630	1.2	1/700	5.4	0.0	4.5	0.783	1.1	5.8
3+ 700	3,700	1.1	1/700	6.1	7.6	8.4	0.742	1.0	6.3
3+ 765	3,765	1.0	1/700	2.6	-1.9	2.6	0.565	0.9	2.2
3+ 800	3,800	1.1	1/700	4.8	7.1	5.9	0.770	1.1	5.0
3+ 870	3,870	1.2	1/700	4.5	-0.2	6.0	0.695	1.0	4.5
3+ 920	3,920	1.2	1/700	4.6	5.3	5.6	0.761	1.0	4.8
3+ 970	3,970	1.1	1/700	6.8	7.3	7.9	0.868	1.1	7.8
4+ 020	4,020	2.4	1/700	9.3	0.0	5.5	1.164	1.4	13.0
4+ 060	4,060	1.4	1/700	5.6	4.2	5.4	1.076	1.3	7.4
4+ 110	4,110	2.5	1/700	8.9	6.8	6.1	1.085	1.3	11.8
4+ 160	4,160	2.2	1/700	7.1	5.4	5.6	0.988	1.2	8.9
4+ 210	4,210	2.5	1/700	10.2	0.0	5.6	1.258	1.5	15.0
4+ 260	4,260	1.7	1/700	7.4	2.3	4.3	0.952	1.2	9.0
4+ 320	4,320	1.8	1/700	7.6	2.3	4.3	0.971	1.2	9.4
4+ 350	4,350	2.1	1/700	7.6	6.0	5.4	1.021	1.3	9.7
4+ 400	4,400	0.6	1/700	7.1	4.7	5.7	1.530	1.7	11.9
4+ 450	4,450	2.3	1/700	10.7	6.7	6.1	1.222	1.4	15.5
4+ 500	4,500	1.4	1/700	5.5	5.4	6.2	0.882	1.2	6.3
4+ 550	4,550	1.1	1/700	4.4	-1.8	7.5	0.688	1.0	4.3
4+ 600	4,600	0.8	1/700	2.6	-1.0	6.2	0.477	0.8	2.0
4+ 650	4,650	1.2	1/700	6.0	5.9	6.8	0.924	1.2	7.1
4+ 700	4,700	1.5	1/700	5.3	4.9	5.0	0.871	1.1	6.1
4+ 750	4,750	1.3	1/700	8.2	8.6	8.2	1.026	1.3	10.5
4+ 800	4,800	1.7	1/700	9.8	8.3	8.3	1.048	1.3	12.7
4+ 850	4,850	1.1	1/700	7.4	6.3	8.8	1.038	1.3	9.5
4+ 870	4,870	0.6	1/700	4.0	2.5	2.5	1.081	1.3	5.3

Table 2.1 (3/4) Hydraulic Features of Existing Drainage Channels in Iloilo City

Bo. Obrero Creek Roughness Coef. n = 0.030

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+ 000	0	1.2	1/1,300	19.9	23.9	36.2	0.804	0.8	15.9
0+ 050	50	3.1	1/1,300	70.4	36.9	37.9	1.856	1.4	98.3
0+ 073	73	1.7	1/1,300	16.9	15.8	15.0	1.082	1.0	16.4
0+ 100	100	2.4	1/1,300	49.8	28.2	28.5	1.703	1.3	65.6
0+ 150	150	2.2	1/1,300	48.3	33.3	33.8	1.413	1.2	56.2
0+ 190	190	2.2	1/1,300	60.0	38.2	39.1	1.546	1.2	74.1
0+ 235	235	2.2	1/1,300	77.2	49.4	50.0	1.546	1.2	95.4
0+ 280	280	2.1	1/1,300	66.2	44.6	47.4	1.467	1.2	79.0
0+ 325	325	1.9	1/1,300	57.2	38.9	39.7	1.509	1.2	69.6
0+ 380	380	1.8	1/1,300	45.4	36.2	34.6	1.282	1.1	49.5
0+ 420	420	2.4	1/1,300	54.7	35.7	33.4	1.634	1.3	70.2
0+ 475	475	0.8	1/1,300	18.2	-2.8	35.3	0.553	0.6	11.3
0+ 515	515	1.9	1/1,300	57.6	37.0	37.4	1.532	1.2	70.8
0+ 560	560	2.2	1/1,300	44.4	27.5	27.5	1.571	1.2	55.5
0+ 610	610	1.9	1/1,300	41.1	34.4	36.9	1.188	1.0	42.6
0+ 655	655	2.0	1/1,300	20.6	23.6	26.0	0.861	0.8	17.3
0+ 700	700	1.5	1/1,300	21.2	20.1	22.0	1.032	0.9	20.0
0+ 750	750	2.2	1/1,300	30.0	28.7	25.3	1.250	1.1	32.2
0+ 795	795	3.7	1/1,300	51.3	27.8	28.0	1.774	1.4	69.5
0+ 825	825	2.3	1/1,300	29.9	-2.0	16.4	1.666	1.3	38.8
0+ 855	855	1.6	1/1,300	32.0	29.5	29.5	1.068	1.0	30.9
0+ 915	915	1.5	1/1,300	49.1	33.9	34.5	1.426	1.2	57.5
0+ 975	975	2.0	1/1,300	50.6	-0.3	34.1	1.476	1.2	60.6
1+ 040	1040	1.5	1/1,300	54.5	40.1	40.5	1.348	1.1	61.5
1+ 115	1115	0.8	1/1,300	43.4	30.9	32.7	1.401	1.2	50.3
1+ 180	1180	1.5	1/1,300	28.7	26.2	26.2	1.080	1.0	27.9
1+ 240	1240	1.5	1/1,300	15.4	16.5	16.5	0.908	0.9	13.3
1+ 310	1310	0.8	1/1,300	77.1	50.2	53.0	1.529	1.2	94.6
1+ 375	1375	0.9	1/1,300	49.9	40.6	42.5	1.227	1.1	52.8
1+ 435	1435	1.2	1/1,300	17.6	16.9	17.5	1.025	0.9	16.6
1+ 500	1500	1.0	1/1,300	22.0	27.2	27.7	0.801	0.8	17.5
1+ 555	1555	0.9	1/1,300	31.6	53.7	53.7	0.583	0.6	20.4
1+ 640	1640	0.7	1/1,300	1.5	6.4	3.5	0.392	0.5	0.7
1+ 715	1715	0.6	1/1,300	107.8	0.0	64.0	0.745	0.8	81.9
1+ 780	1780	0.5	1/1,300	36.8	0.0	50.0	0.729	0.7	27.5
1+ 870	1870	0.5	1/1,300	6.8	20.9	23.6	0.326	0.4	3.0
1+ 925	1925	0.5	1/1,300	3.3	18.4	27.0	0.176	0.3	0.9
1+ 990	1990	0.6	1/1,300	5.4	7.7	9.3	0.683	0.7	3.8
2+ 055	2055	1.4	1/1,300	5.7	6.7	6.7	0.744	0.8	4.3
2+ 120	2120	0.4	1/1,300	1.2	19.0	15.6	0.225	0.3	0.4
2+ 175	2175	0.9	1/1,300	3.5	6.9	3.5	0.657	0.7	2.4
2+ 240	2240	1.0	1/1,300	4.9	-39.0	8.0	0.586	0.6	3.2
2+ 240	2240	0.4	1/1,300	5.1	2.6	26.4	0.273	0.4	2.0
2+ 390	2390	0.9	1/1,300	5.6	-3.4	11.7	0.491	0.6	3.2
2+ 415	2415	1.1	1/1,300	3.7	0.0	5.2	0.634	0.7	2.5
2+ 465	2465	1.0	1/1,300	3.5	0.0	7.0	0.451	0.5	1.9
2+ 515	2515	0.6	1/1,300	1.2	-1.8	2.0	0.375	0.5	0.6
2+ 565	2565	0.7	1/1,300	5.1	-10.1	8.1	0.655	0.7	3.6
2+ 618	2618	0.6	1/1,300	17.6	0.0	32.6	0.531	0.6	10.7
2+ 715	2715	0.3	1/1,300	3.8	-6.3	17.0	0.224	0.3	1.3
2+ 765	2765	0.7	1/1,300	1.2	-6.1	2.8	0.352	0.5	0.5
2+ 815	2815	1.3	1/1,300	2.9	-6.1	4.0	0.600	0.7	1.9
2+ 830	2830	1.2	1/1,300	2.2	-4.7	2.5	0.565	0.6	1.4
2+ 870	2870	0.9	1/1,300	1.5	-4.6	2.2	0.476	0.6	0.9
2+ 915	2915	0.5	1/1,300	0.9	-5.1	2.6	0.336	0.4	0.4
2+ 960	2960	0.9	1/1,300	0.9	-5.7	0.9	0.311	0.4	0.4
3+ 010	3010	1.4	1/1,300	2.2	-5.3	2.0	0.545	0.6	1.4
3+ 015	3015	0.4	1/1,300	0.7	-1.6	5.2	0.186	0.3	0.2
3+ 070	3070	0.3	1/1,300	0.6	-4.0	1.4	0.280	0.4	0.2
3+ 161	3161	0.7	1/1,300	2.8	4.0	4.0	0.519	0.6	1.7
3+ 215	3215	0.5	1/1,300	0.8	-12.7	2.7	0.270	0.4	0.3
3+ 239	3239	0.3	1/1,300	0.6	-9.2	2.2	0.211	0.3	0.2
3+ 315	3315	0.6	1/1,300	0.6	-4.7	1.3	0.300	0.4	0.3

Table 2.1 (4/4) Hydraulic Features of Existing Drainage Channels in Iloilo City

Bo. Obrero Creek(Continued) Roughness Coef. n = 0.030

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m2)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m3/s)
3+ 336	3336	1.2	1/1,300	1.4	1.2	0.400	0.5	0.7
3+ 365	3365	1.2	1/1,300	1.5	1.2	0.401	0.5	0.7
3+ 415	3415	0.5	1/1,300	1.2	2.4	0.353	0.5	0.6
3+ 421	3421	0.6	1/1,300	0.4	0.6	0.200	0.3	0.1
3+ 469	3469	1.2	1/1,300	1.5	1.2	0.403	0.5	0.7
3+ 515	3515	0.6	1/1,300	0.7	1.4	0.316	0.4	0.3
3+ 563	3563	0.6	1/1,300	0.5	0.8	0.240	0.4	0.2
3+ 615	3615	0.5	1/1,300	0.5	1.3	0.263	0.4	0.2
3+ 665	3665	0.5	1/1,300	0.4	0.9	0.233	0.3	0.1
3+ 715	3715	0.5	1/1,300	0.4	0.8	0.222	0.3	0.1
3+ 765	3765	0.1	1/1,300	0.1	0.6	0.134	0.2	0.0
3+ 815	3815	0.3	1/1,300	0.2	0.5	0.136	0.2	0.0
3+ 865	3865	0.4	1/1,300	0.3	0.9	0.197	0.3	0.1
3+ 915	3915	0.4	1/1,300	0.3	1.1	0.213	0.3	0.1
3+ 980	3980	0.3	1/1,300	0.2	0.6	0.150	0.3	0.0
4+ 015	4015	0.1	1/1,300	0.1	0.5	0.143	0.3	0.0
4+ 065	4065	0.3	1/1,300	0.2	0.9	0.162	0.3	0.1
4+ 115	4115	0.3	1/1,300	0.2	0.8	0.171	0.3	0.1
4+ 165	4165	0.5	1/1,300	1.4	2.4	0.424	0.5	0.8
4+ 215	4215	0.3	1/1,300	0.2	0.6	0.200	0.3	0.1

Rizal Creek

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m2)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m3/s)
0+000	0	2.0	1/700	45.3	23.5	1.731	1.8	82.2
0+017	17	2.9	1/700	52.7	22.2	2.160	2.1	111.0
0+043	43	2.7	1/700	80.7	19.8	3.553	2.9	236.8
0+100	100	1.9	1/700	24.1	13.3	1.589	1.7	41.4
0+130	130	1.2	1/700	5.8	4.8	0.800	1.1	6.3
0+159	159	1.0	1/700	21.3	17.7	1.146	1.4	29.4
0+185	185	1.3	1/700	6.0	4.6	0.831	1.1	6.7
0+200	200	1.0	1/700	6.0	5.7	0.821	1.1	6.6
0+250	250	0.9	1/700	4.6	5.7	0.675	1.0	4.4
0+302	302	0.9	1/700	4.6	5.6	0.667	1.0	4.4
0+330	330	1.1	1/700	4.4	4.3	0.736	1.0	4.5
0+368	368	1.2	1/700	6.0	5.0	0.811	1.1	6.6
0+615	615	-	-	-	-	-	-	-

Table 2.2 (1/2) Hydraulic Features of Existing Drainage Channels in Cebu City

Mabolo Creek Roughness Coef. n = 0.030

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0-400	-400	2.5	1/1,300	28.2	15.7	1.679	1.3	36.8
0-200	-200	2.5	1/1,300	28.2	15.7	1.679	1.3	36.8
0+000	0	2.0	1/1,300	12.9	8.2	1.241	1.1	13.8
0+200	200	1.1	1/1,300	3.3	4.0	0.666	0.7	2.3
0+400	400	1.6	1/1,300	14.8	11.3	1.156	1.0	15.1
0+450	450	4.7	1/1,300	32.0	10.6	2.111	1.5	48.6
0+600	600	1.7	1/1,300	12.7	10.9	1.075	1.0	12.3
0+800	800	1.3	1/360	4.0	4.7	0.722	1.4	5.7
1+000	1,000	1.0	1/360	6.9	7.1	0.917	1.7	11.4
1+195	1,195	1.4	1/360	4.4	3.5	0.859	1.6	7.0
1+285	1,285	2.0	1/360	6.3	3.2	0.883	1.6	10.2
1+400	1,400	1.4	1/360	5.3	3.9	0.867	1.6	8.4
1+530	1,530	2.1	1/360	4.3	2.4	0.724	1.4	6.1
1+540	1,540	2.1	1/360	5.0	2.4	0.764	1.5	7.4
Lahuge Tributary								
0+000	0	1.4	1/1,000	9.9	9.6	0.942	1.0	10.0
0+165	165	2.2	1/1,000	17.6	8.0	1.419	1.3	23.4
0+200	200	3.0	1/1,000	32.4	12.0	2.008	1.7	54.4
0+380	380	1.2	1/1,000	8.7	7.6	0.892	1.0	8.5
0+390	390	2.5	1/1,000	27.7	12.3	1.766	1.5	42.6
0+400	400	2.2	1/1,000	22.9	11.2	1.709	1.5	34.5
0+600	600	2.4	1/1,000	23.6	10.8	1.820	1.6	37.1
0+730	730	0.9	1/1,000	3.2	3.6	0.600	0.7	2.4
0+740	740	1.9	1/1,000	22.1	11.4	1.636	1.5	32.3
0+800	800	1.4	1/1,000	3.9	2.8	0.700	0.8	3.3
0+810	810	2.4	1/1,000	29.9	11.9	2.046	1.7	50.8
1+000	1,000	1.4	1/1,000	3.9	2.8	0.700	0.8	3.3
1+010	1,010	2.3	1/1,000	11.7	6.9	1.294	1.3	14.7
1+090	1,090	0.4	1/200	1.1	3.8	0.269	1.0	1.1
1+220	1,220	1.8	1/200	4.6	3.0	0.868	2.1	9.8
1+410	1,410	1.8	1/200	4.2	3.0	0.833	2.1	8.7
1+480	1,480	1.2	1/200	3.0	2.5	0.612	1.7	5.1
1+680	1,680	0.9	1/200	0.8	0.9	0.300	1.1	0.9
Tinago Creek								
0+000	0	5.8	1/2,400	48.1	9.3	2.554	1.3	61.1
0+110	110	2.4	1/2,400	12.2	6.0	1.264	0.8	9.7
0+200	200	1.4	1/2,400	8.3	6.3	0.980	0.7	5.6
0+235	235	2.0	1/2,400	11.4	5.7	1.175	0.8	8.6
0+400	400	1.4	1/2,400	22.5	7.4	2.252	1.2	26.3
0+450	450	2.0	1/2,400	12.6	6.8	1.230	0.8	9.8
0+530	530	2.5	1/2,400	16.5	7.0	1.439	0.9	14.3
0+600	600	0.9	1/2,400	6.5	5.8	1.001	0.7	4.4
0+690	690	1.1	1/2,400	2.3	4.5	0.458	0.4	0.9
0+700	700	1.8	1/2,400	8.8	5.3	1.077	0.7	6.3
0+800	800	1.3	1/2,400	5.1	4.5	0.825	0.6	3.1
0+870	870	1.4	1/2,400	5.8	4.9	0.879	0.6	3.6
1+000	1,000	1.8	1/2,400	6.3	3.8	0.920	0.6	4.1
1+010	1,010	1.4	1/170	2.9	2.3	0.621	1.9	5.5
1+030	1,030	1.3	1/170	2.7	2.3	0.602	1.8	5.0
1+070	1,070	1.1	1/170	1.9	1.7	0.479	1.6	2.9
1+071	1,071	1.1	1/170	1.9	1.7	0.479	1.6	3.0
1+220	1,220	0.9	1/380	1.6	1.8	0.450	1.0	1.6
1+220	1,220	1.4	1/380	2.9	2.1	0.600	1.2	3.6
Sto.Nino Creek								
0+000	0	2.0	1/800	85.7	51.9	1.615	1.6	139.0
0+200	200	1.0	1/800	9.0	10.7	0.794	1.0	9.1
0+410	410	3.1	1/800	42.4	17.0	2.019	1.9	79.8
0+600	600	0.1	1/800	1.0	20.0	0.050	0.2	0.2
0+800	800	0.1	1/100	0.0	0.5	0.069	0.6	0.0
1+000	1,000	0.1	1/100	0.0	0.6	0.062	0.5	0.0
1+030	1,030	0.8	1/100	1.2	1.7	0.407	1.8	2.2
1+200	1,200	1.0	1/100	1.5	1.5	0.429	1.9	2.8
Brangay Inayawan Drainage Channel								
0+000	0	0.6	1/230	0.5	0.8	0.240	0.8	0.4
0+700	700	0.6	1/230	0.5	0.8	0.240	0.8	0.4
1+500	1,500	0.3	1/100	0.2	0.6	0.150	0.9	0.2

Table 2.2 (2/2) Hydraulic Features of Drainage Channels in Cebu City

Pahina Central Kalubihan Drainage Main — Roughness Coeff. n = 0.015

Station No.	Cumulative Dist. (m)	Pipe Dia. B (m)	Slope	Pipe Invert EL. (m)	Pipe Crown EL. (m)	Ground EL. (m)	Flow Area A (m^2)	Hyd. Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	1.8	1/380	-0.8	1.0	2.0	2.5	5.655	2.0	5.1
0+500	500	1.8	1/200	0.5	2.3	3.3	2.5	5.655	2.8	7.0
0+950	950	1.8	1/200	2.7	4.5	5.5	2.5	5.655	2.8	7.0
0+960	960	0.9	1/180	3.6	4.5	5.5	0.6	2.827	1.8	1.2
1+100	1,100	0.9	1/180	4.4	5.3	6.3	0.6	2.827	1.8	1.2

Calamba Drainage Main — Roughness Coeff. n = 0.015(pipe) or 0.023(channel)

Station No.	Cumulative Dist. (m)	Pipe Dia. B (m)	Slope	Pipe Invert EL. (m)	Pipe Crown EL. (m)	Ground EL. (m)	Flow Area A (m^2)	Hyd. Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	1.0	1/170	0.8	1.8	1.8	1.5	3.500	1.9	2.8
0+100	100	0.9	1/130	0.8	1.7	2.7	0.8	4.240	2.2	1.6
0+550	550	0.9	1/130	4.1	5.0	6.0	0.8	4.240	2.2	1.6
0+560	560	0.9	1/80	4.2	5.1	6.1	0.6	2.827	2.8	1.8
0+800	800	0.9	1/80	6.9	7.8	8.8	0.6	2.827	2.8	1.8
0+830	830	0.6	1/80	7.4	8.0	9.0	0.4	1.800	1.7	0.6

(*) : Open Channel

Sta. Teresita Village Drainage Main — Roughness Coeff. n = 0.015

Station No.	Cumulative Dist. (m)	Pipe Dia. B (m)	Slope	Pipe Invert EL. (m)	Pipe Crown EL. (m)	Ground EL. (m)	Flow Area A (m^2)	Hyd. Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	1.2	1/177	8.1	9.3	10.1	1.1	3.770	2.2	2.5
0+090	90	1.2	1/177	8.1	9.3	9.6	1.1	3.770	2.2	2.5
0+259	259	1.2	1/177	8.5	9.7	11.4	1.1	3.770	2.2	2.5
0+260	260	1.2	1/177	8.5	9.7	11.4	1.1	3.770	2.2	2.5
0+330	330	1.2	1/177	9.4	10.6	11.1	1.1	3.770	2.2	2.5
0+430	430	1.2	1/177	10.6	11.8	12.4	1.1	3.770	2.2	2.5
0+431	431	0.9	1/177	11.0	11.9	12.4	0.6	2.827	1.9	1.2
0+530	530	0.9	1/177	11.1	12.0	12.1	0.6	2.827	1.9	1.2

Basak-San Nicolas Drainage Main — Roughness Coeff. n = 0.015

Station No.	Cumulative Dist. (m)	Pipe Dia. B (m)	Slope	Pipe Invert EL. (m)	Pipe Crown EL. (m)	Ground EL. (m)	Flow Area A (m^2)	Hyd. Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	0.6	1/80	1.4	2.0	2.0	0.4	1.800	2.5	0.9
0+600	600	0.6	1/80	8.4	9.0	9.0	0.4	1.800	2.5	0.9
0+610	610	1.0	1/80	8.4	9.4	10.4	0.8	3.142	3.0	2.3
0+700	700	1.0	1/80	9.0	10.0	11.0	0.8	3.142	3.0	2.3
0+710	710	0.9	1/80	9.1	10.0	11.0	0.9	2.827	2.8	2.4
0+860	860	0.9	1/80	11.0	11.9	12.9	0.9	2.827	2.8	2.4

(*):Open Channel

Table 2.3 Hydraulic Features of Existing Drainge Channels in Ormoc City

Lotao Creek Roughness Coef. n = 0.030

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	0.3	1/400	6.7	4.7	0.650	1.3	8.4
0+053	53	2.6	1/400	14.7	3.0	1.372	2.1	30.2
0+165	165	1.7	1/400	9.0	4.4	0.896	1.5	13.9
0+200	200	1.0	1/400	3.2	11.9	0.510	1.1	3.4
0+250	250	0.6	1/400	2.3	4.2	0.522	1.1	2.5
0+374	374	1.2	1/400	1.8	1.0	0.500	1.0	1.9
0+381	381	1.0	1/400	1.0	0.5	0.333	0.8	0.8
0+392	392	0.9	1/400	2.2	3.0	0.549	1.1	2.5
0+405	405	1.0	1/400	1.0	1.0	0.333	0.8	0.8
0+450	450	0.3	1/400	0.7	6.4	0.159	0.5	0.3
0+500	500	0.9	1/400	2.1	3.0	0.535	1.1	2.3
0+550	550	0.6	1/400	5.2	13.3	0.419	0.9	4.9
0+587	587	0.4	1/400	1.1	3.2	0.294	0.7	0.8
0+596	596	1.1	1/400	1.1	1.0	0.348	0.8	0.9
0+600	600	0.6	1/400	0.5	1.3	0.303	0.8	0.4
0+650	650	0.4	1/400	0.6	2.4	0.250	0.7	0.4
0+700	700	0.2	1/400	0.1	1.0	0.121	0.4	0.0
0+750	750	0.5	1/400	0.6	1.7	0.292	0.7	0.5
0+800	800	0.6	1/400	0.7	1.6	0.323	0.8	0.6
0+850	850	1.0	1/400	1.9	3.6	0.506	1.1	2.0
0+900	900	0.7	1/400	0.8	2.7	0.382	0.9	0.7
1+000	1,000	0.5	1/400	1.0	2.3	0.369	0.9	0.8
1+050	1,050	0.5	1/400	0.7	2.4	0.275	0.7	0.5
1+163	1,163	2.4	1/400	0.7	1.3	0.121	0.4	0.3
1+180	1,180	-	-	-	-	-	-	-

City Proper Creek Roughness Coef. n = 0.030

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	0.9	1/220	3.3	4.7	0.597	1.6	5.2
0+027	27	1.6	1/220	6.3	4.7	0.966	2.2	13.7
0+060	60	1.4	1/220	4.9	4.4	0.830	2.0	9.8
0+090	90	1.0	1/220	2.9	3.0	0.597	1.6	4.7
0+100	100	1.9	1/220	8.0	5.5	1.062	2.3	18.6
0+115	115	0.5	1/220	3.9	3.8	0.949	2.2	8.4
0+169	169	1.3	1/220	4.9	4.5	0.812	2.0	9.6
0+199	199	1.9	1/220	6.9	4.1	0.976	2.2	15.3
0+234	234	1.0	1/220	3.8	4.0	0.655	1.7	6.4
0+264	264	1.7	1/220	4.9	4.0	0.846	2.0	9.8
0+299	299	2.3	1/220	7.4	3.9	1.026	2.3	16.8
0+409	409	0.8	1/220	2.1	3.0	0.497	1.4	3.0
0+419	419	1.6	1/220	6.5	5.8	0.925	2.1	13.8
0+509	509	1.2	1/220	2.6	2.4	0.596	1.6	4.2
0+519	519	2.0	1/220	6.7	4.8	0.994	2.2	15.0
0+584	584	1.9	1/220	5.0	3.0	0.830	2.0	9.8
0+594	594	2.4	1/220	7.8	4.0	1.055	2.3	18.2
0+630	630	0.8	1/220	0.8	1.2	0.335	1.1	0.9

Table 2.4 (1/2) Hydraulic Features of Existing Drainage Channels in Tacloban City

Abucay River Roughness Coef. n = 0.030

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	1.2	1/670	66.2	132.1	0.501	0.8	53.8
0+500	500	1.1	1/670	22.5	49.0	0.456	0.8	17.1
0+960	960	1.0	1/670	3.0	3.0	0.600	0.9	2.7
0+970	970	2.4	1/670	28.8	14.0	1.773	1.9	54.3
1+000	1000	1.3	1/670	6.1	5.8	0.917	1.2	7.4
1+500	1500	0.7	1/670	3.3	4.1	0.737	1.1	3.4
1+705	1705	0.6	1/670	13.4	35.9	0.373	0.7	8.9
1+713	1713	0.6	1/670	0.7	1.2	0.300	0.6	0.4
1+723	1723	2.0	1/670	2.4	1.2	0.462	0.8	1.8

Naga-naga River

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	0.2	1/860	3.5	35.2	0.100	0.2	0.9
0+300	300	0.9	1/860	6.4	13.8	0.458	0.7	4.3
0+600	600	2.1	1/860	3.8	1.8	0.630	0.8	3.2
0+610	610	1.0	1/240	20.2	21.9	0.893	2.0	40.2
1+000	1000	0.1	1/100	2.1	27.8	0.075	0.6	1.2
1+500	1500	0.1	1/100	2.1	28.1	0.075	0.6	1.2

Mangonbangon River

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	1.3	1/800	13.7	16.4	0.814	1.0	14.0
0+298	298	2.6	1/800	47.0	22.2	1.856	1.8	83.6
0+493	493	1.9	1/800	9.5	5.0	1.080	1.2	11.8
0+503	503	2.2	1/800	11.9	5.6	1.235	1.4	16.1
0+500	500	1.9	1/800	12.4	8.0	1.216	1.3	16.6
0+830	830	1.8	1/800	18.2	11.0	1.295	1.4	25.4
0+975	975	1.9	1/800	10.2	5.7	1.127	1.3	13.0
1+000	1000	2.2	1/800	13.9	7.9	1.354	1.4	20.0
1+450	1450	2.6	1/800	21.5	9.8	1.656	1.6	35.5
1+500	1500	2.3	1/800	14.7	8.2	1.450	1.5	22.2
1+655	1655	2.2	1/800	5.7	2.6	0.817	1.0	5.9
2+000	2000	1.4	1/800	6.5	5.5	0.916	1.1	7.2
2+460	2460	1.2	1/4,000	3.2	2.7	0.635	0.4	1.3
2+470	2470	1.3	1/4,000	10.0	8.5	0.987	0.5	5.2
2+500	2500	1.9	1/4,000	17.5	9.4	1.685	0.7	13.0
2+625	2625	2.0	1/4,000	13.3	7.3	1.303	0.6	8.4
2+810	2810	4.1	1/4,000	25.5	10.0	1.900	0.8	20.6
3+000	3000	0.9	1/4,000	5.5	9.3	0.574	0.4	2.0
3+100	3100	1.6	1/4,000	8.9	7.0	1.038	0.5	4.8
3+285	3285	0.4	1/4,000	3.2	10.5	0.303	0.2	0.8
3+500	3500	0.3	1/4,000	2.7	9.8	0.273	0.2	0.6
4+000	4000	2.7	1/4,000	3.2	1.2	0.491	0.3	1.1

Langhas-Lirang Creek

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	1.1	1/2,500	17.1	17.7	0.887	0.6	10.5
0+041	41	1.1	1/2,500	3.5	3.6	0.658	0.5	1.8
0+200	200	0.9	1/2,500	5.2	6.2	0.707	0.5	2.8
0+225	225	2.3	1/2,500	13.8	6.2	1.313	0.8	11.0
0+500	500	0.9	1/2,500	5.3	6.9	0.669	0.5	2.7
0+700	700	1.6	1/2,500	9.3	6.2	1.067	0.7	6.5
0+718	718	2.1	1/2,500	10.6	6.2	1.203	0.8	8.0
0+790	790	1.7	1/2,500	10.1	6.4	1.082	0.7	7.1
0+800	800	0.9	1/2,500	6.7	8.2	0.739	0.5	3.6
1+000	1000	0.9	1/2,500	6.6	6.8	0.835	0.6	3.9
1+300	1300	1.7	1/2,500	6.1	3.6	0.874	0.6	3.7
1+310	1310	1.3	1/2,500	5.5	4.4	0.823	0.6	3.2
1+500	1500	0.9	1/2,500	4.5	6.0	0.661	0.5	2.3
2+000	2000	1.0	1/2,500	8.3	6.7	1.100	0.7	5.9
2+090	2090	2.4	1/2,500	12.1	5.6	1.285	0.8	9.5
2+500	2500	1.9	1/2,500	12.4	7.8	1.202	0.8	9.4
3+030	3030	0.3	1/2,500	1.4	5.1	0.260	0.3	0.4
3+370	3370	0.6	1/2,500	0.4	0.6	0.200	0.2	0.1
3+380	3380	1.9	1/2,500	5.7	4.0	0.906	0.6	3.6
3+530	3530	0.3	1/2,500	1.2	4.4	0.266	0.3	0.3
3+750	3750	0.1	1/2,500	1.3	15.5	0.085	0.1	0.2

Table 2.4 (2/2) Hydraulic Features of Existing Drainage Channels in Tacloban City

Sagkahan Creek Roughness Coef. n = 0.030

Station No.	Cumulative Dist. (m)	Depth (m)	Slope	Flow Area A (m^2)	Width B (m)	Hyd.Radi. R (m)	Velocity V (m/s)	Discharge Q (m^3/s)
0+000	0	0.1	1/120	0.6	7.8	0.075	0.5	0.3
0+046	46	2.0	1/120	7.6	3.8	0.974	3.0	22.7
0+142	142	1.2	1/120	5.2	5.7	0.771	2.6	13.3
0+382	382	0.6	1/400	0.4	0.6	0.200	0.6	0.2
0+392	392	0.5	1/400	0.6	1.4	0.282	0.7	0.4
Pleasantrille Creek								
0+000	0	0.1	1/250	0.6	7.4	0.075	0.4	0.2
0+027	27	1.0	1/250	2.0	2.0	0.500	1.3	2.7
0+037	37	1.2	1/250	5.8	6.4	0.790	1.8	10.4
0+330	330	0.7	1/250	0.8	1.1	0.308	1.0	0.7
0+340	340	0.9	1/1,900	1.7	2.5	0.489	0.5	0.8
0+500	500	0.2	1/1,900	0.2	2.1	0.098	0.2	0.0
0+570	570	2.4	1/1,900	2.2	0.9	0.379	0.4	0.9
0+580	580	1.0	1/1,900	1.6	2.3	0.482	0.5	0.8
0+650	650	0.2	1/1,900	0.2	1.4	0.153	0.2	0.1
1+000	1,000	0.2	1/1,900	2.3	13.7	0.168	0.2	0.5
1+140	1,140	1.0	1/1,900	0.7	0.7	0.259	0.3	0.2
1+500	1,500	1.3	1/1,900	3.2	4.1	0.629	0.6	1.8
1+600	1,600	0.1	1/1,900	0.5	6.7	0.075	0.1	0.1
Burayan River								
0+000	0	0.7	1/2,400	30.4	33.4	0.909	0.6	19.4
0+500	500	3.1	1/2,400	17.5	6.6	1.556	0.9	16.0
1+000	1,000	1.0	1/2,400	9.2	11.4	0.790	0.6	5.4
1+500	1,500	0.9	1/2,400	9.5	12.4	0.746	0.6	5.3
1+980	1,980	0.2	1/2,400	1.5	8.9	0.167	0.2	0.3
2+560	2,560	0.2	1/2,400	0.7	7.4	0.100	0.1	0.1
2+920	2,920	2.4	1/2,400	15.7	6.6	1.387	0.8	13.3
3+090	3,090	0.6	1/2,400	1.3	3.0	0.385	0.4	0.5
3+377	3,377	1.2	1/2,400	6.1	5.4	0.981	0.7	4.1
3+510	3,510	1.3	1/2,400	3.5	2.7	0.662	0.5	1.8

Table 3.1 Habitual Inundation Area and Condition

City		Location of Inundation	Area (ha)	Depth (m)	Inundation Duration (hours)	Frequency (times)
Iloilo	1	Ingore Upstream	42.4	0.30 - 1.00	2 - 12	2
	2	Lopez Jaena St.	3.4			
	3	Commision Civil St.	3.2			
	4	Burgos St.	2.4			
	5	Rizal-Hervana St.	9.6	0.20 - 0.30	2	5
	6	General Luna St.	5.6			
	7	Compania St.	7.4			
	8	No.8	7.6			
	9	No. 9	4.4			
	10	No. 10	27.6	0.10 - 0.30	1 - 2	3 - 5
	11	No. 11	1.2			
		Total	114.8			
Cebu	1	Lahug River	3.2	0.40	1 - 5	2
	2	Subang Daku Ave.	1.6			
	3	Mabolo Creek	14.0	0.50	2	2 - 3
	4	Lahug Tributary	8.0	0.30 - 0.60	1 - 3	2
	5	Camp Thaw	0.8			
	6	Barangay Tinago 1	1.6			
	7	Barangay Tinago 2	0.6			
	8	Barangay Tinago 3	2.6			
	9	Tinago Creek	7.2	0.30 - 0.50	1 - 2	2 - 3
	10	Barangay Sta. Cruz	0.7			
	11	L. Kilat St.	1.2			
	12	Magallanes St.	0.5			
	13	Guadalupe Downstream	1.4			
	14	M. del Rosario St.	0.4			
	15	Barangy Calamba	1.2			
	16	Gen. Maxilom Ext.	1.0			
	17	Kinalumsan Upstream	1.2			
	18	Savador-Labangon Rd.	5.5			
	19	Sta. Teresita Village	10.0	0.50 - 1.20	1 - 2	2 - 3
	20	J. R. Avenue Ext. 1	0.5			
	21	J. R. Avenue Ext. 2	0.5			
	22	J. R. Avenue Ext. 3	0.7			
	23	J. R. Avenue Ext. 4	0.6			
	24	J. R. Avenue Ext. 5	1.1			
	25	Sto. Nino Creek	18.8	0.20 - 0.30	1	3 - 4
	26	Cogon-Pardo 1	1.1			
	27	Cogon-Pardo 2	0.6			
	28	Cogon-Pardo 3	1.0			
	29	Barangay Inayawan	3.8			
		Total	91.4			
Ormoc	1	Lotao Creek	17.1	0.50 - 1.00	6 - 12	
	2	Government Center	9.5	0.20 - 0.40	1	
	3	Punta	6.8	0.20 - 0.40	24 - 48	
	4	Alegria-Punta Rd.	0.8			
	5	Bonifacio-Larazabal Int.	1.0			
	6	Rizal Avenue 1	0.8			
	7	Rizal Avenue 2	0.5			
	8	Rizal Extension	4.1	0.20 - 0.40	2 - 6	2 - 3
	9	Bonifacio-Hermosilla Int.	0.3			
	10	Aviles-Guevara Int.	1.0			
		Total	41.9			
Tacloban	1	Abucay River	16.6	0.30 - 0.50	5 - 6	4 - 5
	2	Naga-naga Creek	7.8	0.30 - 1.00	2 - 4	1 - 2
	3	Mangonbangon Upstream	34.8	0.50 - 1.00	24 - 72	3 - 5
	4	Mangonbangon Downstream	5.2	0.30 - 0.60	2 - 4	3 - 5
	5	Laghas-Lirang Creek	24.4	0.20 - 1.00	2 - 24	3 - 5
	6	Old Sagkahan Creek	1.2	0.20 - 0.50	4 - 5	3 - 5
	7	Pleasantville Creek	18.2	0.50 - 0.80	12 - 24	33 - 4
	8	Burayan Upstream	92.0	0.30 - 0.60	24 - 36	3 - 4
	9	Burayan Downstream	5.6	0.10 - 0.30	1 - 2	4 - 5
		Total	205.8			

Table 4.1 (1/2) Design Discharge of Urban Drainage Area
(Iloilo & Cebu)

City	Channel No.	Drainage Area (km²)	Channel Length (m)	Drain Length (m)	Average Velocity (m/s)	Time of Concent. (min)	Rainfall Intensity (mm/hr) 1-yr	2-yr	3-yr	5-yr	10-yr	Runoff Coeffi.	Design Discharge (m³/s) 1-yr	2-yr	3-yr	5-yr	10-yr	Spec. Discharge (m³/s/km²) 3-yr	5-yr
Iloilo																			
	1. Ingore Creek																		
	Ia-1	8.02	3,600	7,500	1.2	114.2	19	35	39	48	57	0.44	18.7	34.0	38.5	47.1	55.8	4.8	5.9
	Ia-2	5.31	1,300	3,900	1.2	64.2	27	52	58	70	82	0.44	17.6	33.5	37.5	45.2	53.2	7.1	8.5
	2. Bo. Obrero Creek																		
	Bo-1	3.89	800	4,700	0.8	107.9	20	36	41	50	59	0.57	12.2	22.3	25.2	30.8	36.5	6.5	7.9
	Bo-2	2.30	1,300	3,900	0.8	91.3	22	41	46	56	66	0.58	8.2	15.1	17.0	20.7	24.5	7.4	9.0
	Bo-3	1.25	2,600	2,600	0.8	64.2	27	52	58	70	82	0.61	5.7	10.9	12.2	14.7	17.3	9.8	11.8
	3. Rizal Creek																		
	Ri-1	0.50	2,000	2,000	1.2	37.8	35	69	77	91	107	0.61	2.9	5.9	6.5	7.7	9.0	13.0	15.5
Cebu																			
	1. Mabolo Creek																		
	Ma-1	2.78	3,900	3,900	3.0	31.7	33	78	89	105	124	0.68	20.5	44.0	49.7	58.5	#REF!	17.9	21.1
	(Lahug Diversion)		-	-	-	-	-	-	-	-	-	-	(3.2)	(3.2)	(3.2)	(3.2)	3.2	-	-
	2. LahugTributary																		
	La-1	0.65	1,000	1,900	1.5	31.1	33	78	89	106	124	0.61	3.7	8.6	9.8	11.7	13.7	15.1	18.0
	La-2	0.22	900	900	1.5	20.0	42	95	107	125	144	0.63	1.6	3.7	4.1	4.8	5.6	18.8	21.8
	3. Tinago Creek																		
	Ti-1	1.10	400	2,700	2.0	32.5	32	77	87	104	122	0.74	7.3	17.3	19.8	23.6	27.7	18.0	21.4
	Ti-2	0.90	600	2,300	2.0	29.2	35	81	92	109	128	0.77	6.7	15.6	17.7	21.0	24.5	19.7	23.3
	Ti-3	0.43	1,700	1,700	2.0	24.2	38	88	100	117	136	0.80	3.7	8.4	9.5	11.2	13.0	22.2	26.0
	4. Pahina Central - Kalubihan Drainage Main																		
	Pa-1	1.00		2,250	3.5	20.7	41	94	106	123	143	0.80	9.2	20.9	23.5	27.4	31.7	23.5	27.4
	5. Calamba Drainage Main																		
	Ca-1	0.79		2,000	4.5	17.4	45	101	113	130	150	0.73	7.2	16.1	18.0	20.7	23.9	22.8	26.3
	6. Sta. Teresita Village Drainage Main																		
	St.-1	3.80	200	3,200	4.0	23.3	39	90	101	118	138	0.38	15.6	35.9	40.6	47.5	55.2	10.7	12.5
	St.-2	2.94	3,000	3,000	4.0	22.5	40	91	103	120	139	0.33	10.7	24.5	27.7	32.3	37.5	9.4	11.0
	7.Basak-san Nicolas Drainage Main																		
	Bas-1	0.67		1,200	4.5	14.4	49	107	119	136	157	0.69	6.2	13.7	15.3	17.5	20.1	22.8	26.1
	8. Sto. Nino Creek																		
	Sto.-1	5.11	600	5,200	2.0	53.3	23	58	67	82	98	0.42	14.0	34.4	39.8	48.9	58.2	7.8	9.6
	Sto.-2	3.82	4,600	4,600	2.0	48.3	25	61	71	86	103	0.37	9.9	24.1	27.8	33.9	40.3	7.3	8.9
	9. Barangay Inayawan Drainage Channel																		
	Bar.-1	1.29		1,600	3.0	18.9	43	98	110	127	147	0.66	10.2	23.1	25.9	30.0	34.7	20.1	23.3

Table 4.1 (2/2) Design Discharge of Urban Drainage Area
(Ormoc & Tacloban)

City	Channel No.	Drainage Area (km²)	Channel Length (m)	Drain Length (m)	Average Velocity (m/s)	Time of Concen. (min)	Rainfall Intensity (mm/hr) 1-yr	2-yr	3-yr	5-yr	10-yr	Runoff Coeffi.	Design Discharge (m³/s) 1-yr	2-yr	3-yr	5-yr	10-yr	Spec.Discharge (m³/s/km²) 3-yr	5-yr
Ormoc																			
	1. Lotao Creek																		
	Lot-1	1.03	500	1,700	1.7	26.7	26	48	58	68	229	0.49	3.6	6.8	8.1	9.5	32.1	7.8	9.3
	Lot-2	0.44	1,200	1,200	1.7	21.8	29	54	64	76	259	0.54	1.9	3.6	4.2	5.0	17.1	9.7	11.4
	2. City Proper Creek																		
	Cit-1	0.32	900	900	2.2	16.8	33	62	74	87	303	0.69	2.0	3.8	4.5	5.4	18.6	14.2	16.8
Tacloban																			
	1. Abucay River																		
	Abu-1	2.38	2,400	2,400	1.2	43.3	40	63	68	77	87	0.44	11.6	18.2	19.8	22.5	25.4	8.3	9.5
	2. Naga-naga Creek																		
	Nag-1	1.21	600	2,800	1.0	56.7	33	53	59	67	76	0.48	5.4	8.6	9.4	10.8	12.3	7.8	9.0
	Nag-2	1.00	2,200	2,200	1.0	46.7	38	60	65	75	84	0.48	5.1	8.0	8.7	9.9	11.2	8.7	9.9
	3. Mangonbangon River																		
	Man-1	5.12	4,900	4,900	1.4	68.3	29	47	52	60	69	0.45	18.8	30.3	33.3	38.5	43.9	6.5	7.5
	4. Langhas Lirang Creek																		
	Lan-1	4.38	4,100	4,100	1.3	62.6	31	50	55	63	72	0.47	17.9	28.7	31.5	36.3	41.3	7.2	8.3
	5. Sagkahan Creek																		
	Sag-1	0.14	500	500	1.5	15.6	66	98	104	114	125	0.62	1.6	2.4	2.5	2.7	3.0	18.0	19.6
	6. Pleasantville Creek																		
	Ple-1	1.25	500	1,600	1.0	36.7	44	68	74	84	94	0.52	7.9	12.4	13.4	15.1	17.0	10.7	12.1
	Ple-2	0.88	600	1,100	1.0	28.3	51	78	84	93	104	0.49	6.1	9.3	10.0	11.2	12.5	11.4	12.7
	Ple-3	0.37	500	500	1.0	18.3	62	92	99	108	120	0.45	2.9	4.3	4.6	5.0	5.5	12.4	13.6
	7. Burayan River																		
	Bur-1	6.90	5,200	5,200	0.8	118.3	19	32	35	42	48	0.43	15.9	26.2	29.1	34.3	39.6	4.2	5.0
	Bur-3	1.41	2,300	2,300	0.8	57.9	33	53	58	66	75	0.45	5.8	9.3	10.2	11.7	13.3	7.2	8.3

Table 4-2 (1/2) Hydraulic Design of Channel Improvement (Iloilo & Cebu)

City	Channel No.	Channel Length (m)	Design Discharge (m^3/s)	Hydraulic Channel Section Type	Width (m)	Depth (m)	Freeboard (m)	Bank Slope	Flow Area (m^2)	Perimeter (m)	Hyd. Radi. (m)	Rough. Coeff.	Gradient	Velocity (m/s)	Discharge Capacity (m^3/s)
Iloilo															
	1. Ingore Creek														
	Ing-1	3,000	47.1	Trapez.	23.0	2.5	0.5	1 : 2	45.0	24.2	1.861	0.030	1/2200	1.1	48.4
	Ing-2	600	47.1	Trapez.	18.0	2.5	0.5	1 : 2	32.5	19.2	1.694	0.030	1/1000	1.5	48.7
	Ing-3	1,400	45.2	Trapez.	10.0	2.5	0.5	1:0.5	21.9	11.2	1.959	0.023	1/1000	2.2	47.0
	2. Bo. Obrero Creek														
	Bo.-1	800	30.8	Trapez.	27.0	2.5	0.5	1 : 2	55.0	28.2	1.952	0.030	1/8000	0.6	32.0
	Bo.-2	1,300	20.7	Trapez.	17.0	2.5	0.5	1 : 2	30.0	18.2	1.650	0.030	1/4000	0.7	22.1
	Bo.-3	2,300	14.7	Trapez.	7.0	2.2	0.5	1:0.5	13.0	8.0	1.617	0.023	1/2000	1.3	17.4
	3. Rizal Creek														
	Riz-1	130	6.5	Trapez.	13.0	1.0	0.2	1 : 2	11.0	13.5	0.817	0.030	1/2000	0.7	7.2
	Riz-2	240	6.5	Trapez.	5.0	1.0	0.2	1 : 0.5	4.5	6.2	0.722	0.023	1/500	1.6	7.0
	Riz-3	250	6.5	Box. Cul	3.5	1.0	0.1	-	3.5	4.7	0.739	0.015	1/500	2.2	7.7
Cebu															
	1. Mabolo Creek														
	Mab-1	1,200	58.5	Trapez.	17.0	2.0	0.4	1 : 0.5	32.0	19.5	1.643	0.023	1/1000	1.9	61.3
	Mab-2	400	58.5	Trapez.	11.0	2.0	0.4	1 : 0.5	20.0	13.5	1.485	0.023	1/350	3.0	60.5
	Mab-3	330	58.5	Rectan.	7.0	2.0	0.4	-	14.0	11.0	1.273	0.015	1/300	4.5	63.3
	2. LahugTributary														
	Lah-1	1,000	11.7	Trapez.	7.0	2.0	0.4	1 : 0.5	12.0	9.5	1.267	0.023	1/2000	1.1	13.7
	Lah-2	680	4.8	Trapez.	3.0	1.1	0.3	1 : 0.5	2.7	4.4	0.618	0.023	1/250	2.0	5.4
	3. Tinago Creek														
	Tin-1	1,000	23.6	Trapez.	7.0	3.0	0.6	1 : 0.5	16.5	10.7	1.541	0.023	1/1500	1.5	24.7
	Tin-2	70	21.0	Rectan.	4.0	3.0	0.6	-	12.0	10.0	1.200	0.015	1/1500	1.9	23.3
	Tin-3	150	11.2	Box Cul.	2.0	1.7	0.2	-	3.4	5.4	0.630	0.015	1/200	3.5	11.8
	4. Pahina Central - Kalubihan Drainage Main														
	Pah-1	500	27.4	Box Cul.	4.0	2.1	0.3	-	8.4	8.2	1.024	0.015	1/400	3.4	28.5
	Pah-2	600	27.4	Box Cul.	4.0	1.6	0.2	-	6.4	7.2	0.889	0.015	1/200	4.4	27.9
	5. Calamba Drainage Main														
	Cal-1	830	20.7	Box Cul.	2.5	1.9	0.2	-	4.8	6.3	0.754	0.015	1/150	4.5	21.4
	6. Sta. Teresita Village Drainage Main														
	Sta-1	260	47.5	Box Cul.	4.0	2.6	0.3	-	10.4	9.2	1.130	0.015	1/250	4.5	47.6
	Sta-2	270	32.3	Box Cul.	3.0	2.5	0.3	-	7.5	8.0	0.938	0.015	1/200	4.5	33.9
	7.Basak-san Nicolas Drainage Main														
	Bas-1	860	17.5	Box Cul.	2.5	1.7	0.2	-	4.3	5.9	0.720	0.015	1/150	4.4	18.6
	8. Sto. Nino Creek														
	Sto-1	600	48.9	Trapez.	28.0	2.0	0.4	1 : 2	48.0	28.9	1.658	0.030	1/2000	1.0	50.1
	Sto-2	600	33.9	Trapez.	10.0	1.5	0.3	1 : 1	12.8	11.2	1.134	0.023	1/250	3.0	38.1
	9. Barangay Inayawan Drainage Channel														
	Bar-1	700	30.0	Trapez.	9.0	1.5	0.3	1 : 1	11.3	10.2	1.098	0.023	1/250	2.9	32.9
	Bar-2	800	30.0	Trapez.	6.0	1.3	0.3	1 : 0.5	7.0	7.6	0.914	0.015	1/200	4.4	30.9

Table 4-2 (2/2) Hydraulic Design of Channel Improvement
(Tacloban & Ormoc)

City	Channel No.	Channel Length (m)	Design Discharge (m^3/s)	Hydraulic Channel Section: Type	Width (m)	Depth (m)	Freeboard (m)	Bank Slope	Flow Area (m^2)	Peri-meter (m)	Hyd. Radi. (m)	Rough. Coeff.	Gradient	Velocity (m/s)	Discharge Capacity (m^3/s)
Ormoc															
	1. Lotao Creek														
	Lot-1	500	9.5	Trapez..	7.0	1.2	0.3	1 : 2	7.0	8.0	0.871	0.030	1/500	1.4	9.5
	Lot-2	700	5.0	Trapez..	3.5	1.2	0.3	1 : 1	2.8	4.5	0.614	0.023	1/250	2.0	5.5
	2. City Proper Creek														
	Cit-1	630	4.5	Trapez..	3.0	1.0	0.2	1 : 0.5	2.5	4.2	0.590	0.023	1/200	2.2	5.4
Tacloban															
	1. Abucay River														
	Abu-1	1,700	22.5	Trapez..	13.0	2.0	0.4	1 : 2	18.0	13.9	1.291	0.030	1/1000	1.2	22.5
	2. Naga-naga Creek														
	Nag-1	600	10.8	Trapez..	12.0	2.0	0.4	1 : 2	16.0	12.9	1.236	0.030	1/3000	0.7	11.2
	Nag-2	400	9.9	Trapez..	8.0	1.5	0.3	1 : 2	7.5	8.7	0.861	0.030	1/400	1.5	11.3
	3. Mangonbangon River														
	Man-1	3,100	38.5	Trapez..	12.0	2.0	0.4	1 : 0.5	22.0	14.5	1.520	0.023	1/1000	1.8	40.0
		900	38.5	Trapez..	18.0	2.0	0.4	1 : 2	28.0	18.9	1.478	0.030	1/1000	1.4	38.3
	4. Langhas Lirang Creek														
	Lan-1	2,500	36.3	Trapez..	12.0	2.0	0.4	1 : 0.5	22.0	14.5	1.520	0.023	1/1200	1.7	36.5
		1,250	36.3	Trapez..	14.0	2.0	0.4	1 : 1	24.0	15.7	1.533	0.023	1/1200	1.7	40.0
	5. Sagkahan Creek														
	Sag-1	380	2.5	Trapez..	3.0	0.8	0.2	1 : 1	1.8	3.7	0.481	0.023	1/300	1.5	2.7
	6. Pleasantville Creek														
	Ple-1	500	15.1	Trapez..	7.0	2.0	0.4	1 : 1	10.0	8.7	1.155	0.023	1/1000	1.5	15.1
	Ple-2	600	11.2	Trapez..	6.0	2.0	0.4	1 : 1	8.0	7.7	1.045	0.023	1/1000	1.4	11.3
	Ple-3	500	5.0	Trapez..	5.0	1.3	0.3	1 : 1	4.8	6.1	0.792	0.023	1/1000	1.2	5.7
	7. Burayan River														
	Bur-1	2,900	34.3	Trapez..	17.0	2.0	0.4	1 : 1	30.0	18.7	1.608	0.023	1/2500	1.2	35.8
	Bur-3	600	11.7	Trapez..	8.0	2.0	0.4	1 : 1	12.0	9.7	1.243	0.023	1/2500	1.0	12.1

Table 5.1 Cost Comparison of Channel Improvement in Planning Scale

Project Scale	Channel				Hydraulic Feature						Quantity for Major Works				Direct Construction Cost			
	Name	No.	Type	Length (m)	Water Depth (m)	Water Surf. Width (m)	Channel Width (m)	Bank Slope	Freeboard (m)	Flow Area (m2)	Earth Works (m3)	Revet-ment (m2)	Bridge (m2)	Box-culv. (Conc.Vol.) (m3)	per Section (Mill. Peso)	Sub-total (Mill. Peso)	Grand Total	Ratio (%)
Unit Const. Cost (Peso)											83	1412	22909	7330				
10-YEAR	1. INGORE	Ia-1	Earth	1300	2.2	12.0	14.0	1:2	0.5	16.7	21736				1.8			
		Ia-2	Earth	900	2.2	12.0	14.0	1:2	0.5	16.7	15048		186		5.5			
			(CUTOFF)	580	3.1	17.5	20.3	1:2	0.7	35.0	20317		158		5.3			
		Ia-3	Earth	1000	3.1	17.5	20.3	1:2	0.7	35.0	35030		228		8.1			
		Ia-4	2-Lining	1300	2.8	8.0	8.6	1:0.5	0.6	18.5	24024	11337	300		24.9	45.7		
	2. B.OBRERO	Bo-1	Earth	150	1.7	30.0	31.6	1:2	0.4	45.2	6783				0.6			
		Bo-2	Earth	700	1.7	22.5	24.1	1:2	0.4	32.5	22729				1.9			
		Bo-3	Earth	650	1.7	22.5	24.1	1:2	0.4	32.5	21106				1.8			
		Bo-4	Earth	550	1.7	22.5	24.1	1:2	0.4	32.5	17859				1.5			
		Bo-5	2-Lining	250	1.6	6.0	6.4	1:0.5	0.4	8.3	2000	1398	78		3.9			
		Bo-6	2-Lining	450	0.5	1.5	1.6	1:0.5	0.1	0.6	281	1107			1.6			
			(Cutoff)	200	2.2	10.5	12.5	1:2.0	0.5	13.4	2084		158		3.8			
		Bo-7	3-Lining	400	2.2	4.0	4.5	1:0.5	0.5	6.4	2552	2862		50	4.6			
		Bo-8	3-Lining	250	2.2	4.0	4.5	1:0.5	0.5	6.4	1595	1789		65	3.1			
		Bo-9	3-Lining	800	1.5	3.0	3.3	1:0.5	0.3	3.4	2700	4114		99	6.8	29.6		
	3. RIZAL	Ri-1	Earth	240	1.4	7.0	8.2	1:2	0.3	5.9	1411				0.1			
		Ri-2	2-Lining	190	1.2	4.0	4.3	1:0.5	0.3	4.1	775	850			1.3			
		Ri-3	Box Culv.	190	1.2	2.5	2.5 -		0.1	3.0	570			494	3.8	5.2		
	4. LOTAO	Lot-1	Earth	600	1.6	8.5	10.1	1:2	0.4	8.5	5088				0.4			
		Lot-2.0	2-Lining	250	1.6	2.5	2.9	1:0.5	0.4	2.7	600	1398		78	2.6			
		Lot-2.1	2-Lining	350	0.8	2.3	2.7	1:0.5	0.2	1.7	588	1174		77	2.3	5.3	85.8	100
5-YEAR	1. INGORE	Ia-1	Earth	1300	2.2	11.0	13.0	1:2	0.5	14.5	18876				1.6			
		Ia-2	Earth	900	2.2	11.0	13.0	1:2	0.5	14.5	13068		171		5.0			
			(CUTOFF)	580	2.5	17.5	19.5	1:2	0.5	31.3	18125		158		5.1			
		Ia-3	Earth	1000	2.5	17.5	19.5	1:2	0.5	31.3	31250		228		7.8			
		Ia-4	2-Lining	1300	2.5	8.0	8.5	1:0.5	0.5	16.9	21938	10174	300		23.1	42.6		
	2. B. OBRERO	Bo-1	Earth	150	1.5	30.0	31.2	1:2	0.3	40.5	6075				0.5			
		Bo-2	Earth	700	1.5	22.5	23.7	1:2	0.3	29.3	20475				1.7			
		Bo-3	Earth	650	1.5	22.5	23.7	1:2	0.3	29.3	19013				1.6			
		Bo-4	Earth	550	1.5	22.5	23.7	1:2	0.3	29.3	16088				1.3			
		Bo-5	2-Lining	250	1.5	6.0	6.3	1:0.5	0.3	7.9	1969	1286	78		3.8			
		Bo-6	2-Lining	450	0.6	1.2	1.4	1:0.5	0.2	0.5	243	1308			1.9			
			(Cutoff)	200	1.9	10.5	12.1	1:2.0	0.4	12.7	2546		158		3.8			
		Bo-7	3-Lining	400	1.9	4.0	4.4	1:0.5	0.4	5.8	2318	2504		46	4.1			
		Bo-8	3-Lining	250	1.9	4.0	4.4	1:0.5	0.4	5.8	1449	1565		60	2.8			
		Bo-9	3-Lining	800	1.3	3.0	3.3	1:0.5	0.3	3.1	2444	3757		93	6.2	27.7		
	3. RIZAL	Ri-1	Earth	240	1.1	7.0	8.2	1:2	0.3	5.3	1267				0.1			
		Ri-2	2-Lining	190	1.1	4.0	4.3	1:0.5	0.3	3.8	721	807			1.2			
		Ri-3	Box Culv.	190	1.1	2.5	2.5 -		0.1	2.8	523			437	3.3	4.6		
	4. LOTAO	Lot-1	Earth	600	1.3	8.5	9.7	1:2	0.3	7.7	4602				0.4			
		Lot-2.0	2-Lining	250	1.3	2.5	2.8	1:0.5	0.3	2.4	601	1174		69	2.2			
		Lot-2.1	2-Lining	350	0.7	2.5	2.7	1:0.5	0.2	1.5	327	1096		63	2.1	4.7	79.6	93
3-YEAR	1. INGORE CRE	Ia-1	Earth	1300	1.7	11.0	12.6	1:2	0.4	12.9	16796				1.4			
		Ia-2	Earth	900	1.7	11.0	12.6	1:2	0.4	12.9	11628		171		4.9			
			(CUTOFF)	580	2.1	17.5	19.5	1:2	0.5	27.9	16199		158		5.0			
		Ia-3	Earth	1000	2.1	17.5	19.5	1:2	0.5	27.9	27930		228		7.5			
		Ia-4	2-Lining	1300	2.1	8.0	8.5	1:0.5	0.5	14.6	18974	9011	300		21.2	40.0		
	2. B.OBRERO	Bo-1	Earth	150	1.3	30.0	31.2	1:2	0.3	35.6	5343				0.4			
		Bo-2	Earth	700	1.3	22.5	23.7	1:2	0.3	25.9	18109				1.5			
		Bo-3	Earth	650	1.3	22.5	23.7	1:2	0.3	25.9	16816				1.4			
		Bo-4	Earth	550	1.3	22.5	23.7	1:2	0.3	25.9	14229				1.2			
		Bo-5	2-Lining	250	1.3	6.0	6.3	1:0.5	0.3	7.0	1739	1174	78		3.6			
		Bo-6	2-Lining	450	0.5	1.2	1.3	1:0.5	0.1	0.5	214	1107			1.6			
			(Cutoff)	200	1.6	10.0	11.6	1:2.0	0.4	10.9	2176		150		3.6			
		Bo-7	3-Lining	400	1.6	4.0	4.4	1:0.5	0.4	5.1	2048	2236		42	3.6			
		Bo-8	3-Lining	250	1.6	4.0	4.4	1:0.5	0.4	5.1	1280	1398		55	2.5			
		Bo-9	3-Lining	800	1.2	2.9	3.2	1:0.5	0.3	2.8	2208	3578		90	5.9	25.4		
	3. RIZAL CREE	Ri-1	Earth	240	0.9	7.0	7.8	1:2	0.2	4.7	1123				0.1			
		Ri-2	2-Lining	190	0.9	4.0	4.2	1:0.5	0.2	3.2	607	680			1.0			
		Ri-3	Box Culv.	190	0.9	2.5	2.5 -		0.1	2.3	428			399	3.0	4.2		
	4. LOTAO	Lot-1	Earth	600	1.1	8.0	9.2	1:2	0.3	6.4	3828				0.3			
		Lot-2.0	2-Lining	250	1.1	2.5	2.8	1:0.5	0.3	2.1	536	1062		63	2.0			
		Lot-2.1	2-Lining	350	0.6	2.5	2.7	1:0.5	0.2	1.3	462	1017		54	1.9	4.2	73.7	86
2-YEAR	1. INGORE	Ia-1	Earth	1300	1.5	11.0	12.2	1:2	0.3	12.0	13600				1.3			
		Ia-2	Earth	900	1.5	11.0	12.2	1:2	0.3	12.0	10800		171		4.8			
			(CUTOFF)	580	2.0	17.5	19.1	1:2	0.4	27.0	15660		158		4.9			
		Ia-3	Earth	1000	2.0	17.5	19.1	1:2	0.4	27.0	27000		228		7.5			
		Ia-4	2-Lining	1300	2.0	8.0	8.4	1:0.5	0.4	14.0	18200	8430	300		20.3	38.8		
	2. B.OBRERO	Bo-1	Earth	150	1.2	30.0	31.2	1:2	0.3	33.1	4968				0.4			
		Bo-2	Earth	700	1.2	22.5	23.7	1:2	0.3	24.1	16884				1.4			
		Bo-3	Earth	650	1.2	22.5	23.7	1:2	0.3	24.1	15678				1.3			
		Bo-4	Earth	550	1.2	22.5	23.7	1:2	0.3	24.1	13266				1.1			
		Bo-5	2-Lining	250	1.2	6.0	6.3	1:0.5	0.3	6.5	1620	1118	78		3.5			
		Bo-6	2-Lining	450	0.5	1.1	1.2	1:0.5	0.1	0.4	191	1107			1.6			
			(Cutoff)	200	1.5	9.5	10.7	1:2.0	0.3	9.8	1950		143		3.4			
		Bo-7	3-Lining	400	1.5	4.0	4.3	1:0.5	0.3	4.9	1950	2057		40	3.4			
		Bo-8	3-Lining	250	1.5	4.0	4.3	1:0.5	0.3	4.9	1219	1286		52	2.3			
		Bo-9	3-Lining	800	1.1	3.0	3.3	1:0.5	0.3	2.7	2156	3399		83	5.6	24.0		
	3. RIZAL	Ri-1	Earth	240	0.9	6.5	7.3	1:2	0.2	4.2	1015				0.1			
		Ri-2	2-Lining	190	0.9	3.7	3.9	1:0.5	0.2	2.9	556	680			1.0			
		Ri-3	Box Culv.	190	0.9	2.3	2.3 -		0.1	2.1	393			361	2.8	3.8		
	4. LOTAO	Lot-1	Earth	600	0.9	8.5	9.3	1:2	0.2	6.0	3618				0.3			
		Lot-2.0	2-Lining	250	0.9	2.5	2.7	1:0.5	0.2	1.8	461	894		57	1.7			
		Lot-2.1	2-Lining	350	0.6	2.2	2.4	1:0.5	0.2	1.1	399	1017		50	1.8	3.9	70.6	82
1-YEAR	1. INGORE	Ia-1	Earth	1300	0.9	11.0	11.8	1:2	0.2	8.3	10764				0.9			
		Ia-2	Earth	900	0.9	10.5	11.3	1:2	0.2	7.8	7047		163		4.3			
			(CUTOFF)	580	1.3	16.0	17.2	1:2	0.3	17.4	10104		144		4.1			
		Ia-3	Earth	1000	1.3	16.0	17.2	1:2	0.3	17.4	17420		208		6.2			
		Ia-4	2-Lining	1300	1.3	8.0	8.3	1:0.5	0.3	9.6	12422	6104	300		16.5	32.1		
	2. B.OBRERO	Bo-1	Earth	150	0.9	27.0	27.8	1:2	0.2	22.7	3402				0.3			
		Bo-2	Earth	700	0.8	22.5	23.3	1:2	0.2	16.7	11704				1.0			
		Bo-3	Earth	650	0.8	22.5	23.3	1:2	0.2	16.7	10868				0.9			
		Bo-4	Earth	550	0.8	22.5	23.3	1:2	0.2	16.7	9196				0.8			
		Bo-5	2-Lining	250	0.8	5.5	5.7	1:0.5	0.2	4.1	1020	839	72		2.9			
		Bo-6	2-Lining	450	0.4	0.9	1.0	1:0.5	0.1	0.3	126	1006			1.4			
			(Cutoff)	200	0.9	9.0	9.8	1:2.0	0.2	6.5	1296		133		3.2			
		Bo-7	3-Lining	400	0.9	4.0	4.2	1:0.5	0.2	3.2	1278	1431		28	2.3			
		Bo-8	3-Lining	250	0.9	3.7	3.9	1:0.5	0.2	2.9	731	894		35	1.6			
		Bo-9	3-Lining	800	0.6	3.0	3.2	1:0.5	0.2	1.6	1296	2326		51	3.8	18.2		
	3. RIZAL	Ri-1	Earth	240	0.6	6.0	6.8	1:2	0.2	2.9	691				0.1			
		Ri-2	2-Lining	190	0.6	3.5	3.7	1:0.5	0.2	1.9	345	552			0.8			
		Ri-3	Box Culv.	190	0.4	2.1	2.1 -		0.1	1.3	239			228	1.7	2.6		
	4. LOTAO	Lot-1	Earth	600	0.6	7.5	8.3	1:2	0.2	3.8	2268				0.2			
		Lot-2.0	2-Lining	250	0.6	2.3	2.5	1:0.5	0.2	1.2	300	727		36	1.3			
		Lot-2.1	2-Lining	350	0.4	2.0	2.1	1:0.5	0.1	0.7	252	783		36	1.4	2.9	55.8	65

Table 5-2 Design Discharges for Alternatives of Drainage Improvement (Iloilo & Ormoc)

CITY	Channel No.	Drainage Area (km^2)	Drain Length (m)	Average Velocity (m/s)	Time of Concent. (min)	Rainfall Intensity 3-yr (mm/hr)	Rainfall Intensity 5-yr (mm/hr)	Runoff Coeffi.	Design Discharge 3-yr (m^3/s)	Design Discharge 5-yr (m^3/s)	Specific Discharge 3-yr ($m^3/s/km^2$)	Specific Discharge 5-yr ($m^3/s/km^2$)
Iloilo	1. INGORE CREEK											
	Alternative-I.a											
	In-1	8.57	8,370	1.1	136.8	34	42	0.45	36.7	45.1	4.3	5.3
	In-2	8.00	6,970	1.1	115.6	39	48	0.46	39.7	48.6	5.0	6.1
	In-3	6.64	5,970	1.1	100.5	43	52	0.47	37.3	45.5	5.6	6.9
	In-4	4.96	4,820	1.1	83.0	49	60	0.46	31.1	37.7	6.3	7.6
	In-5	2.69	3,500	0.9	74.8	52	64	0.43	16.9	20.4	6.3	7.6
	In-6	1.90	2,400	0.5	90.0	46	56	0.39	9.6	11.6	5.0	6.1
	Alternative-I.b											
	In-1	1.93	3,400	1.1	61.5	59	71	0.41	13	15.7	6.7	8.1
	In-2	1.36	2,000	1.1	40.3	74	89	0.41	11.5	13.7	8.5	10.1
			1,000									
	In-3	6.64	5,970	1.1	100.5	43	52	0.47	37.3	45.5	5.6	6.9
	In-4	4.96	4,820	1.1	83.0	49	60	0.46	31.1	37.7	6.3	7.6
	In-5	2.69	3,500	0.9	74.8	52	64	0.43	16.9	20.4	6.3	7.6
	In-6	1.90	2,400	0.5	90.0	46	56	0.39	9.6	11.6	5.0	6.1
	2. BO. OBRERO CREEK											
	Alternative-II.a											
	Bo-1	3.71	5,200	1.2	82.2	49	60	0.56	28.5	34.6	7.7	9.3
	Bo-2	2.87	5,050	1.2	80.1	50	61	0.55	22	26.7	7.7	9.3
	Bo-3	2.57	4,350	1.2	70.4	54	66	0.56	21.8	26.3	8.5	10.3
	Bo-4	2.30	3,850	1.2	63.5	58	70	0.56	20.8	25.1	9.0	10.9
	Bo-5	1.56	3,100	1.5	44.4	71	85	0.58	17.8	21.3	11.4	13.6
	Bo-6	0.90	2,850	1.5	41.7	73	87	0.64	11.7	14	13.0	15.5
	Bo-7	0.88	2,350	1.5	36.1	78	93	0.64	12.3	14.6	13.9	16.6
	Bo-8	0.81	1,950	1.5	31.7	83	98	0.65	12.2	14.4	15.0	17.8
	Bo-9	0.48	1,700	1.5	28.9	86	102	0.59	6.8	8	14.2	16.7
	Bo-10	0.32	900	0.5	40.0	75	89	0.56	3.7	4.4	11.6	13.8
	Alternative-II.b											
	Bo-1	2.83	3,850	0.5	138.3	34	42	0.54	14.4	17.7	5.1	6.3
	Bo-2	1.99	3,700	0.5	133.3	35	43	0.52	10	12.3	5.0	6.2
	Bo-3	1.69	3,000	0.5	110.0	40	49	0.52	9.8	12	5.8	7.1
	Bo-4	1.42	2,500	0.5	93.3	45	55	0.51	9.1	11.1	6.4	7.8
	Bo-5	0.68	1,750	0.5	68.3	56	67	0.5	5.2	6.3	7.7	9.3
	Bo-6	0.02	1,500	0.5	60.0	60	72	0.5	0.2	0.2	8.3	10.0
			1,000									
	Bo-7	0.88	2,350	1.5	36.1	78	93	0.64	12.3	14.6	13.9	16.6
	Bo-8	0.81	1,950	1.5	31.7	83	98	0.65	12.2	14.4	15.0	17.8
	Bo-9	0.48	1,700	1.5	28.9	86	102	0.59	6.8	8	14.2	16.7
	Bo-10	0.32	900	0.5	40.0	75	89	0.56	3.7	4.4	11.6	13.8
	Alternative-II.c											
	Bo-1	1.40	1,950	0.4	91.3	46	56	0.55	9.8	12	7.0	8.6
	Bo-2	0.56	1,800	0.4	85.0	48	59	0.52	3.9	4.7	7.0	8.5
	Bo-3	0.26	1,100	0.4	55.8	63	75	0.58	2.6	3.2	10.1	12.1
			600									
	Bo-4	2.30	3,850	1.2	63.5	58	70	0.56	20.8	25.1	9.0	10.9
	Bo-5	1.56	3,100	1.5	44.4	71	85	0.58	17.8	21.3	11.4	13.6
	Bo-6	0.90	2,850	1.5	41.7	73	87	0.64	11.7	14	13.0	15.5
	Bo-7	0.88	2,350	1.5	36.1	78	93	0.64	12.3	14.6	13.9	16.6
	Bo-8	0.81	1,950	1.5	31.7	83	98	0.65	12.2	14.4	15.0	17.8
	Bo-9	0.48	1,700	1.5	28.9	86	102	0.59	6.8	8	14.2	16.7
	Bo-10	0.32	900	0.5	40.0	75	89	0.56	3.7	4.4	11.6	13.8
	3. RIZAL CREEK											
	Ri-1	0.41	2,160	0.7	61.4	59	71	0.64	4.3	5.2	10.5	12.7
	Ri-2	0.36	1,970	0.7	56.9	62	74	0.62	3.8	4.6	10.7	12.8
	Ri-3	0.33	1,790	0.7	52.6	65	78	0.61	3.6	4.3	11.0	13.2
	Ri-4	0.26	1,600	0.5	63.3	58	70	0.56	2.4	2.8	9.0	10.9
Ormoc	1. LOTAO CREEK											
	Lot-1	1.03	1,700	1.2	33.6	51	60	0.52	7.6	8.9	7.3	8.7
	Lot-2.0	0.44	1,200	1.2	26.7	58	68	0.53	3.7	4.4	8.5	10.0
	Lot-2.1	0.18	650	1.2	19.0	69	82	0.53	1.8	2.2	10.2	12.0

Table 5.3 Hydraulic Design for Alternatives of Channel Improvement (Iloilo & Ormoc)

Channel Type	Length (m)	Water Depth (m)	Width (m)	Bank Slope	Freeboard (m)	Flow Area (m^2)	Hyd. Radi. (m)	Rough. Coeff.	Gradient	Velocity (m/s)	Discharge Capacity (m^3/s)	Design Discharge (m^3/s)
1. INGORE CREEK												
Alternative-I.a												
Earth	1400	2.5	23.5	1:2	0.5	46.3	1.874	0.030	1/2200	1.1	50.0	45.1
Earth	1000	2.5	23.5	1:2	0.5	46.3	1.874	0.030	1/2200	1.1	50.0	48.6
Earth	1150	2.5	23.5	1:2	0.5	46.3	1.874	0.030	1/2200	1.1	50.0	45.5
2-Lining	1320	2.5	8.0	1:0.5	0.5	16.9	1.838	0.023	1/800	2.3	38.9	37.7
Alternative-I.b												
Earth	1400	2.2	11.0	1:2	0.5	14.5	1.206	0.030	1/2200	0.8	11.7	15.7
Earth	1000	2.2	11.0	1:2	0.5	14.5	1.206	0.030	1/2200	0.8	11.7	13.7
(Diversion)	580	2.5	17.5	1:2	0.5	31.3	1.673	0.030	1/1000	1.5	46.4	45.5
Earth	1150	2.5	17.5	1:2	0.5	31.3	1.673	0.030	1/1000	1.5	46.4	45.5
2-Lining	1320	2.5	8.0	1:0.5	0.5	16.9	1.838	0.023	1/800	2.3	38.9	37.7
2. BO. OBRERO CREEK												
Alternative-II.a												
Earth	150	2.4	30.0	1:2	0.5	60.5	1.943	0.030	1/8000	0.6	35.1	34.6
Earth	700	2.4	25.0	1:2	0.5	48.5	1.855	0.030	1/8000	0.6	27.3	26.7
Earth	500	2.4	25.0	1:2	0.5	48.5	1.855	0.030	1/8000	0.6	27.3	26.3
Earth	750	2.4	25.0	1:2	0.5	48.5	1.855	0.030	1/8000	0.6	27.3	25.1
2-Lining	250	2.4	9.0	1:0.5	0.5	18.7	1.847	0.023	1/3000	1.2	22.4	21.3
3-Lining	500	2.4	4.5	1:0.5	0.5	7.9	1.406	0.015	1/2000	1.9	14.8	14.0
3-Lining	400	2.4	4.5	1:0.5	0.5	7.9	1.406	0.015	1/2000	1.9	14.8	14.6
3-Lining	250	2.4	4.5	1:0.5	0.5	7.9	1.406	0.015	1/2000	1.9	14.8	14.4
3-Lining	800	1.3	3.0	1:0.5	0.3	3.1	0.845	0.015	1/500	2.7	8.1	8.0
Alternative-II.b												
Earth	150	1.5	30.0	1:2	0.3	40.5	1.319	0.030	1/8000	0.4	18.2	17.7
Earth	700	1.5	22.5	1:2	0.3	29.3	1.260	0.030	1/8000	0.4	12.7	12.3
Earth	500	1.5	22.5	1:2	0.3	29.3	1.260	0.030	1/8000	0.4	12.7	12.0
Earth	750	1.5	22.5	1:2	0.3	29.3	1.260	0.030	1/8000	0.4	12.7	11.1
2-Lining	250	1.5	6.0	1:0.5	0.3	7.9	1.174	0.023	1/3000	0.9	7.0	6.3
2-Lining	500	0.6	1.2	1:0.5	0.2	0.5	0.364	0.023	1/3000	0.4	0.2	0.2
(Diversion)	200	1.9	10.5	1:2	0.4	12.7	1.117	0.030	1/800	1.3	16.2	
3-Lining	400	1.9	4.0	1:0.5	0.4	5.8	1.183	0.015	1/800	2.6	15.3	14.6
3-Lining	250	1.9	4.0	1:0.5	0.4	5.8	1.183	0.015	1/800	2.6	15.3	14.4
3-Lining	800	1.3	3.0	1:0.5	0.3	3.1	0.845	0.015	1/500	2.7	8.1	8.0
Alternative-II.c												
Earth	150	1.3	25.5	1:2	0.3	29.8	1.140	0.030	1/8000	0.4	12.1	12.0
Earth	700	1.3	12.0	1:2	0.3	12.2	0.969	0.030	1/8000	0.4	4.5	4.7
Earth	500	1.3	9.5	1:2	0.3	9.0	0.887	0.030	1/8000	0.3	3.1	3.2
(Diversion)	90	2.4	10.5	1:0.5	0.5	22.3	1.919	0.023	1/3000	1.2	27.4	
Earth	750	2.4	18.0	1:2	0.5	31.7	1.656	0.030	1/3000	0.9	27.0	25.1
2-Lining	250	2.4	9.0	1:0.5	0.5	18.7	1.847	0.023	1/3000	1.2	22.4	21.3
3-Lining	500	2.4	4.5	1:0.5	0.5	7.9	1.406	0.015	1/2000	1.9	14.8	14.0
3-Lining	400	2.4	4.5	1:0.5	0.5	7.9	1.406	0.015	1/2000	1.9	14.8	14.6
3-Lining	250	2.4	4.5	1:0.5	0.5	7.9	1.406	0.015	1/2000	1.9	14.8	14.4
3-Lining	800	1.3	3.0	1:0.5	0.3	3.1	0.845	0.015	1/500	2.7	8.1	8.0
3. RIZAL CREEK												
Earth	190	0.9	7.0	1:2	0.2	4.7	0.630	0.030	1/700	0.9	4.3	4.3
2-Lining	180	0.9	4.0	1:0.5	0.2	3.2	0.625	0.023	1/700	1.2	3.8	3.8
Box Culv.	190	0.9	2.5	-	0.1	2.3	0.523	0.015	1/700	1.6	3.7	3.6
1. LOTAO CREEK												
Earth	600	1.3	8.5	1:2	0.3	7.7	0.801	0.030	1/500	1.3	9.9	8.9
2-Lining	250	1.3	2.5	1:0.5	0.3	2.4	0.672	0.023	1/300	1.9	4.6	4.4
2-Lining	350	0.7	2.5	1:0.5	0.2	1.5	0.489	0.023	1/300	1.6	2.3	2.2

Table 5.4 (1/2) Cost Comparison for Alternatives of Channel Improvement

INGORE CREEK

MAJOR WORK ITEM	UNIT	UNIT PRICE	QUANTITY		CONST.COST (PESO)	
		(PESO)	ALTER-I.A	ALTER-I.B	ALTER-I.A	ALTER-I.B
A. EARTH WORKS	m3	83	186,463	111,186	15,476,388	9,228,397
B. SLOPE PROTECT.						
2-SODDING	m2	19	30,913	34,354	587,355	652,728
2-REVET.	m2	1,412	10,330	10,330	14,586,412	14,586,412
C. RD.BRIDGE/BOX						
COMPENS.	no.		9	10		
BRIDGE(W x L)	m2	22,989	970	856	22,293,583	19,667,090
D. PEDEST. BDGS.	no.		-	-		
E. LAND ACQUISIT.						
CHANNEL	m2		58,575	32,985		
O/M ROAD	m2		14,610	16,350		
TOTAL		190	73,185	49,335	13,889,049	9,362,796
F. HOUSE COMPENS.						
CHANNEL						
SMALL	no.		10	9		
MIDIUM	no.		5	2		
LARGE	no.		1	1		
O/M ROAD						
SMALL	no.		4	4		
MIDIUM	no.		1	1		
LARGE	no.		0	0		
TOTAL	no.	111,900	21	17	2,349,900	1,902,300
G. O/M ROAD	m2	105	14,610	16,350	1,534,050	1,716,750
TOTAL		-	-	-	70,716,736	57,116,472

Table 5.4 (2/2) Cost Comparison for Alternatives of Channel Improvement

B.OBRERO CREEK

MAJOR WORK ITEM	UNIT	UNIT PRICE	QUANTITY			CONST. COST (PESO)		
		(PESO)	ALTER-II.A	ALTER-II.B	ALTER-II.C	ALTER-II.A	ALTER-II.B	ALTER-II.C
A. EARTH WORKS	m3	83	119,840	74,108	59,505	9,946,720	6,150,964	4,938,940
B. SLOPE PROTECT.								
SODDING	m2	19	17,817	14,081	13,893	338,528	267,532	263,968
2-REVET.	m2	1,412	14,400	10,565	15,084	20,332,574	14,917,921	21,298,687
BED LINING	m2	1,240	3,775	2,725	3,775	4,681,000	3,379,000	4,681,000
C. ROAD.BRIDGE/BOX								
COMPENS.	no.		7	8	8			
BRIDGE(W x L)	m2	22,989	117	236	212	2,689,713	5,413,910	4,862,174
BOX CUL.								
(CONC.VOL.)	m3	7,550	247	213	247	1,867,115	1,606,640	1,867,115
D. PEDEST. BDGS.	no.	25,500	22	22	22	561,000	561,000	561,000
E. LAND ACQUISIT.								
CHANNEL	m2		11,215	8,105	11,755			
O/M ROAD	m2		6,300	450	270			
TOTAL		190	17,515	8,555	12,025	3,327,850	1,625,450	2,284,750
F. HOUSE COMPENS.								
CHANNEL								
SMALL	no.		44	39	43			
MIDIUM	no.		5	2	7			
LARGE	no.		0	0	0			
O/M ROAD								
SMALL	no.		5	16	5			
MIDIUM	no.		0	0	1			
LARGE	no.		0	0	0			
TOTAL	no.	111,900	54	57	56	6,042,600	6,378,300	6,266,400
G. O/M ROAD	m2	105	7,050	7,650	7,320	740,250	803,250	768,600
TOTAL		-	-	-	-	50,527,350	41,103,967	47,792,634

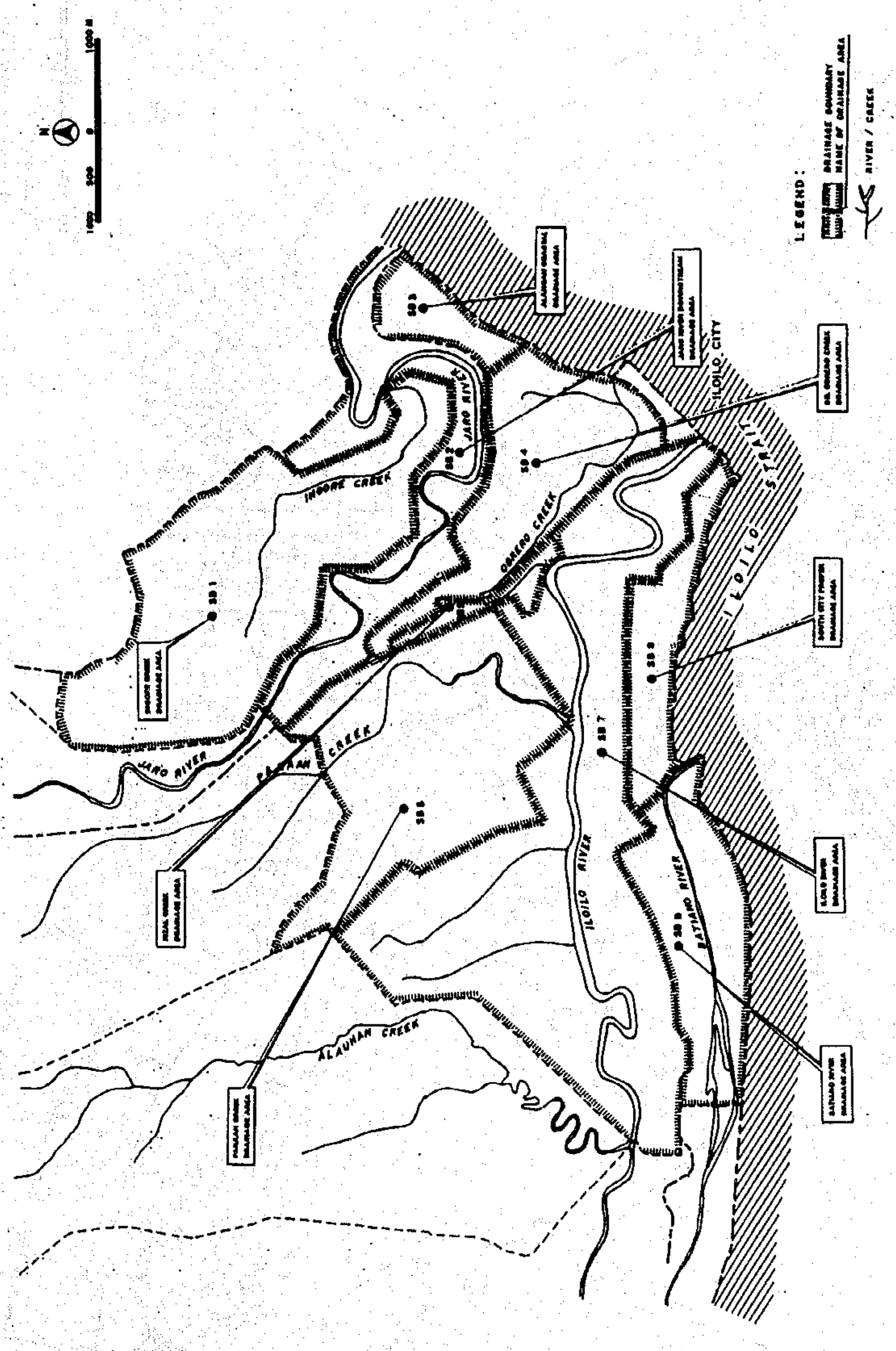
Table 5.5 Cost Comparison of Channel Improvement in Discharge Ration for Ingore Diversion Channel

Channel			Hydraulic Feature						Quantity for Major Works			Direct Construction Cost		
No.	Type	Length (m)	Water Depth (m)	Water Surf. Width (m)	Channel Width (m)	Bank Slope	Freeboard (m)	Flow Area (m^2)	Earth Works (m^3)	Revet-ment (m^2)	Bridge (m^2)	per Section (Mill.Peso)	Total	Ratio (%)
Unit Cost (Peso)									83	1,412	22,989			
1. INGORE CREEK														
Alternative-I.b-(1) : 100 % Runoff to Diversion Channel														
In-1	Earth	1300	2.2	11.0	13.0	1:2	0.5	14.5	18,876			1.6		
In-2	Earth	900	2.2	11.0	13.0	1:2	0.5	14.5	13,068		171	5.0		
	(CUTOFF)	580	2.5	17.5	19.5	1:2	0.5	31.3	18,125		158	5.1		
In-3	Earth	1000	2.5	17.5	19.5	1:2	0.5	31.3	31,250		228	7.8		
In-4	2-Lining	1300	2.5	8.0	8.5	1:0.5	0.5	16.9	21,938	10,174	300	23.1	42.6	100
Alternative-I.b-(2) : 90 % Runoff to Diversion Channel														
In-1	Earth	1300	2.5	12.5	14.5	1:2	0.5	18.8	24,375			2.0		
In-2	Earth	900	2.5	12.2	14.2	1:2	0.5	18.0	16,200		189	5.7		
	(CUTOFF)	580	2.5	16.5	18.5	1:2	0.5	28.8	16,675		149	4.8		
In-3	Earth	1000	2.5	17.5	19.5	1:2	0.5	31.3	31,250		228	7.8		
In-4	2-Lining	1300	2.5	8.0	8.5	1:0.5	0.5	16.9	21,938	10,174	300	23.1	43.4	102
Alternative-I.b-(3) : 80 % Runoff to Diversion Channel														
In-1	Earth	1300	2.5	14.1	16.1	1:2	0.5	22.8	29,575			2.5		
In-2	Earth	900	2.5	14.0	16.0	1:2	0.5	22.5	20,250		217	6.7		
	(CUTOFF)	580	2.5	15.4	17.4	1:2	0.5	26.0	15,080		139	4.4		
In-3	Earth	1000	2.5	17.5	19.5	1:2	0.5	31.3	31,250		228	7.8		
In-4	2-Lining	1300	2.5	8.0	8.5	1:0.5	0.5	16.9	21,938	10,174	300	23.1	44.5	104
Alternative-I.b-(4) : 70 % Runoff to Diversion Channel														
In-1	Earth	1300	2.5	15.7	17.7	1:2	0.5	26.8	34,775			2.9		
In-2	Earth	900	2.5	15.4	17.4	1:2	0.5	26.0	23,400		239	7.4		
	(CUTOFF)	580	2.5	14.4	16.4	1:2	0.5	23.5	13,630		130	4.1		
In-3	Earth	1000	2.5	17.5	19.5	1:2	0.5	31.3	31,250		228	7.8		
In-4	2-Lining	1300	2.5	8.0	8.5	1:0.5	0.5	16.9	21,938	10,174	300	23.1	45.3	106
Alternative-I.b-(5) : 60 % Runoff to Diversion Channel														
In-1	Earth	1300	2.5	17.2	19.2	1:2	0.5	30.5	39,650			3.3		
In-2	Earth	900	2.5	16.9	18.9	1:2	0.5	29.8	26,775		262	8.2		
	(CUTOFF)	580	2.5	13.3	15.3	1:2	0.5	20.8	12,035		120	3.8		
In-3	Earth	1000	2.5	17.5	19.5	1:2	0.5	31.3	31,250		228	7.8		
In-4	2-Lining	1300	2.5	8.0	8.5	1:0.5	0.5	16.9	21,938	10,174	300	23.1	46.2	108
Alternative-I.a : 0 % Runoff to Diversion Channel														
In-1	Earth	1300	2.5	23.5	25.5	1:2	0.5	46.3	60,125			5.0		
In-2	Earth	900	2.5	23.5	25.5	1:2	0.5	46.3	41,625		364	11.8		
In-3	Earth	1000	2.5	23.5	25.5	1:2	0.5	46.3	46,250		306	10.9		
In-4	2-Lining	1300	2.5	8.0	8.5	1:0.5	0.5	16.9	21,938	10,174	300	23.1	50.8	119

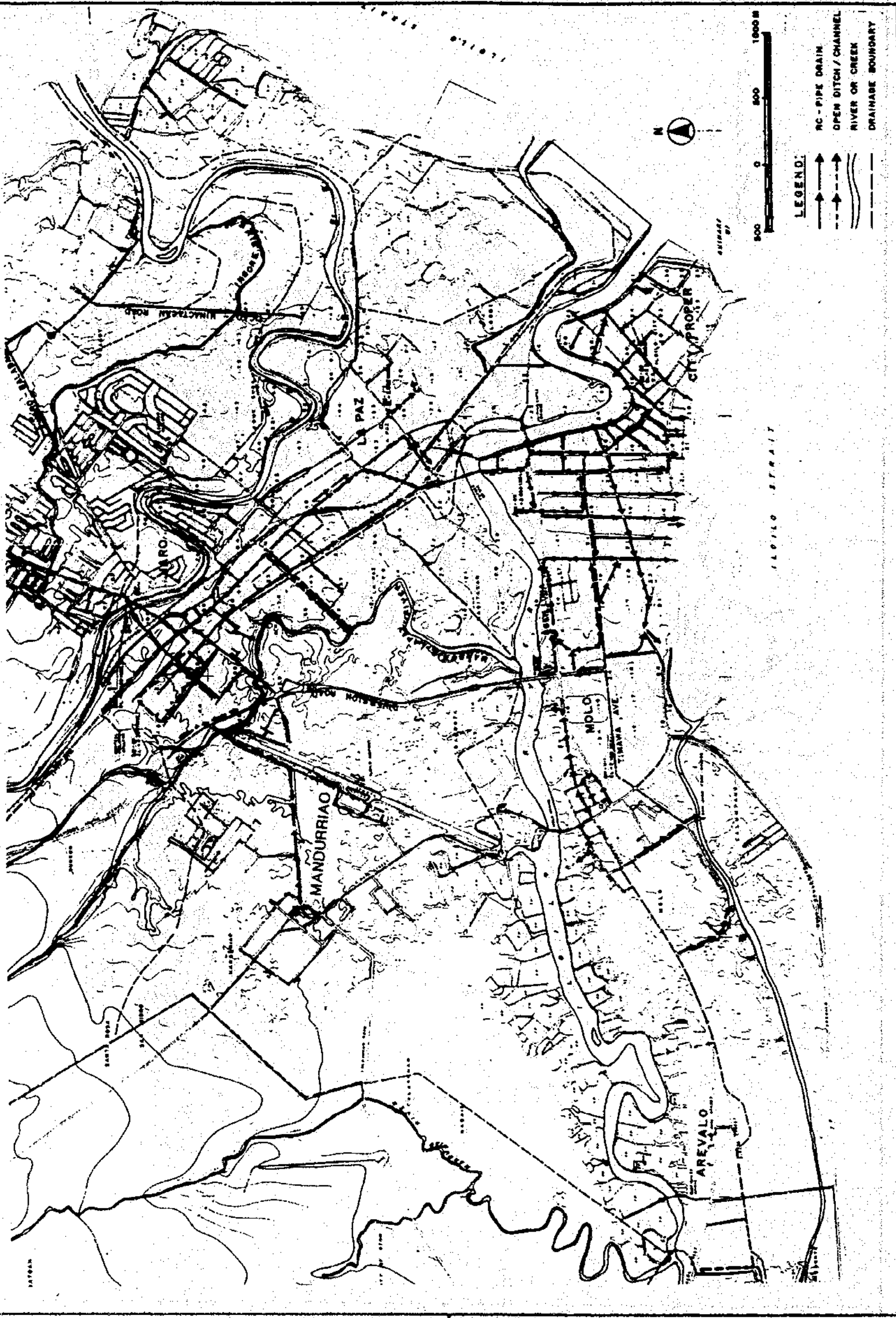
Table 5.6 Drainage Improvemt Works for Urgent Plan
Iloilo & Ormoc

Items	Unit	Ingore	Bo. Obrero	Rizal	Lotao	Total
I. Improvement Length						
Existing Channel	m	4,870	4,220	560	1,200	10,850
Diversion Channel	m	580	200	-	-	780
II. Hydraulic Feature						
Discharge	m^3/s	10.9 to 46.3	4.4 to 18.0	3.6 to 4.3	2.2 to 8.9	-
Channel Width	m	8.5 to 19.5	1.4 to 31.2	2.5 to 7.8	2.7 to 9.7	-
Water Width	m	8.0 to 17.5	1.2 to 30.0	2.5 to 7.0	2.5 to 8.5	-
O/M Road Width	m	3.0	3.0	-	3.0	-
Depth	m	2.2 to 2.5	0.6 to 1.9	0.9	0.7 to 1.3	-
Freeboard	m	0.5	0.3	0.2	0.2 to 0.3	-
Height	m	2.7 to 3.0	0.8 to 2.3	1.1	0.9 to 1.6	-
Flow Area	m^2	14.5 to 31.3	0.5 to 40.5	2.3 to 4.7	1.5 to 7.7	-
Sectional Area	m^2	20.5 to 40.5	0.8 to 49.7	2.8 to 6.2	2.0 to 10.4	-
III. Improvement Works						
A. Earth Works	m^3	111,186	74,108	1,892	5,730	192,915
B. Slope Protection						
2-Sodding	m^2	34,354	14,081	847	3,347	52,629
2-Revetment	m^2	10,330	10,565	644	2,270	23,809
Bed Lining	m^2	-	2,725	-	-	2,725
C. Road Bridge/Box						
Sites	no.	10	8	1	5	24
Bridge (W xL)	m^2	856	236	190	-	1,281
Box Culvert Length	m	-	55	437	75	567
D. Pedestrian Road	no.	-	22	19	6	47
E. Land Acquisition						
Channel	m^2	32,985	8,105	0	2,220	43,310
O/M Road	m^2	16,350	450	0	1,800	18,600
Total		49,335	8,555	0	4,020	61,910
F. House Evacuation						
Channel						
Small	no.	9	39	36	10	94
Medium	no.	2	2	0	0	4
Large	no.	1	0	0	0	1
O/M Road						
Small	no.	4	16	5	3	28
Medium	no.	1	0	0	0	1
Large	no.	0	0	0	0	0
Total	no.	17	57	41	13	128
G. O/M Road	m^2	16,350	7,650	60	1,800	25,860

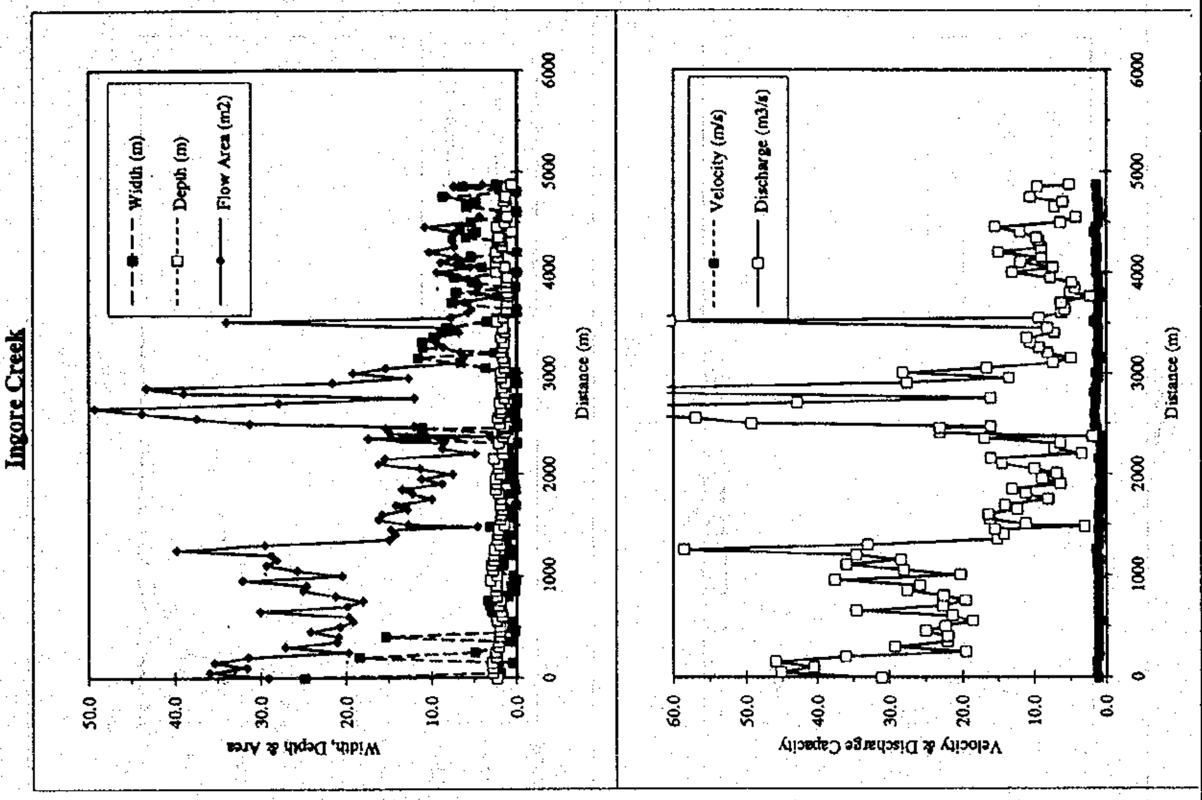
FIGURES

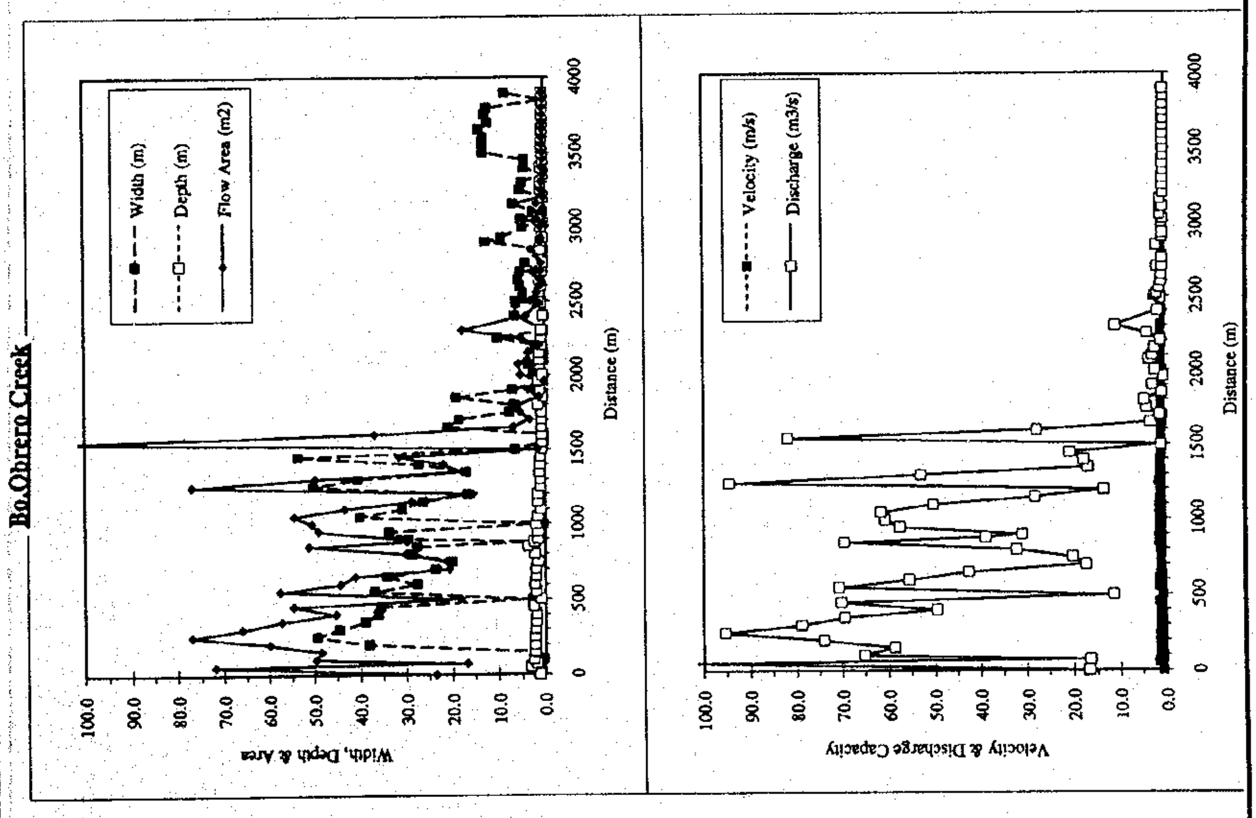


THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 2.1 Delineated Drainage Basin and Subbasin, Iloilo

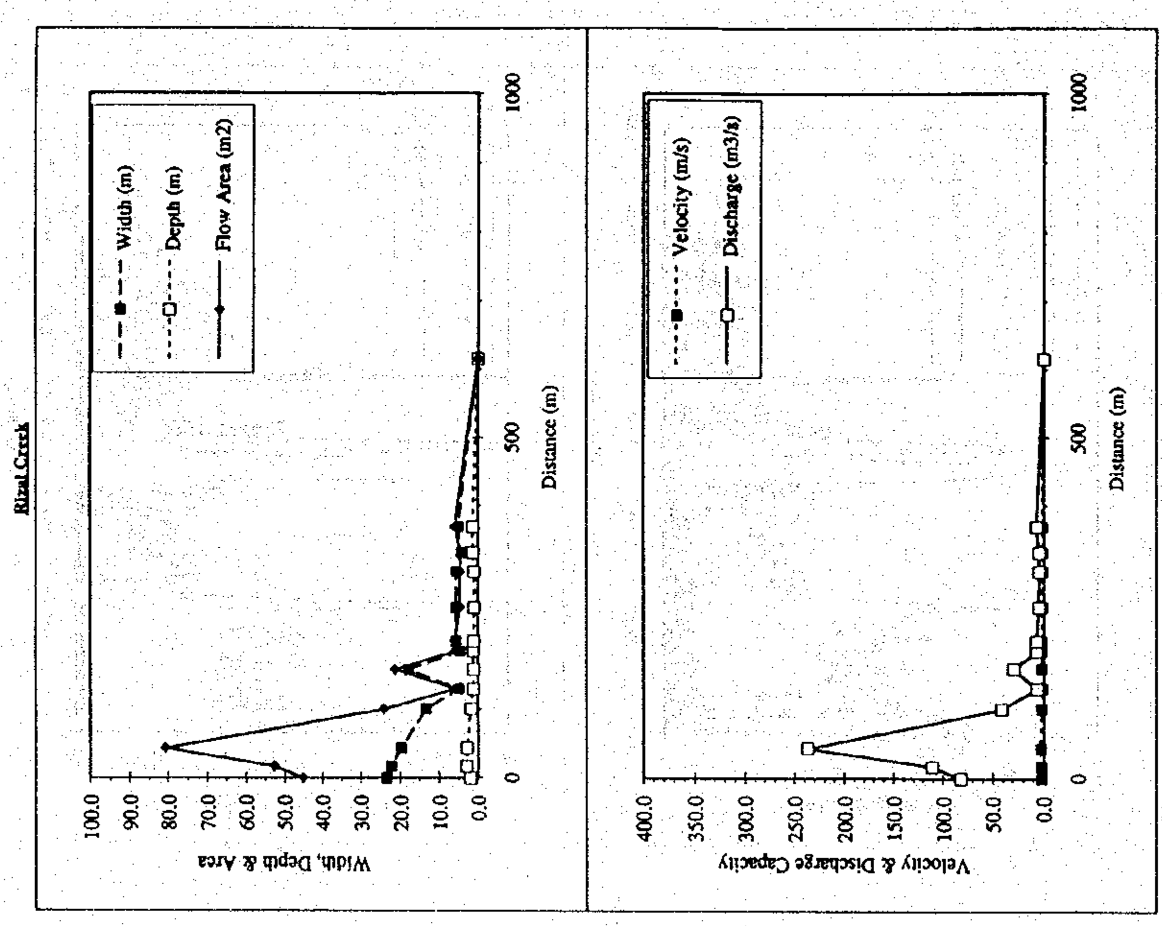


THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 2.2 Existing Urban Drainage System, Iloilo

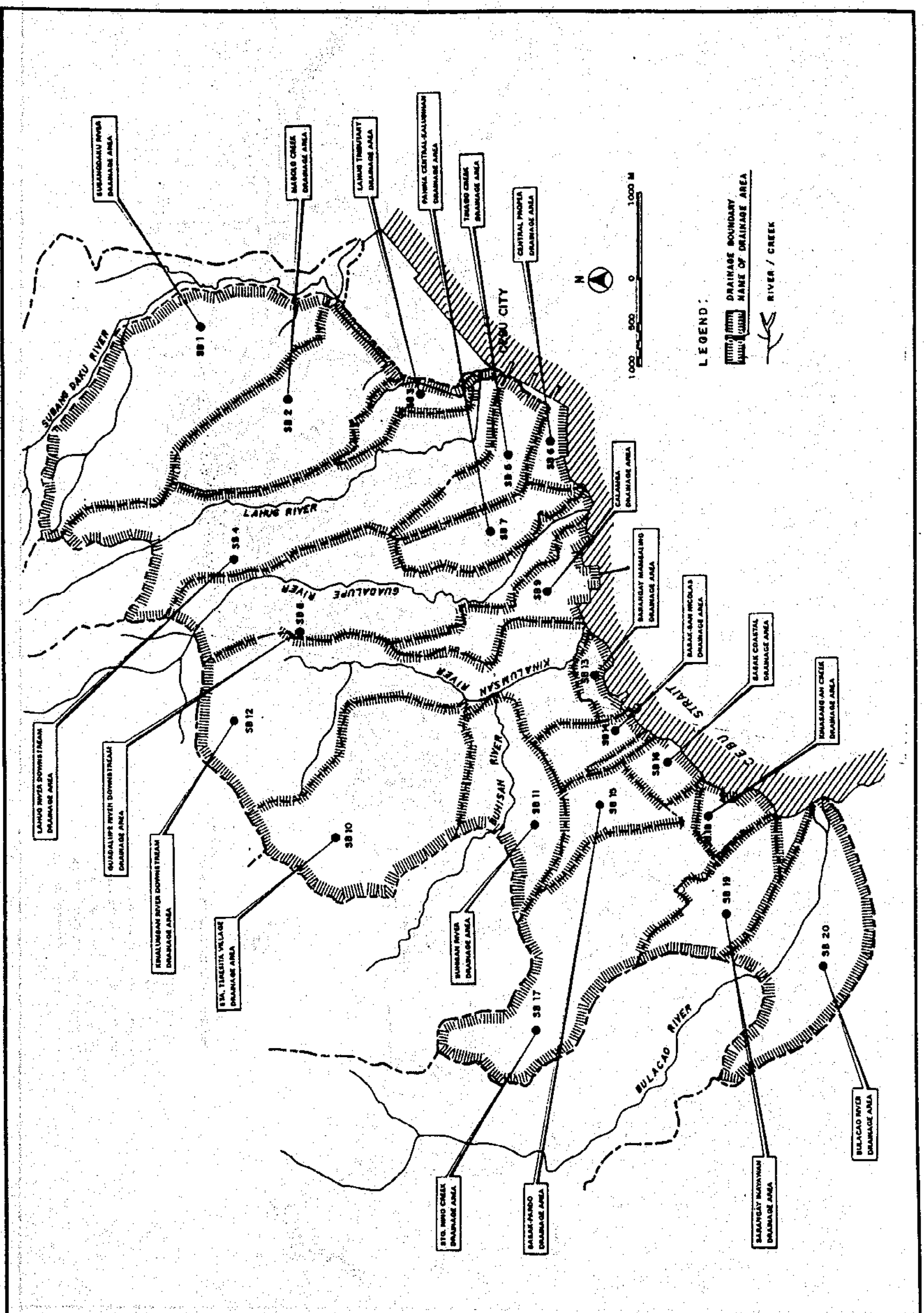




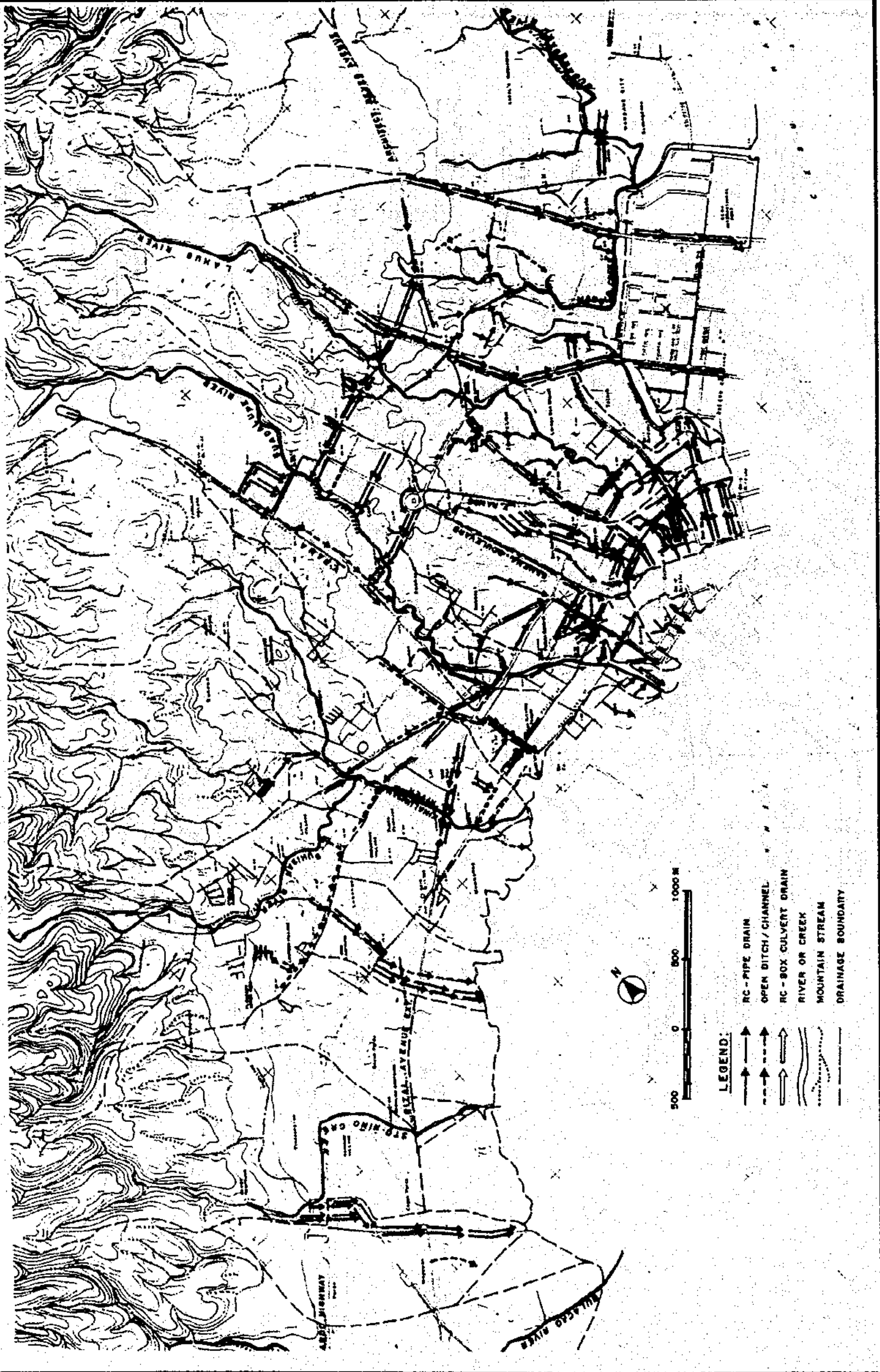
THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 2.3(1/2) Hydraulic Features of Existing Drains, Iloilo
JAPAN INTERNATIONAL COOPERATION AGENCY	



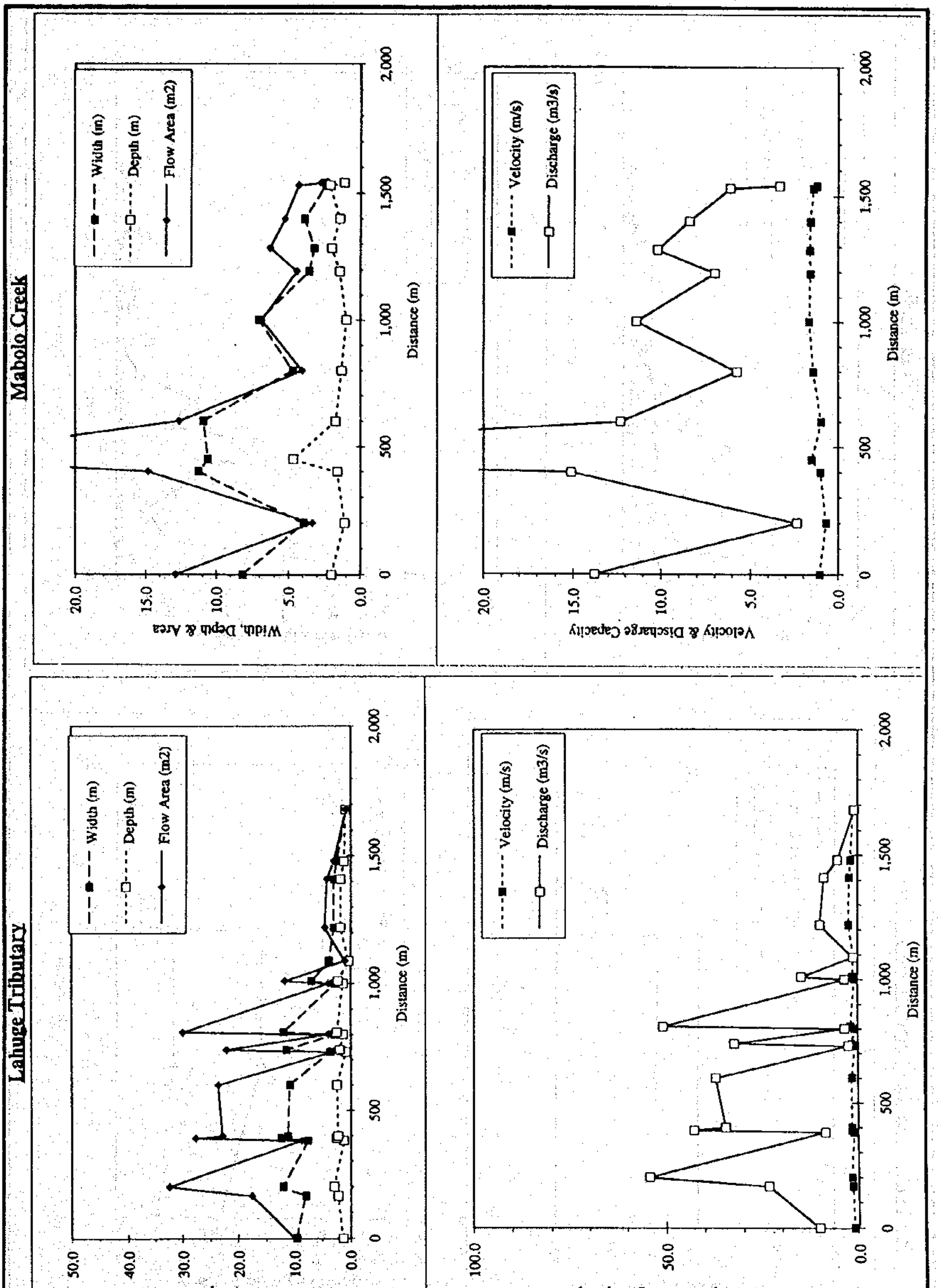
THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 2.3(2/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	Hydraulic Features of Existing Drains, Iloilo



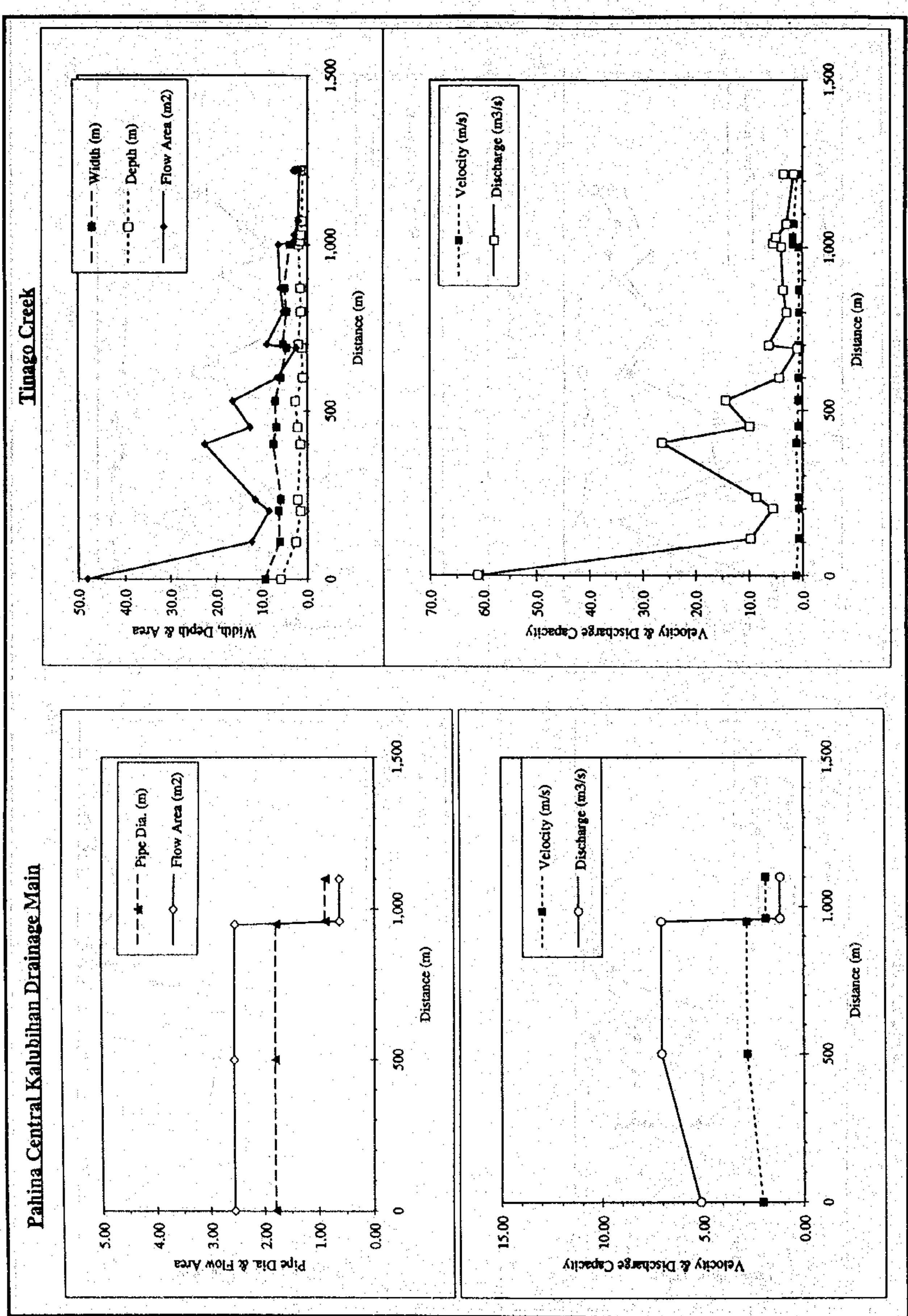
THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 2.4
JAPAN INTERNATIONAL COOPERATION AGENCY	Delineated Drainage Basin and Subbasin, Cebu



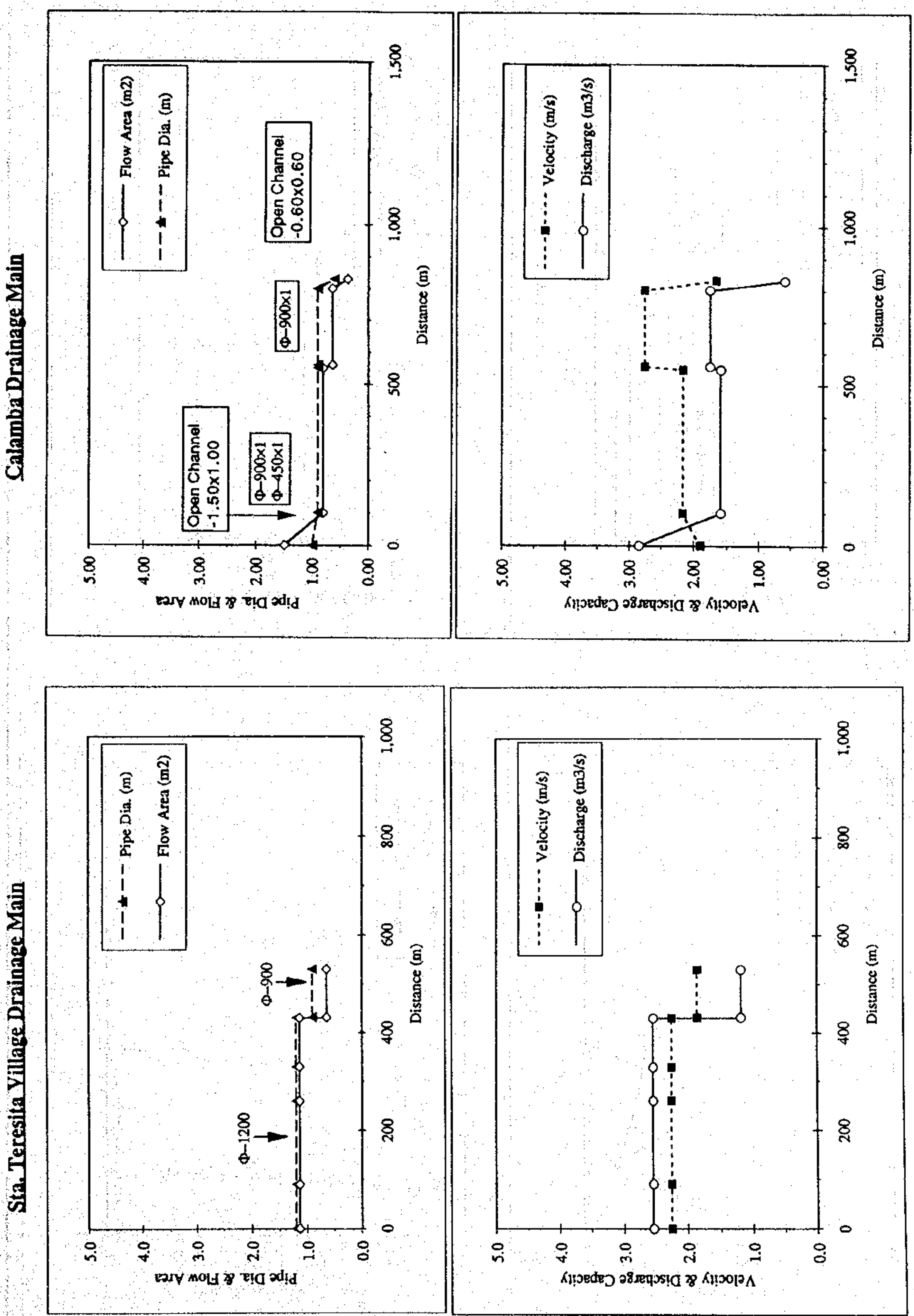
THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 2.5 Existing Urban Drainage System, Cebu



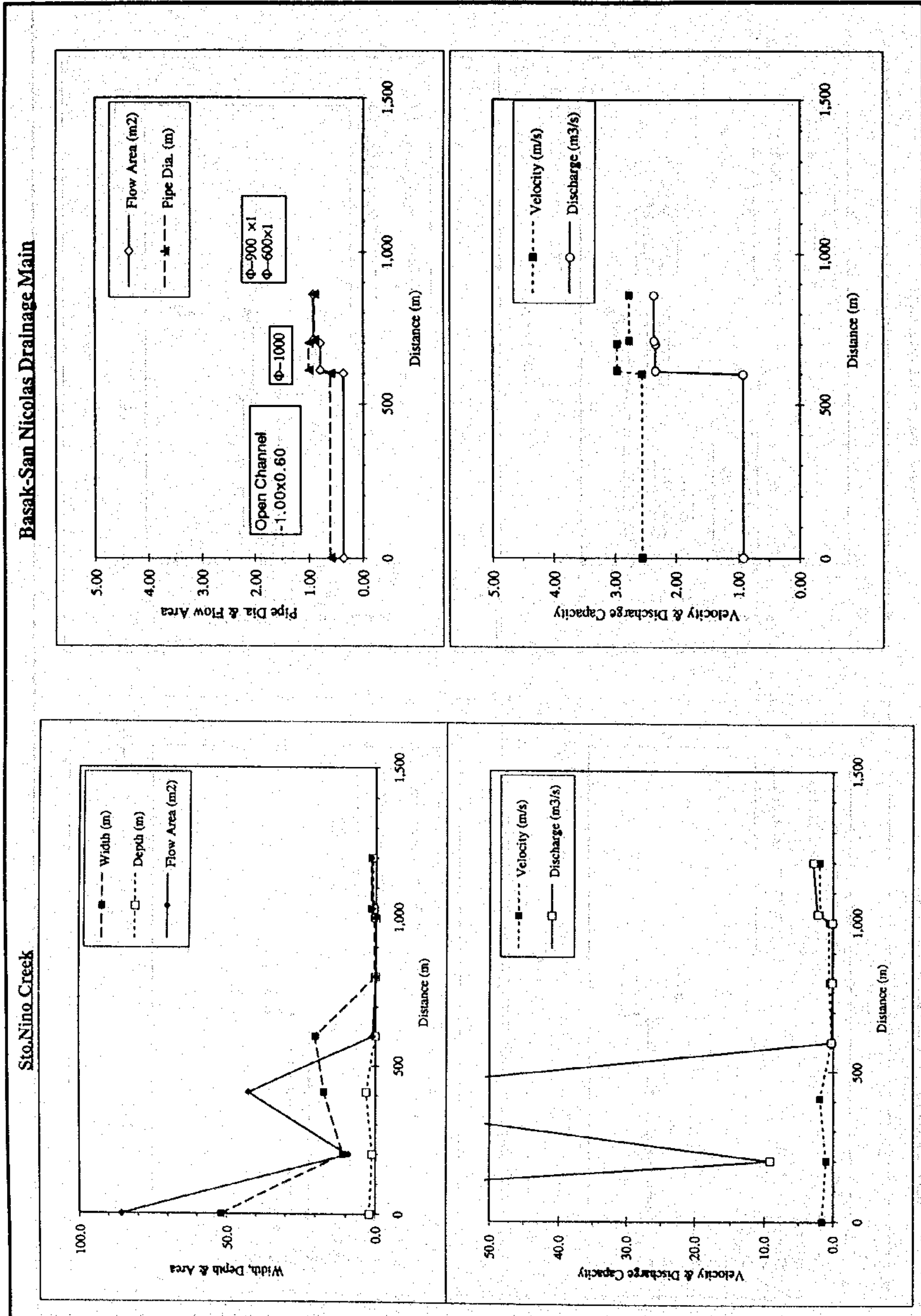
THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 2.6
JAPAN INTERNATIONAL COOPERATION AGENCY	Hydraulic Features of Existing Drains, Cebu(1/5)



THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 2.6
JAPAN INTERNATIONAL COOPERATION AGENCY	Hydraulic Features of Existing Drains, Cebu(2/5)



THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 2.6
JAPAN INTERNATIONAL COOPERATION AGENCY	Hydraulic Features of Existing Drains, Cebu(3/5)



THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 2.6
JAPAN INTERNATIONAL COOPERATION AGENCY	Hydraulic Features of Existing Drains, Cebu(4/5)