Chapter 2. Results of Feasibility Study on the Priority Project as Structural Flood Mitigation Measures

2.1 Location of Sites for Priority Projects

The following four site of the flood retarding basin were selected as the priority components of the structural flood mitigation plan in the foregoing Master Plan Study (refer to Chapter 8 in Vol. 1).

Table R 2.1 Off-site Flood Retarding Basins Selected as Priority Projects in Master Plan

Code of Retarding Basin	River	Design Scale	Approx. Required Extent (ha)	Location
RB-I1	Imus River	10-year return period	40	The retarding basin is located along the right bank about 9.5km upstream from the river mouth and/or about just upstream section of Anabu Dam.
RB-B4	Bacoor River	2-year return period	12	The retarding basin is sandwiched between Imus River and Bacoor River; that is, the basin is along the right bank of Imus River about 6.8km upstream from the river mouth and along the left bank of Bacoor River about 8.2km upstream from the confluence with the Imus River.
RB-J1	Julian River	5-year return period	14	The retarding basin is located along the left bank of the Julian River about 2.9km upstream from the confluence with Imus River
RB-J2	Julian River	5-year return period	11	The retarding basin is located along the left bank of the Julian River about 5.4km upstream from the confluence with Imus River

The above locations as well as the extent of the flood retarding basins were reviewed in this Feasibility Study Stage based on the detailed engineering clarification, the updated conditions on land acquisition and other environmental and social considerations. As the results, the following modifications were made, whereby RB-I1 has shifted downstream, RB-J2 was eliminated and RB-J1 was expanded to compensate the elimination of RB-J2 (refer to Fig. 2.1). The details of the modifications are as described in subsections 2.3.4 and 2.3.6.

Table R 2.2 Modification on the Location and Extent of Offsite Flood Retarding

Code of Retarding Basin	River	Design Scale	Possible Maximum Extent (ha)*	Location
RB-I1	Imus River	10-year return period	45.0	The site shifts about 3.3km downstream from the original location proposed in the Master Plan
RB-B4	Bacoor River	2-year return period	13.5	The site is placed at the location proposed in the Master Plan.
RB-J1	Julian River	5-year return period	38.0	The site is placed at the location proposed in the Master Plan, but expanded in order to compensate the under-mentioned elimination of RB-J2. Moreover, the site is divided into RB-J1R for flood mitigation of Julian River and RB-J1L for the secondary tributary of Julian River.
RB-J2	Julian River	-	-	The site is eliminated

*: The extent, which would not require the land acquisition of the existing built up area

2.2 Hydraulic Analysis of Off-site Flood Retarding Basin

2.2.1 Hydraulic Model Applied

The hydraulic analysis was made to estimate the required storage volume of the aforesaid objective flood retarding basins of RB-I1, RB-B4 and RB-J1 based on the flood runoff and river flood routine simulation by “MIKE 11”. The details of this simulation model are as described in subsection 5.5.2 in Vol. 1 Master Plan Study.

In this simulation model, the flood mitigation effect of flood retarding basin is estimated in such manner that an overflow dike is set as the inlet point of the flood retarding basin and a certain volume of the river flow discharge is overflowed into the flood retarding basin across the overflow dike, which leads to reduction of the river discharge at the downstream sections of the flood retarding basin.

The flood discharge overflowed into the retarding basin is estimated through the following formula called “Villemonte Formula”:

$$Q = CBh_1^k \left[1 - \left(\frac{h_2}{h_1} \right)^k \right]^{0.385} \qquad (2.1)$$

where,
- Q : Discharge overflowed into the flood retarding basin
- C : Overflow coefficient (=1.838 m1/2/s)
- B : Length of overflow dike (m)
- k : Exponential coefficient (=1.5)
- h1 : Water depth of river above the crown of the overflow dike (m)
  = River water level (H1) – Crown level of overflow dike (W)
- h2 : Water Depth of retarding basin above the crown level of the overflow dike (m)

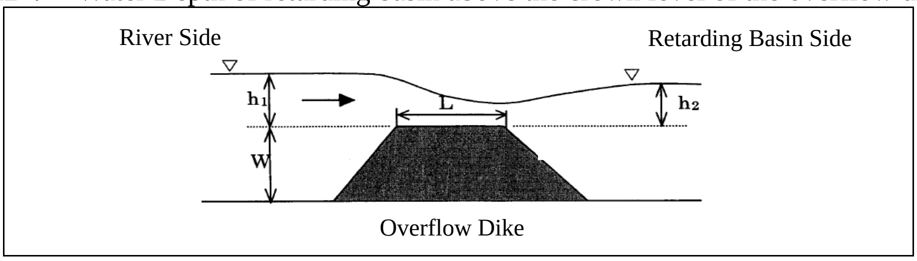


Fig. R 2.1 Concept on Calculation of Overflow Discharge from the River Channel to Flood Retarding Basin

2.2.2 Estimation of Required Storage Volume of the Off-site Flood Retarding Basin

(1) Design Discharges for River Sections

The design scales of flood mitigation plan are set at 10-year return period for Imus River, 2-year return period for Bacoor River and 5-year return period for Julian River in the Master Plan. At the same time, on the premises of these design scales, the river design discharge at the downstream sections from the flood retarding basins are set as shown below:

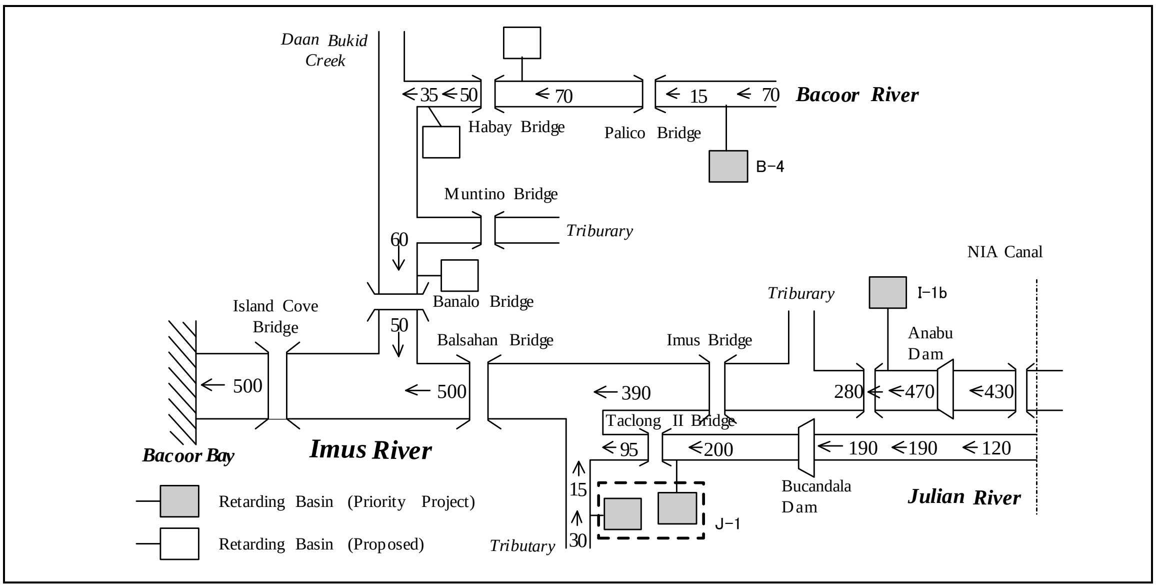


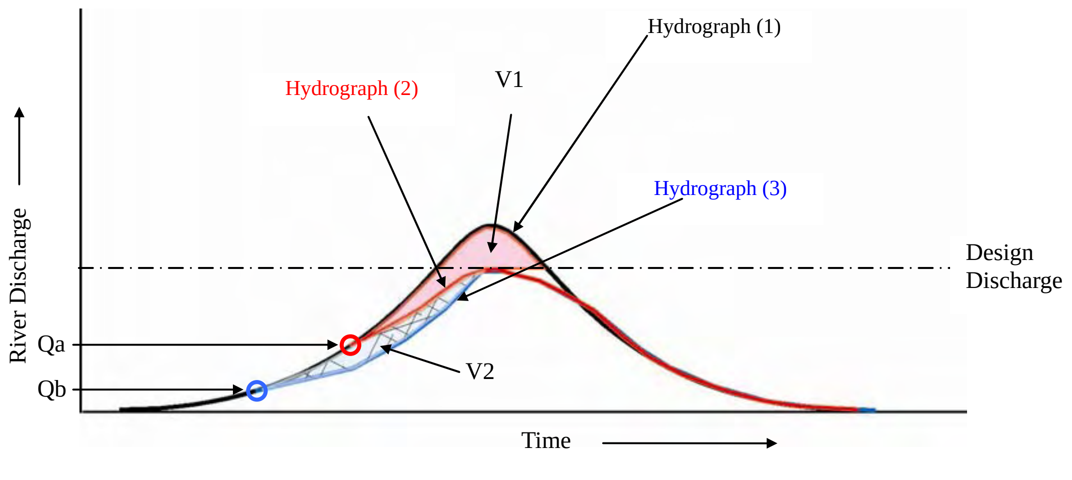
Fig. R 2.2 Design Discharge Distribution of Imus River, Bacoor River and Julian River

(2) Estimation of Required Storage Volume of the Flood Retarding Basin

The aforesaid design discharges of the downstream river channels are determined in the Master Plan Study as the optimum values taking the eligible scale of the river improvement and the effect of the flood retarding basins into account.

The storage volume of the flood retarding basin is required to promise the probable peak river discharge at the downstream sections to be less than the said design discharges, as far as the recurrence probabilities of the floods are within the limit of the design scale. However, such storage volume of the flood retarding basin is variable according to the crown level and the length of the overflow dikes.

That is, as the crown level of the overflow dike is made higher and the length of the dike longer, the less volume of the river discharge enter into the flood retarding basin and therefore, the required storage volume could be reduced (refer to Fig. R 2.3). In such case, however, the flood retarding basin could hardly mitigate the river flow discharge for the smaller floods below the design flood.



Hydrograph (1): Without flood mitigation effect of flood retarding basin
Hydrograph (2): After effect of flood retarding basin, which has the Higher crown level and the Longer length of the overflow dike
Hydrograph (3): After effect of flood retarding basin, which has the Lower crown level and the Shorter length of the overflow dike
Required storage volume of flood retarding basin for Hydrograph (2) = V1( )
Required storage volume of flood retarding basin for Hydrograph (3) = V1( ) + V2( )
Qa: River discharge starting to overflow into retarding basin with Higher crown level of overflow dike
Qb: River discharge starting to overflow into retarding basin with Lower crown level of overflow dike

Fig. R 2.3 Conceptual Drawing on Effect of Flood Retarding Basin

The construction cost of the flood retarding basin also becomes variable depending on the combination of the dimensions of the overflow dike and storage volume. As the crown elevation of the overflow dike is made higher, the cost of excavation for the flood retarding basin could decrease due to the smaller storage volume required. In this case, however, the cost of the overflow dike increases due to the longer dike length required.

In due consideration of the above, the variable combinations of the dimension of the overflow dike and its corresponding storage volume of the flood retarding basins were provisionally estimated. As the result, the combination, which takes the least cost, is finally selected as the optimum as listed in the following table. (refer to Table 2.1 and Fig. 2.26):

Table R 2.3 Estimated Storage Volume for Priority Flood Retarding Basin

Code of Retarding Basin	Design Scale	Elevation of Overflow Dike (EL.m)	Width of Overflow Dike (m)	Required Storage Volume (MCM)	Ratio of Storage Volume Used against Variable Probable Flood (%) *		
					2-y.r. R.P.	5-y.r. R.P.	10-y.r. R.P.
RB-I1	10-yr. R.P.	11.25	45	1.48	32	81	100
RB-B4	2-yr. R.P	8.35	25	0.45	100	100	100
RB-J1L	5-yr. R.P	5.78	30	0.11	64	100	100
RB-J1R	5-yr. R.P	6.60	50	0.44	59	100	100

Note *: Ratio = Storage Volume Used/Required Storage Volume

The optimum storage volumes for RB-I1, RB-J1L and RBJ1R are not in equivalent to the minimum volume among those required to promise the design discharge for the downstream due to the reasons as mentioned above. This could bring the following subordinate advantages besides the least cost for construction:

(a) The crown elevation of the overflow dike for the optimum storage volume is set to be lower than that for the minimum storage volume. This means that the optimum storage volume could store and mitigate the river flow discharge for the smaller floods below the design scales. Construction of the flood retarding basins selected as the priority project is implemented in advance to the river channel improvement. Accordingly, the said effect for the smaller flood is preferable.

(b) The larger storage volume could make possible zoning of the impounding area of the flood retarding basin. This zoning enables that a certain extent of impounding area is less frequently inundated and it could be used as the amenity space, the farmland and other multiple uses of land (refer to subsections2.3.4 item (5) and 2.3.6 item (5)).

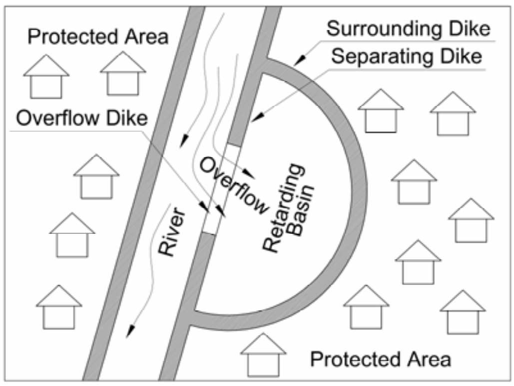
2.3 Preliminary Design of Off-site Flood Retarding Basin

2.3.1 Basic Policy on Design of Facilities and Structures of Off-site Flood Retarding Basin

Off-site Flood Retarding Basin (herein after referred to as the "Retarding Basin") consists of the Surrounding Dike, Separating Dike and Overflow Dike. Every retarding basin is furnished with the Stilling Basin, Outlet Sluice, Sedimentation Basin, and so on.

Typical cross sections of each dike are shown in Fig. 2.2.

The standards for design of the above structural components are as described hereinafter:



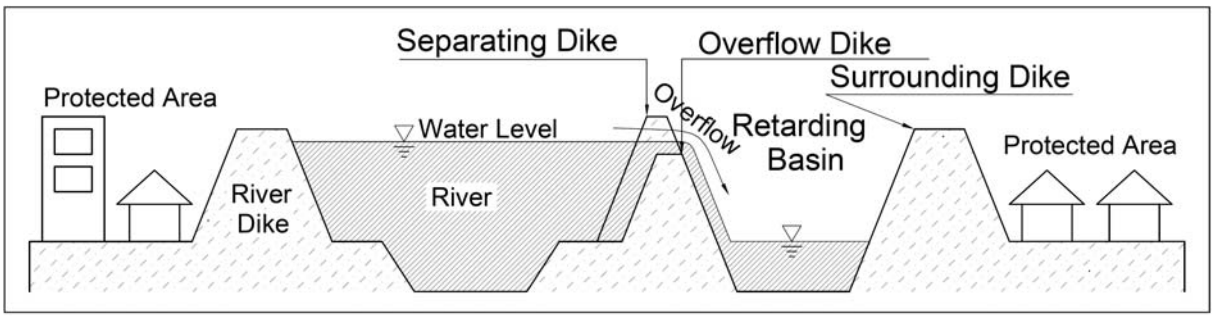


Fig. R 2.4 Image of Flood Mitigation Effect of Retarding Basin

(1) Surrounding Dike

(a) General

The Surrounding Dike shall be constructed along the perimeter of the retarding basin to protect the residential area against spill-over of retarded water. At the same time, the crown of the Surrounding Dike has functions such as operation and maintenance road, and access road to recreational area in the retarding basin.

(b) Elevation of Surrounding Dike Crown

The elevation of the surrounding dike crown shall be set taking the probable excess flood water level (P.W.L.) in the retarding basin and freeboard (FB) into consideration. Therefore, the P.W.L. is set at the highest elevation of the original ground level along expected alignment of surrounding dike, thus, the elevation of the surrounding dike crown of each retarding basin is set as shown in Table R.2.4 (refer to Fig. R 2.5).

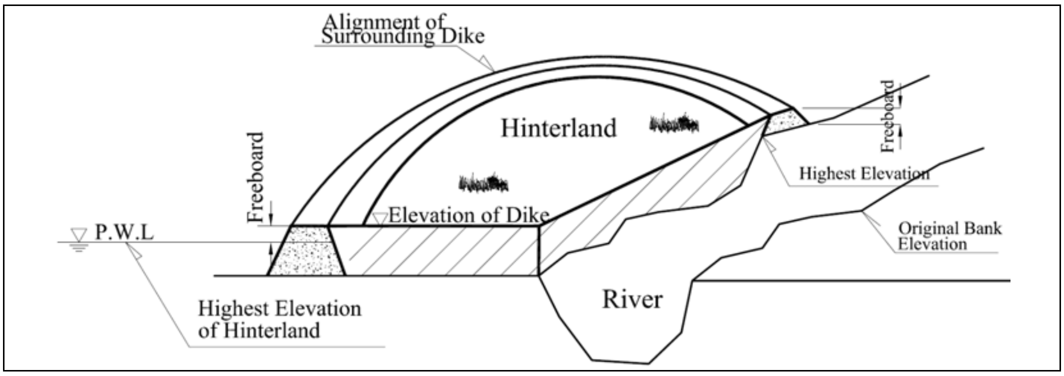


Fig. R 2.5 P.W.L. and Elevation of Surrounding Dike

Table R 2.4 P.W.L. and Elevation of Dike Crown of Retarding Basins

Item	I1 Retarding Basin (Imus River)	B4 Retarding Basin (Bacoor River)	J1 Retarding Basin (Julian River)
Ground Elevation of Hinterland along expected alignment of surrounding dike	EL+14.0~17.2m	EL+9.0~9.8m	EL+7.0~9.4m
Assumed Maximum Water Level (P.W.L)	EL+17.2m	EL+9.8m	EL+9.4m
Freeboard*2	0.80m	0.60m	0.60m
Elevation of Dike Crown	EL+18.0m	EL+10.4m	EL+10.0m

Note *1: Locations of I1 Retarding Basin in Imus river and J1 Retarding Basin in Julian river have been reconsidered in this F/S and relocated from the locations proposed in M/P.

*2: Conforming to the Design Guideline of DPWH (See below)

Design Discharge	Adopted Freeboard Height
Less than $200m^3/s$	0.60m
$200\ m^3/s$ ~ Less than $500m^3/s$	0.80m

(c) Width of Surrounding Dike Crown

The design conditions and procedures for all dikes are same as those applied to common river dikes. The largest design discharge among the three rivers, namely Imus, Bacoor and Julian is smaller than $500m^3/s$. The design guideline and criteria of DPWH prescribes that the dike width for all retarding basins shall be not narrower than 3.0m for the said design discharge.

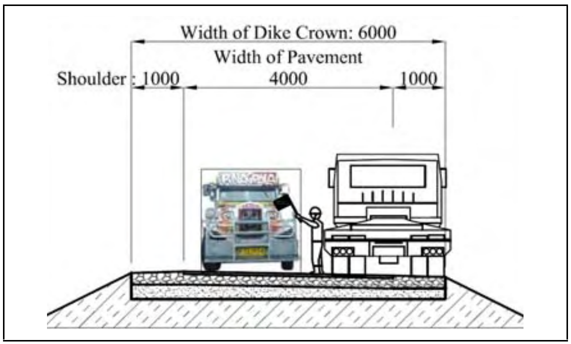


Fig. R 2.6
Dike Crown Width of Retarding Basin

Since the crown of each dike shall be utilized as access road to the retarding basin for O&M and recreational purposes as stated above, the width is set at 6.0m as illustrated in Fig. R 2.6.

(d) Slope of Surrounding Dike

Slope surface of the surrounding dike is covered with grass sod only considering that it is not exposed to the risk of scouring by water flow.

Slope gradient of surrounding dike is designed at V:H=1:3.0 taking the following site conditions into account, although the design criteria and guideline of DPWH allows the slope gradient of V:H=1:2.0 only:

- Excess and large amounts of excavated material will be utilized as embankment material for dike. Most of the excavated materials are classified into cohesive soil such as clay and silt.
- According to the result of soil test, coefficient of permeability of excavated soil is very small (k=1.0x$10^{-5\sim6}$) and it is suitable material for dike in terms of water-tightness
- Since cohesive soil doesn't have shear resistance force, only adhesive force shall be considered in stability analysis of dike.
- Stability of embankment with cohesive soil must be more vulnerable against slope failure comparing to embankment sandy material.

It is considerable to mix excavated clayey material with sandy material to reinforce the stability of dike. This mixing work however will induce the increment of construction cost. It is therefore not recommendable to embank with mixed material, and the raw excavated material shall be utilized as embankment material. Slope gradient shall be designed according to the result of slope stability analysis. Conditions for slope stability analysis are tabulated in the table below.

Table R 2.5 Conditions for Slope Stability Analysis

Item	Setting Value/Coefficient
Unit Weight of Material (normal)	1.7tf/m^3 (17kN/m^3)
(saturated)	1.9tf/m^3 (19kN/m^3)
(in water)	0.9tf/m^3 (9kN/m^3)
Shear Resistance Angle of Material	0 degree
Cohesion	1.0tf/m^2(10kN/m^2)

The slope stability analysis was carried out using the circular slip calculation method. The results of calculation are summarized in the table below.

Table R 2.6 Summary of Circular Slip Analysis for Dike

Item	Slope Gradient V:H=1:2.0 w/Berm	Slope Gradient V:H=1:3.0 w/ Berm
Embankment Material	Cohesive Soil	Cohesive Soil
Calculated Safety Factor (Normal)	1.2 --- N.G	1.7 --- OK
(Seismic)*	0.9 --- N.G	1.2 --- OK
Required Safety Factor (Normal)	1.5	1.5
(Seismic)*	1.2	1.2

Note *: Seismic Coefficient Kh=0.2

As shown in the table, the slope gradient of V:H=1:3.0 is suitable for dike embankment using cohesive soil in terms of stability of dike.

Visitors who wish to approach to the recreational area in the retarding basin will be able to climb up and down the dike with the slope gradient of V:H=1:3.0. Gentle slope on the dike would also have a deterrent effect against dumping of garbage, because the dumped garbage will stop on the slope surface of dike and mar the aesthetic view of the retarding basin.

It is therefore recommendable to design the dike with a gentle slope gradient not only from the structural aspect but also the operation and maintenance aspect of the retarding basin.

With the above conditions taken into account, V:H=1:3.0 is basically applied as the dike slope gradient.

(2) Separating Dike

(a) General

The Separating Dike refers to the dike or embankment placed between the river and the retarding basin so that excess floodwater could be stored safely in the retarding basin.

(b) Elevation of Separating Dike Crown

The elevation of the separating dike crown is set in such a way that floodwater could not overflow the dike. Since the dike crown will be utilized as maintenance and access road, the elevation of dike crown shall be set taking the maximum flood water level (H.W.L.) in the retarding basin and freeboard (FB) into consideration. The H.W.L. is set at 20cm above the original ground level around the overflow dike in the same way as the aforesaid surrounding dike. The crown elevation of separating dike in each retarding basin has been set at the same elevation as that of the surrounding dike, as shown in Table R 2.4.

(c) Width of Separating Dike Crown

Width of separating dike crown shall be set at 6.0m as the same way as the surrounding dike.

(d) Slope of Separating Dike

Slope surface of the separating dike shall be covered with grass sod and slope gradient of separating dike shall be V:H=1:3.0 in general position conforming to the same design procedure of the surrounding dike. However, the excavated surface of the dike facing to riverside may take the slope gradient of V:H=1:2.0 when the existing river bank, which has the slope gradient steeper than V:H=1:2.0, is judged to stable.

Revetment with wet stone masonry type or grouted riprap type shall be adopted at certain sections, such as around the artificial facility, transition sections and where scouring and erosion may occur. Fig. 2.2 shows the standard cross sections of the designed separating dike.

(3) Overflow Dike

(a) General

Overflow Dike is a part of the Separating Dike and elevation of dike crest is lower than that of the Separating Dike to let floodwater flow over the dike crown and into the retarding basin. Overflow Dike is one of the types of fixed weir and dike surface has to be covered with appropriate solid materials such as concrete, asphalt, concrete block or gabion to protect the dike from failure, scouring and collapse.

(b) Crown Elevation and Length of Overflow Dike

Design criteria of crown elevation (or height) and length of overflow dike will be described hereinafter.

(i) Overflow Condition

Crown elevation (or height) and length of overflow dike have been determined and designed through the hydraulic and hydrological simulation model calculation in this study (refer to Subsection 2.2). However, because of the reasons as follows, details of the overflow dike shall be reconsidered through the hydraulic model test in the detailed design stage.

- Overflow coefficient (C) varies with 3 dimensional factors such as height, length and location of the overflow dike, and condition of river flow. Due to these complex factors, each overflow dike may have a unique value of Coefficient (C) (refer to Equation 2.1).
- Higher overflow dike has a smaller C, while the lower dike has a larger C. The larger Froude number (Fr) of river flow causes a smaller C, and the smaller Fr induces a larger C.
- Overflow coefficient C varies with the shape and type of the overflow dike. For example, the gentle slope gradient of overflow dike causes a smaller C, while a steep slope gradient induces a larger C.
- Water level in the retarding basin also affects the value of C.

(ii) Design Criteria of Height and Length of Overflow Dike

In this F/S, three retarding basins are planned along the three rivers of Imus, Bacoor and Julian. These three rivers and three retarding basins have different topographical and hydrological characteristics each other. It is therefore necessary to design the overflow dike of each retarding basin separately.

The optimum dimensions of overflow dike have been studied in Section 2.1 “Hydraulic Analysis of Off-site Flood Retarding Basin” in this report, based on the following concepts:

As shown in the following table, there are some relationship between height and length of overflow dike in general.

- Lower height of overflow dike (lower “W”) is more effective against small scaled flood but it causes frequent overflow and increment of maintenance cost.
- Higher “W” is more effective against larger scaled flood though the low effectiveness against smaller scaled flood. Higher “W” needs longer overflow length and higher construction cost.

Table R 2.7 Relationship between Height of Overflow Dike and Other Figures

Item	Height of Overflow Dike (W)	
	Lower	Higher
Length of Overflow Dike (B)	Shorter	Longer
Cost of Overflow Dike	Economical	Expensive
Contribution to Smaller Flood	Higher	Lower
Maintenance Cost of Retarding Basin	Expensive	Economical
Frequency of Overflowing	Frequent	Fewer

As described in the foregoing subsection2.2, the extent and volume of retarding basin had taken the effectiveness of flood mitigation against not only design flood scale but also smaller flood scale in to consideration.

Downstream stretches in the objective Imus, Bacoor and Julian river basin will neither be improved nor have enough capacity to flush floodwater when the construction of retarding basins will be completed. Therefore, as a design policy in this F/S, retarding basins and overflow dikes shall be designed to be effective against smaller scaled flood as much as possible.

Considering above circumstances, the expected water volume stored in the retarding basin in a 2-year return period flood shall be as shown in the table below.

The retarding basins were designed with these inflow volumes as a guide.

Table R 2.8 Design Policy of Overflow Dike and Design Flood Scale

Description	I1 Retarding Basin (Imus River)	B4 Retarding basin (Bacoor River)	J1 Retarding Basin (Julian River)
Design Flood Scale	10-year return period	2-year return period	5-year return period
Design Policy against Smaller Scaled Flood	Overflow dike is designed so as to store about **30%** of total volume of retarding basin against 2-year return period flood and 80% against 5-year return period flood.	Retarding basin must have proper storage volume and dimension of overflow dike to mitigate flood as much as possible at smaller scaled flood.	Overflow dike is designed so as to store about **60%** of total volume of retarding basin against 2-year return period flood.
Design Policy against Larger Scaled Flood	Effectiveness against larger scaled flood is verified for designed retarding basins.	Effectiveness against larger scaled flood is verified for designed retarding basins.	Effectiveness against larger scaled flood is verified for designed retarding basins.

(c) Study on Structural Types of Overflow Dike

The following four (4) structural types of overflow dike have been applied to the overflow dikes in general:

- Asphalt Facing Type
- Concrete Facing Type
- Concrete-Block Facing Type
- Special Gabion Facing Type

Fig. R 2.7 Example of Overflow Dike of "Special Gabion Facing Type"

These four structural types of overflow dike have been compared and evaluated from the regional, economic, technical points of view as shown in Table 2.2. As the results, the "Special Gabion Facing Type" has been selected as the optimum structural type from the following reasons:

- The "Special Gabion Facing Type" can release uplift force inside the overflow dike. Maintenance is not difficult as compared to other types, because it does not require any ancillary equipment for discharging water nor air from the overflow dike.
- In case of damage caused by unexpected huge earthquakes, the other types would take a longer time to repair. Repair works for the "Special Gabion Facing Type" would take a shorter time to repair because the critical path of repair works is addressed only to the resetting of gabions.
- The "Special Gabion Facing Type" possesses the potential risk of suction of soil particles from bank materials. However, this risk could be avoided by the laying of suction-prevention sheet properly in the construction stage.

(d) Standard Cross Section of Overflow Dike

The following considerations/analyses were required for the design of overflow dike since the Special Gabion Facing type was selected as the optimum type for the overflow dike:

- Seepage flow analysis of overflow dike
- Minimum diameter of filling in gabion considering critical tractive force by overflow

Taking the results of the above analyses into account, and the adjustments to the separating dike to be connected into account, the designed standard cross section of overflow dike is designed as shown in Fig. 2.3.

(4) Facilities in Retarding Basin

(a) Stilling Basin

The stilling basin is necessary to absorb the energy and protect retarding basin from scouring when the water flows over the crest of overflow dike and enter into the retarding basin. The stilling basin is placed at the foot of the overflow dike to dissipate such scouring by river water hitting the base of the dike. The stilling basin is provided with bed protection structures (such as concrete blocks or gabions) and/or end sill structures to induce hydraulic jump in the overflow water.

Table 2.3 shows the comparative study results of three (3) alternatives of stilling basin; namely, Alternative-A as “Bed Protection Independent Structure”; Alternative-B as “Bed Protection with Projected End Sill”; and Alternative-C as “Bed Protection with Mounded End Sill”. According to the results of the comparative study, Alternative C is evaluated to be superior to the other alternatives judging from the flow condition after the hydraulic jump.

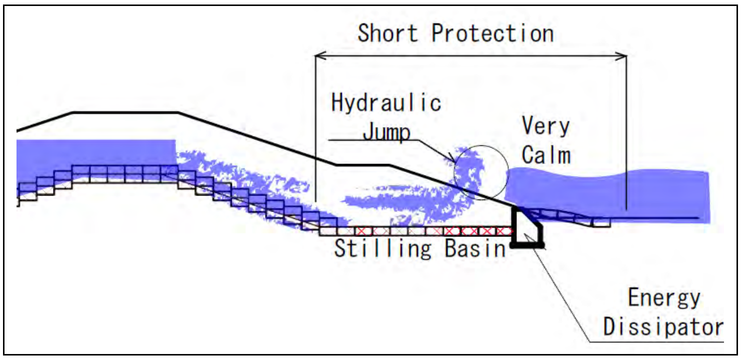


Fig. R 2.8 Typical Longitudinal Profile of Recommendable Stilling Basin
(Alternative-C: Bed Protection with Mounded End Sill)

Actual length of basin and height of end sill for each retarding basin shall be designed in the detailed design stage through the hydraulic model test.

(b) Drainage Sluice

Drainage sluice is designed at the downstream end of each retarding basin, passing under the separating dike in order to drain the water stored in the retarding basin within approximately 12~24 hours after the flooding subsides. The drainage sluice in each retarding basin is provided with flap gate, so that operation activities before and after flooding events are not required.

Slope of separating dike and riverbank around outlet of drainage sluice shall be protected by revetment structures with extent of 10m long on upstream and downstream side of the sluice (20m in total length) since turbulence of flow would occur around the outlet of sluice. Typical design drawings of drainage sluice are shown in Fig. 2.4.

(c) Sedimentation Basin

Should the inflow discharge to the flood retarding basin contains a large volume of the wash load and/or suspended sediment, the retarding basin would need to be provided with sedimentation basin to trap such wash load/suspended sediment.

The annual mean sediment inflow volume to each of the retarding basin is estimated by the following formula:

$$Vs = Vq \times W \div r \quad (2.2)$$

where,
- Vs : Annual mean sediment volume flowing into the retarding basin (MCM)
- Vq : Annual mean water volume flowing into the retarding basin (MCM)
- W : Average weight of sediment contained in the water flowing into the retarding basin (g/liter)
- r : Unit Weight of sediment (=1.5tf/m^3)

According to the sampling survey made in the Study, the discharge of Imus and Bacoor River contains the sediment of 8.15g/liter as listed in Table R. 2.9. The annual mean water inflow volumes to the flood retarding basins are further estimated at 0.72 MCM for the retarding basin of RB-I1 on Imus River, 0.38MCM for RB-4 on Bacoor River and 0.37 MCM for RB-J1 on Julian River as shown in Table R. 2.10.

The annual mean sediment volume flowing into the retarding basin is estimated based on the above results of the sampling survey and the estimation of the annual mean water inflow volume as shown in Table R. 2.11. As shown in this table, the sediment volume is judged to be negligible as compared to the designed storage volume on the premise that sedimentation deposited would be removed at once every three years as a part of maintenance works of retarding basins. From this point of view the sedimentation basins are not considered for all of the objective three retarding basins.

Table R 2.9 Results of Sampling Survey for Sediment Contained in the River Discharge

Sampling Location	Date of Sampling	Weight of Sediment Contained in River Discharge
Bacoor River	11 Sep. 2008	8.14 g/liter
Imus River (Imus Bridge)	11 Sep. 2008	7.62 g/liter
Imus River (Daan Hari Bridge)	11 Sep. 2008	12.94 g/liter
Bacoor River	25 Sep. 2008	8.54 g/liter
Imus River (Imus Bridge)	25 Sep. 2008	5.32 g/liter
Imus River (Daan Hari Bridge	25 Sep. 2008	6.32 g/liter
Average		**8.15 g/liter (=W)**

Table R 2.10 Estimated Annual Mean Water Volume Flowing into Retarding Basin

Retarding Basin	Return Period	2-yr return period	5-yr return period	10-yr return period	20-yr return period	**Total (Annual Mean: Vq)**
	Occurrence Probability	0.50	0.20	0.10	0.05	
RB-I1 (Imus River)	Probable Volume	0.48	1.20	1.48	1.74	
	Annual Mean Volume	0.24	0.24	0.15	0.09	**0.72**
RB-B4 (Bacoor River)	Probable Volume	0.45	0.45	0.45	0.45	
	Annual Mean Volume	0.23	0.09	0.05	0.02	**0.38**
RB-J1 (Julian River)	Probable Volume	0.32	0.55	0.62	0.69	
	Annual Mean Volume	0.16	0.11	0.06	0.03	**0.37**

Note: Annual Mean Volume = “Occurrence Probability” x “Probable Volume”

Table R 2.11 Rates of Annual Sediment Inflow Volume in the Retarding basin

Retarding Basin	(1) Annual Mean Sediment Volume Flowing into Retarding Basin (Vs)	(2) Designed Storage Volume of Retarding Basin	(1)/(2)
RB-I1 (Imus River)	3,900 m^3	1,520,000 m^3	0.3%
RB-B4(Bacoor River)	2,100 m^3	450,000 m^3	0.5%
RB-J1(Julian River)	2,000 m^3	550,000 m^3	0.4%

(d) Zoning of Retarding Basin and Partition Dike/Partition Slope

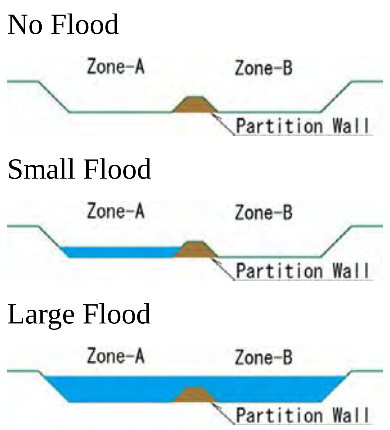
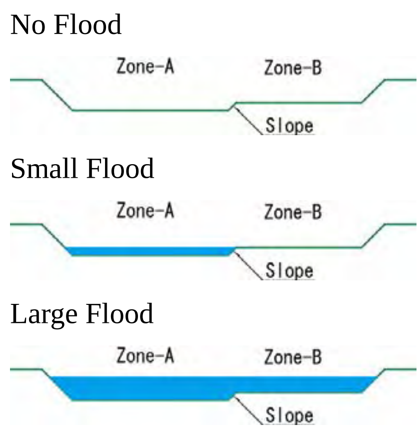
Retarding basin shall be divided into the following three zones for multipurpose use according to the frequency of inundation.

Table R 2.12 Basic Policy on Zoning Method and Utilization Plan of Each Zone

Item	Zone A	Zone B	Zone C
Zonal Policy	Inundated every 2 years	Inundated every 5 years	Inundated every 10 years
Basic Policy on Utilization Plan	Community Pond, Community Farm, Eco-Park, and Others	Park, Playground, Sports Field, and Others	Basketball Court, Barangay Facility, Public Parking Lot, and Others
Ground Elevation	Approx. 1m above riverbed level adjacent to the retarding basin	Water level of 2-year return period flood in the retarding basin.	Water level of 5-year return period flood in the retarding basin

The zoning for the retarding basin is made, in general, by two types of partitioning namely, the "Partition Wall Method" and the "Elevation Method" The advantages/disadvantages of these two types of portioning are evaluated as shown in Table R. 2.13 and, as the results of evaluation, the "Elevation method" is adopted considering that the Method requires the smaller project cost of the retarding basin and the less work for maintenance.

Table R 2.13 Comparison of Zoning Method

Item	Alternative-1: Partition Wall Method	**Alternative-2: Elevation Method**
Conceptual Figure		
Area of Retarding Basin	Total area of retarding basin is smaller. Most of the area of retarding basin can be excavated at lowest level.	Total area of retarding basin is larger. Less frequent areas of inundation are elevated above the lowest elevation.
Construction Cost	Construction cost is higher due to additional cost of partition wall and its ancillaries.	Construction cost is lower due to no additional facility.
Compensation Cost	Compensation cost for land acquisition is lower due to smaller area of retarding basin.	Compensation cost for land acquisition is slightly higher due to larger area of retarding basin.
Total Project Cost *1)	Total project cost is higher since construction cost is quite higher.	Total cost is lower because of low construction cost.
Operation & Maintenance	O&M cost is higher due to maintenance work for partition wall and its ancillaries.	O&M activities are easier because number of facilities is fewer.

(5) Drainage Channel Treatment and Conduit for Sewerage Water

There currently exist several irrigation canals and drainage channels crossing through the site of each retarding basin, and these facilities have to be shifted prior to construction of the retarding basin. The small conduits/ditches along both sides of the surrounding dike are further designed to segregate sewer water from floodwater and prevent the polluted sewer water from flowing into the retarding basin.

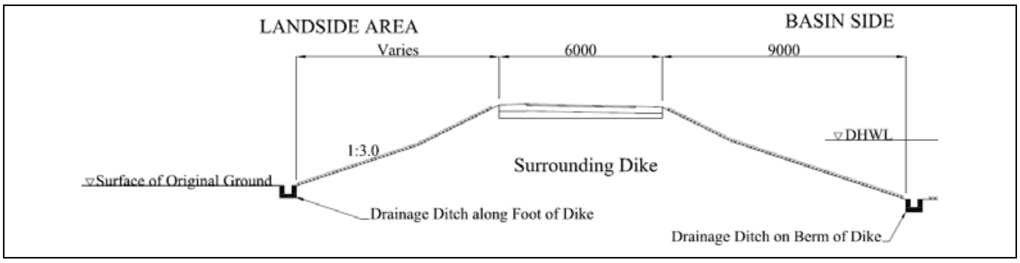


Fig. R 2.9 Drainage Ditches along Surrounding Dike

2.3.2 River Improvement Works around the Retarding Basin

The present conditions of the three river stretches along the designed retarding basins are as follows:

Table R 2.14 Present Condition of River Stretches around Retarding Basins

Description	I1 Retarding Basin (Imus river)	B4 Retarding Basin (Bacoor river)	J1 Retarding Basin (Julian river)
Present Condition of River around Retarding Basin			
Present Condition of Riverbank	Natural River Stream with Riparian Forests	Opposite side of riverbank has been urbanized. Retarding basin side has been sustained as natural river stream.	Opposite side of riverbank has been urbanized. Retarding basin side has been sustained as natural river stream.
Present Condition of Riverbed	Soft rock stratum is exposed as surface of riverbed.	Soft rock stratum is exposed as surface of riverbed at some portions, but there are some deposits on riverbed.	Soft rock stratum is exposed as surface of riverbed.

Present flow conditions in the river stretches around the retarding basins are unsteady because of meander of the river channel, change of the channel width and depth, and disturbance by artificial structures. This may affect the overflow condition on the overflow dike, and the retarding basin may not be able to mitigate flood as designed. Hence, river improvement works shall be implemented at sections around the overflow dike in parallel with the construction of each retarding basin.

Imus River and Julian River expose the soft rocks on its riverbeds, which possibly lead to degradation of riverbed, while the riverbed of Bacoor River is judged to be rather stable. In any case of the present riverbed conditions, however, the construction of the flood retarding basin could cause the partial degradation of the riverbed and/or scaring, which may change the hydraulic conditions for overflow from the river into the flood retarding basin. In order to avoid such degradation of the riverbed and maintain the designed hydraulic conditions for intake of the flood retarding basin, the groundsill is designed at the downstream section of the overflow dike of the flood.

Table R 2.15 Basic Condition of River Improvement Works around Retarding Basins

Item	Imus River	Bacoor River	Julian River
Extent of River Improvement			
Downstream Section	100m from Overflow Dike	100m from Overflow Dike	50m from Overflow Dike
Upstream Section	50m from Overflow Dike	10m long Overflow Dike	20m from Overflow Dike
Location of Groundsill	100m toward downstream from Overflow Dike	100m toward downstream from Overflow Dike	50m toward downstream from Overflow Dike
Structural Type of Revetment			
Separating Dike (Retarding Basin Side)	Slope Gradient: V:H=1:3.0 with berm	Slope Gradient: V:H=1:3.0 with berm	Slope Gradient: V:H=1:3.0 with berm
Separating Dike (River Side) River Bank	Slope Gradient: V:H=1:2.0 with berm	Slope Gradient: V:H=1:0.5 with Revetment	Slope Gradient: V:H=1:2.0 w/ berm
River Bank (Opposite Side)	Slope Gradient: V:H=1:2.0 with berm	Slope Gradient: V:H=1:0.5 w / Revetment	Slope Gradient: V:H=1:0.5 w/ Revetment

2.3.3 Geology of Proposed Site of Retarding Basins

(1) General

To obtain the geological characteristics of the proposed sites of the flood retarding basin, the geological survey was carried out taking two boreholes foe the site of “RB-I1”and three boreholes for each of RB-J1 and RB-4 B4.

It was evaluated through the field reconnaissance in the M/P Study that the Study Area is covered broadly with Quaternary volcanic products of Taal Volcano, namely Taal Tuff, and sedimentary rocks of Guadalupe Formation. These basic soft rock strata are expand at 5~6m below loosed Alluvium stratum as surface layer. All boring logs executed have proved that all of the sites for the proposed flood retarding basins possess the above geological conditions as preliminarily evaluated in the M/P Study.

(2) Geological Survey Result

Items and envisaged quantities of Core drilling with Field/Laboratory tests are summarized in the table below.

Table R 2.16 Quantity of Core Drilling and Laboratory Test Undertaken

Location	No. of Boring	Length (m)	SPT (nos.)	Laboratory Test (Samples)
Imus I1	I1-1	10	6	3
	I1-2	10	6	3
Bacoor B4	B4-1	10	6	3
	B4-2	10	6	3
	B4-3	10	6	3
Julian J1	J1-1	10	6	3
	J1-2	10	6	3
	J1-3	10	6	3
Total	8 boreholes	80	48	24 per each test

(a) Field Survey

The core drillings were made at eight points in total as explained above. Locations of core drillings are shown in Fig.2.5. The following field tests were carried out in each borehole:

- Standard Penetration Test (SPT) specified under ASTM D1586, every 1.5m in deep,
- Groundwater Level Survey

(b) Laboratory Test

Laboratory tests were carried out by using samples obtained through the standard penetration tests. Items and envisaged quantities of the laboratory tests are listed as below.

- Particle size analysis by sieve (ASTM D422) : 24 samples
- Liquid limit, plastic limit, plastic index (ASTM D4318) : 24 samples
- Specific gravity of soil (ASTM D854) : 24 samples
- Natural water content of soil (ASTM D4959) : 24 samples
- Soil Classification (ASTM D2487) : 24 samples

(c) Results of Geological Survey

Boring logs with number of SPT and soil classification based on laboratory tests are illustrated in Fig.2.6. Based on these boring logs, soil profiles at each site are described in Fig.2.7 respectively.

2.3.4 Preliminary Design for Imus Retarding Basin (Code: RB-I1)

This subsection discusses the preliminary design of Retarding Basin of RB-I1 on Imus River (hereinafter referred to as the “Imus Retarding Basin”).

(1) Transfer of Location of the Site of Imus Retarding Basin

In the M/P, the farmland located in the right bank at the upstream section of Anabu Dam has been proposed as the construction site of the Imus Retarding Basin to reduce the peak discharge of Imus River (see figure below).

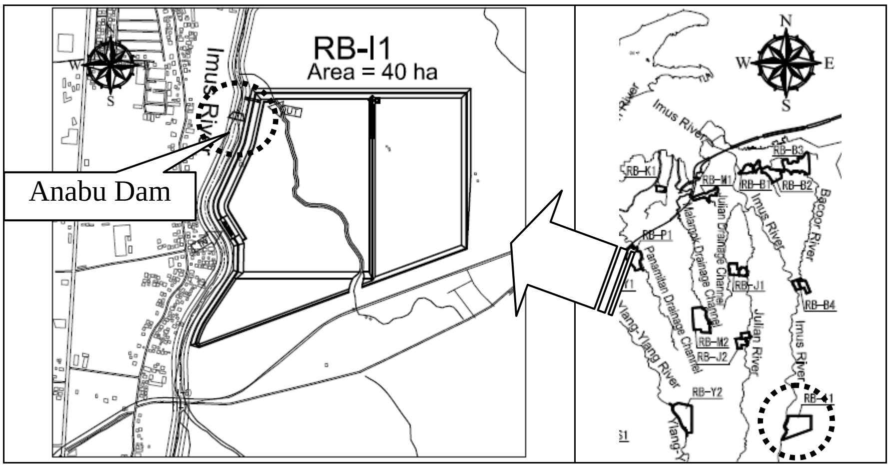


Fig. R 2.10 Location of Imus Retarding Basin Originally Proposed in M/P

It was, however, confirmed that the site proposed in the M/P has been recently commenced to be bought up by several land developers for the sake of conversion of the land for the commercial and residential use, which lead to difficulties in attaining the land acquisition for the site. Hence, the location of Imus Retarding Basin should be reconsidered.

Under the above conditions, the Study Team in collaboration with the Municipal Planning and Development Coordinator of Imus attempted to select the second best site for the retarding basin. As the results, the farmland in Barangay Anabu 1-G along Sta.8+500~9+500 of Imus River has been selected as the alternative site (see Figs. R. 2.11 and 2.12). This alternative site has been also brought up by the land developer but the any official permission on the commercial and/residential use has not been issued yet, whereby the land acquisition would be made possible.

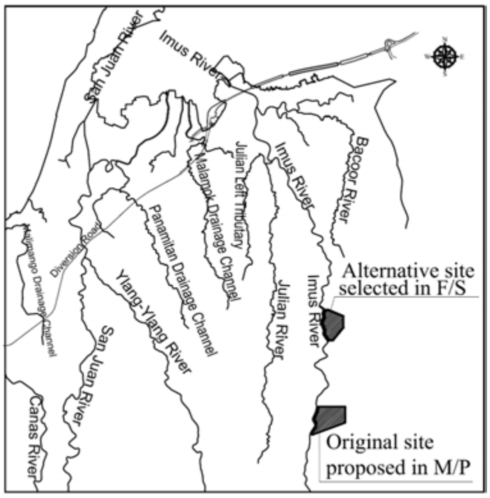


Fig. R 2.11 Two Alternative Locations of Imus Retarding Basin

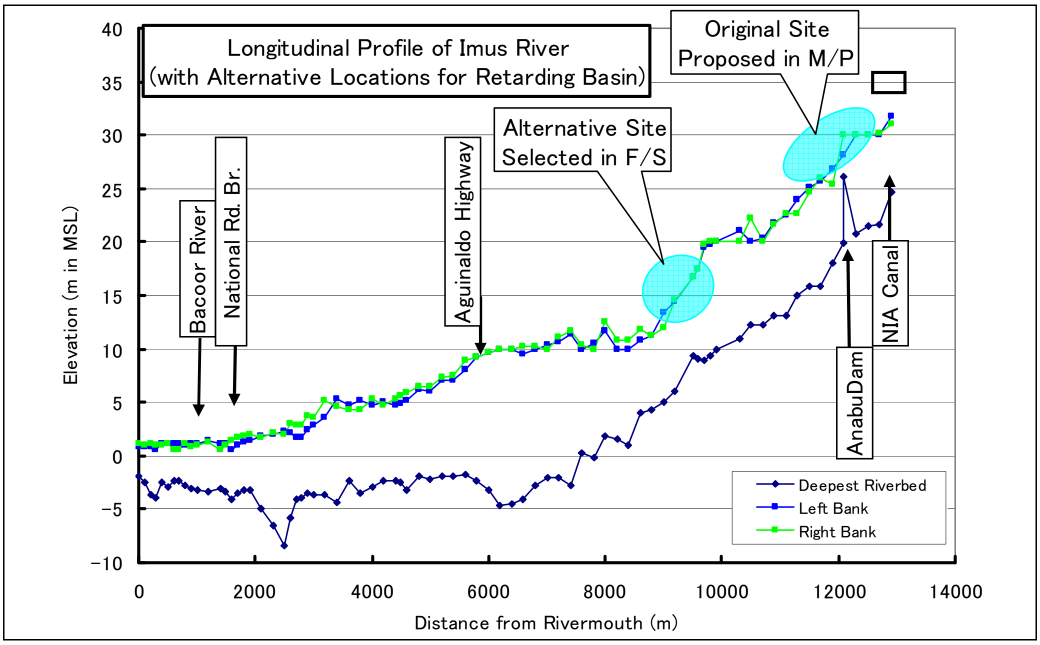


Fig. R 2.12 Longitudinal Profile of Imus River
and Location of Alternative Sites of Imus Retarding Basin

(2) Design Condition of Imus Retarding Basin

(a) Design Flood Scale for Imus Retarding Basin

Design conditions applied in consideration of scale of Imus Retarding Basin are as follows.

Table R 2.17 Design Conditions for Consideration of Scale of Imus Retarding Basin

Description	Condition	Remarks
Basic Hydrograph	Ratio of Built-up Area: 45% (in 2020)	With On-site Regulation Pond
Basic Flood Scale for Design	10-year Return Period Flood	
Consideration of Smaller Scaled Flood	Effective against 2-year return period flood	approx. 30% of total volume of retarding basin

Note : See Table R2.3 for details.

(b) Basic Topographical and Hydraulic Conditions for Imus Retarding Basin

The basic topographical and hydraulic conditions of Imus Retarding Basin have been compiled as follows:

Table R 2.18 Basic Topographical and Hydraulic Conditions of Imus Retarding Basin

Item	Station	Existing Riverbed Elevation	Existing Bank Elevation	Average Hinterland Elevation	Designed Riverbed Elevation	Designed High Water Level
Upstream end	Sta.9+600	EL+9.093m	EL+14.801m	EL+17.5m	EL+7.733m	EL+14.133m
Overflow Dike	Sta.9+400	EL+9.353m	EL+16.299m	EL+17.0m	EL+6.933m	EL+13.333m
Downstream end	Sta.8+800	EL+4.370m	EL+10.834m	EL+15.0m	EL+4.533m	EL+10.933m
Elevation of Surrounding/Separating Dike Crown			EL+18.0m			
Possible Lowest Bottom of Retarding Basin*1)			EL+6.00m*1)			
Elevation of Surface of Soft-Rock Stratum			EL+10m, more or less			
Required Area of Retarding Basin in M/P			Approximately 40ha			

Note: *1) 1m above the existing or designed riverbed elevation at downstream end of retarding basin

(c) Geological Condition around Imus Retarding Basin

The Study Area is covered broadly by Quaternary volcanic products of Taal Volcano, namely Taal Tuff and sedimentary rocks of Guadalupe Formation. It is deemed that upper surface of soft rock stratum is expanded at 5~6m below ground surface around the Imus Retarding Basin, judging from the exposed river bank condition and the results of soil investigations carried out in the study area. (refer to Fig. 2.6 and Fig. 2.7)

The ground surface elevation is EL+15~18m and the surface elevation of soft rock layer is approximately EL+10m in the proposed site of Imus Retarding Basin. In this connection, bulldozer with ripper or equivalent attachment will be required to excavate soft rock.

(3) Dimension of Overflow Dike and Storage Volume of Imus Retarding Basin

As the result of hydraulic analysis as described in section 2.2 aforementioned and section 2.6 discussed below, the elevation and length of the overflow dike have been determined at the least cost in association with the required storage volume as shown in Fig.2.8 attached and summarized in the table below.

Table R 2.19 Dimension of Overflow Dike and Storage Volume of Imus Retarding Basin

Item	Optimum Value	Remarks
Location of Overflow Dike (Center)	Sta.9+450	At straight section of river stretch
Crown Elevation of Overflow Dike	EL+11.25m	Under consideration of 2-year flood
Length of Overflow Dike	45m	Adjustment Results in 10-year flood
Required Storage Volume of Retarding Basin	Not less than 1.48 million m^3	Required storage volume in 10-year flood
Design Water Level in Retarding Basin	EL+12.91m	Peak River Water Level in 10-year flood:EL+13.02m

(4) Area and Bottom Elevation of Imus Retarding Basin

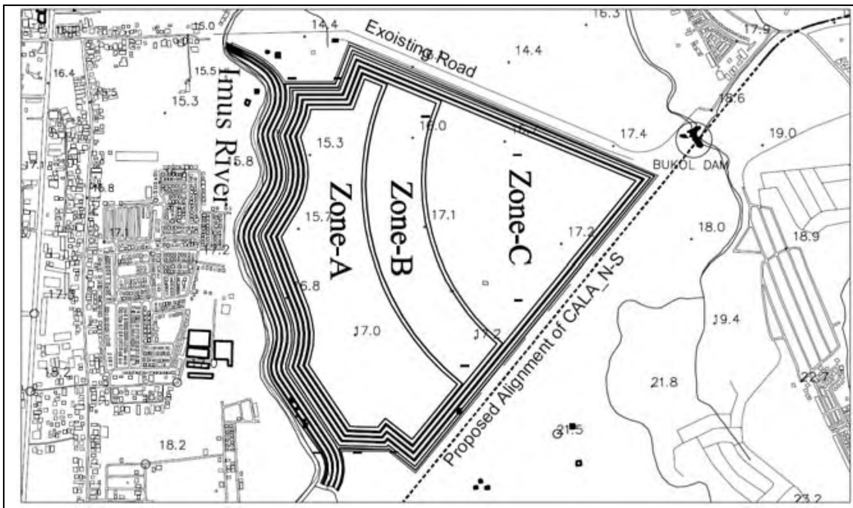
(a) Possible Maximum Extent for the Site of Imus Retarding Basin

The maximum extent of the site for Imus Retarding Basin is estimated at 58 hectares assuming that the eligible land acquisition would be made within the area encompassed by an arterial road extending toward East-West at the downstream side and the proposed alignment of CALA_N-S Expressway at the upstream side. The major features and dimensions of Imus Retarding Basin for the maximum extent of the site are estimated based on the result of hydraulic analysis as shown in Table R. 2.20 and Fig. R. 2.13.

Table R 2.20 Major Features of Imus Retarding Basin with Maximum Area (Area: 58ha)

Zoning	Elevation (EL.m)	Partial Area	Accumulated Area	Accumulated Storage Volume	Inundation Frequency	Remarks
Bottom (Zone-A)	6.0	14.9 ha	14.9 ha ~ 16.8 ha	0 MCM ~ 0.5 MCM	Every 2 years or more frequent	Plane
	6.0~9.0	1.9 ha				Slope, etc.
Zone-B	9.0	9.5 ha	26.3 ha ~ 28.4 ha	0.5 MCM ~ 1.3 MCM	Every 3~5 years	Plane
	9.0~12.0	2.1 ha				Slope, etc.
Zone-C	12.0	16.1 ha	44.5 ha ~ 45.2 ha	1.3 MCM ~ 1.7 MCM	Less frequent than every 5 years	Plane
	12.0~12.91	0.7 ha				Slope, etc.
H.W.L	EL+12.91m	-	45.2 ha	1.7 MCM	Every 10 years	
Perimeter	-	12.8 ha	58.0 ha	-	-	Max. extent of site

Note: High Water Level in the Imus Retarding Basin with 10-year return period flood: H.W.L = EL+12.91m
Required Storage Volume=Not less than 1.48MCM (10-year return period flood)



AREA : Approx. **58**ha

LOWEST
BED ELEVATION:
EL+6.0m

Fig. R 2.13 Plan of Imus Retarding Basin with Maximum Area (58ha)

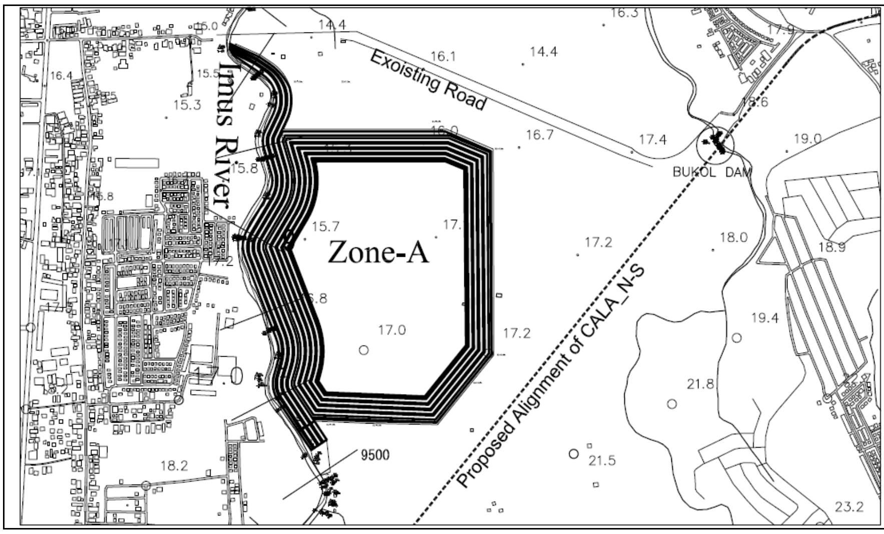
(b) Required Minimum Extent of Imus Retarding Basin

The possible lowest bottom elevation of Imus Retarding Basin could be set at EL+6.0m, which is 1m above the river bed level at the downstream end of the retarding basin. When the bottom elevation of the retarding basin is designed to be EL+6.0m and the retarding basin is not divided into the zones, the required extent of site for the Imus Retarding Basin is minimized. The minimized area of the retarding basin is estimated at 32 hectares. The major features and dimensions of the Imus Retarding Basin for the minimum extent of site are estimated based on the result of hydraulic analysis as Table R. 2.21 and Fig. R. 2.14.

Table R 2.21 Major Features of Imus Retarding Basin with Minimum Area (Area: 32ha)

Zoning	Elevation (EL.m)	Partial Area	Accumulated Area	Accumulated Storage Volume	Inundation Frequency	Remarks
Bottom (Zone-A)	6.0	20.2 ha	20.2 ha ~ 25.3 ha	0 MCM ~ 1.5 MCM	Every 2 years or more frequent	Plane, Lowest Level
	6.0~12.91	5.1 ha				Slope, etc.
H.W.L	EL+12.91m	-	25.3 ha	1.5 MCM	Every 10 years	
Perimeter	-	6.7 ha		-	-	

Note: High Water Level in the Imus Retarding Basin with 10-year return period flood: H.W.L = EL+12.91m
Required Storage Volume=Not less than 1.48MCM (10-year return period flood)



AREA : Approx. **32**ha

LOWEST
BED ELEVATION:
EL +6.0m

Fig. R 2.14 Plan of Imus Retarding Basin with Minimum Area (32ha)

(c) Optimum Extent of the Site for Imus Retarding Basin

The optimum extent of the site for Imus Retarding Basin is between the aforesaid maximum and the minimum extent of the site, and estimated at 40 hectares based on the following concepts:

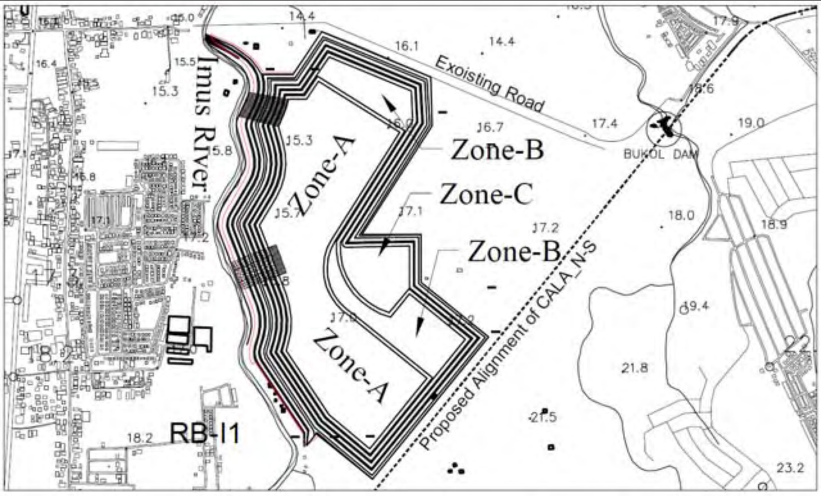
- The flood retarding basin should contain the three zones namely Zone A for flood mitigation against the probable flood of 2-year return period, Zone B for 5-year return period and Zone C for 10-year return period as proposed in the foregoing Table R. 2.12.
- The optimum extent of the site could be calculated based on the required storage volume of the flood retarding basin for the design scales for 2, 5 and 10-year return period as estimated in the hydraulic analysis (refer to the foregoing Table R. 2.3).

The major features and dimensions of Imus Retarding Basin for the optimum extent of the site are estimated based on the result of hydraulic analysis as Table R. 2.22 and Fig. R. 2.15.

Table R 2.22 Major Features of Imus Retarding Basin with Optimum Area (Area: 40ha)

Zoning	Elevation (EL.m)	Partial Area	Accumulated Area	Accumulated Storage Volume	Inundation Frequency	Remarks
Bottom (Zone-A)	6.0	15.5 ha	15.5 ha ~ 17.6 ha	0 MCM ~ 0.5 MCM	Every 2 years or more frequent	Plane
	6.0~9.0	2.1 ha				Slope, etc.
Zone-B	9.0	5.1ha	22.7 ha ~ 25.1 ha	0.5 MCM ~ 1.2 MCM	Every 3~5 years	Plane
	9.0~12.0	2.4ha				Slope, etc.
Zone-C	12.0	2.7ha	27.8 ha ~ 28.5 ha	1.2 MCM ~ 1.5 MCM	Less frequent than every 5 years	Plane
	12.0~12.91	0.7 ha				Slope, etc.
H.W.L	EL+12.91m	-	28.5 ha	1.5 MCM	Every 10 years	
Perimeter	-	11.5 ha	40 ha	-	-	

Note: High Water Level in the Imus Retarding Basin with 10-year return period flood: H.W.L = EL+12.91m
Required Storage Volume=Not less than 1.48MCM (10-year return period flood)



AREA : Approx. **40ha**

LOWEST
BED ELEVATION:
EL +6.0m

Fig. R 2.15 Plan of Imus Retarding Basin with Optimum Area (40ha)

The above three (3) alternatives are summarized as follows:

Table R 2.23 Summary of Comparison of Alternative Areas for Imus Retarding Basin

Item		Maximum Extent	Minimum Extent	Optimum Extent
Required Land Acquisition Area		58ha	32ha	40ha
Land Price	Land Price by BIR *1	Anabu I: All other Streets; RR: Php 800/m^2, CR: Php 2,000/m^2, A: Php 300/m^2		
	Market Price*2	Php 1,000/m^2		
	Adopted Price in M/P	Php 300/m^2		
Bottom Elevation of Basin		EL+6.0m	EL+6.0m	EL+6.0m
Maximum Excavation Depth		8~11m deep	8~11m deep	8~11m deep
Assumed Excavation Volume		Approx.2.2 million m^3	Approx.1.8 million m^3	Approx.2.0 million m^3
Assumed Embankment Volume		0.05 million m^3	0.03 million m^3	0.04 million m^3
Possibility of Zoning		Possible	Difficult	Possible
Area of Inundation every year		33%	100%	54%
Area of Inundation once in 5 years		58%	100%	80%
Area of Inundation once in 10 years		100%	100%	100%

Note: *1 : Quoted from ZONAL VALUATION, Province of Cavite (2002)
BIR: Bureau of Internal Revenue, RR: Residential Area, CR: Commercial Area, A: Agricultural Area
*2: Maximum value from results of hearing inspection with agencies concerned.

The proposed plan of the Imus Retarding Basin described above had been presented to and accepted in general by the residents, officials and other stakeholders through the various meetings and discussions such as the stakeholders' meeting and the internal meetings with the Provincial Government of Cavite and DPWH.

(5) Plan for Multipurpose Use of the Imus Retarding Basin

The flood retarding basin is divided into the three zones, and Zone C in particular would be submerged under the water, only with the flood larger than 5-year return period flood. Hence, the multipurpose use of the land in the flood retarding basin is possible. The plan for the multipurpose use would need to be prepared by the project proponents, the DPWH, the Provincial Government of Cavite, and the LGU that will be administrative organizations of the retarding basin. In this subsection, the tentative zoning and utilization plan of the retarding basin is proposed as an example based on the optimum plan of Imus Retarding Basin.

(a) Zoning Plan of Imus Retarding Basin

The plan of Imus Retarding Basin shall be divided into three (3) zones based on inundation frequency, as summarized in the table below and shown in Fig. 2.9.

Table R 2.24 Proposed Concepts of Zoning for Imus Retarding Basin

Zone	Area (ha)	Inundation Frequency
Zone-A (EL+6.0m)	15.5	Every Flood Event
Zone-B (EL+9.0m)	5.1	Every 3~5 years
Zone-C (EL+12.0m)	2.7	Every 5~10 years
Slopes and Other Internal Areas	10.7	-
Access Road and External Areas	6.0	No Inundation
Total Area of Retarding Basin	40.0	

(b) Utilization Plan of Imus Retarding Basin

Tentatively, the area inside the retarding basin can be utilized as follows:

<u>Zone-A</u>

- Eco-Park and Community Pond, to also serve as sedimentation trap
- Community Farmland (during Dry Season)

<u>Zone-B</u>

- Basketball Court(s)
- Other Sports Facilities, such as track and field

<u>Zone-C</u>

- Public Parking Lots
- Area for Sunday Market
- Barangay and Municipal Public Spaces

The conceptual plan of the Imus Retarding Basin based on the above tentative uses is shown in Fig. 2.10.

2.3.5 Preliminary Design for Bacoor Retarding Basin (Code: RB-B4)

This subsection discusses the preliminary design of Retarding Basin of RB-B4 on Bacoor River (hereinafter referred to as the "Bacoor Retarding Basin").

(1) Location of Bacoor Retarding Basin (B4)

The Bacoor Retarding Basin is proposed at the open space of unused land between Bacoor River and Imus River. This site is located in Barangay Buhay na Tubig and its distance or station point of Bacoor river is approximately 7km upstream (Sta. 7) from the merging point with Imus river.

As explained in the M/P report, the average flow capacity of the present Bacoor river channel is less than 20m^3/s, which hardly cope with even 2-year return period flood. This extremely small channel flow capacity is attributed to a number of narrow sections, as well as bridge and culvert construction with less clearance, and the densely packed hoses along the river channel. Therefore, the area along the Bacoor River has suffered from perennial inundation by flood overflow. The Bacoor Retarding Basin will be able to mitigate those flood condition dramatically.

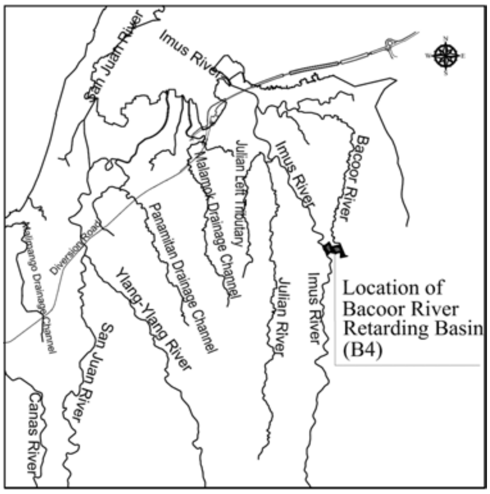


Fig. R 2.16 Location of Bacoor Retarding Basin (B4)

(2) Design Condition of Bacoor Retarding Basin

(a) Design Flood Scale for Bacoor Retarding Basin

Design conditions applied in consideration of scale of Bacoor Retarding Basin are as follows.

Table R 2.25 Design Conditions for Consideration of Scale of Bacoor Retarding Basin

Description	Condition	Remarks
Basic Hydrograph	Ratio of Built-up Area: 45% (in 2020)	With On-site Regulation Pond
Basic Flood Scale for Design	2-year Return Period Flood	
Consideration of Smaller Scaled Flood	Effective against flood smaller than 2-year return period flood	

Note : See Table R2.3 for details.

(b) Basic Topographical and Hydraulic Conditions of Bacoor Retarding Basin

The design discharge of 2-year return period at the designated point of Bacoor Retarding Basin is 67m^3/s. Based on the results of hydrological analysis as described in Section 2.2, the Bacoor Retarding Basin will cut this peak discharge into approximately 20m^3/s and store 450,000 m^3 of river water during the whole flooding event. The hydraulic and topographic data of the Bacoor Retarding Basin have been compiled, as follows:

Table R 2.26 Basic Topographical and Hydraulic Conditions of Bacoor Retarding Basin

Name of River	Item	Station	Average Hinterland Elevation	Designed Riverbed Elevation	Designed High Water Level
Bacoor River	Upstream end	Sta.8+200	EL+10.0m	EL+7.25m	EL+10.056m
	Overflow Dike	Sta.8+150	EL+9.5m	EL+7.125m	EL+9.931m
	Downstream end	Sta.7+800	EL+9.0m	EL+6.75m	EL+9.056m
Imus River	Upstream end	Sta.7+000	EL+10.0m	EL+0.0m	EL+6.40m
	Downstream end	Sta.6+700	EL+10.0m	EL-0.40m	EL+6.00m
Elevation of Surrounding/Separating Dike Crown			EL+10.4m		
Possible Lowest Bottom of Retarding Basin			Drain into Bacoor River: EL+7.50m*1) Drain into Imus River: EL+2.50m*2)		
Elevation of Surface of Soft-Rock Stratum			EL+4m, more or less		
Required Area of Retarding Basin in M/P			Approximately 13ha		

Note: *1): Designed riverbed elevation at downstream end of retarding basin + 1.0m
*2): Recorded Highest Tide Level (EL+1.3m) + 1.0m = EL+2.3m => EL+2.5m

(c) Geological Condition around Bacoor Retarding Basin

The Study Area is covered broadly by Quaternary volcanic products of Taal Volcano, namely Taal Tuff and sedimentary rocks of Guadalupe Formation. The upper surface of soft rock stratum is deemed to lie about 4~5m below ground surface around the Bacoor Retarding Basin, judging from the exposed riverbank condition and the results of soil investigations carried out in the study area. (refer to Fig. 2.6 and Fig. 2.7)

The ground surface elevation is EL+8.5~10m and the surface elevation of soft rock layer is approximately EL+4~5m in the proposed site of Bacoor Retarding Basin. In this connection, bulldozer with ripper or equivalent attachment will be required to excavate soft rock.

(3) Dimension of Overflow Dike and Storage Volume of Bacoor Retarding Basin

As the result of hydraulic analysis, the appropriate features and parameters of the overflow dike have been determined as summarized in the table below.

Table R 2.27 Dimension of Overflow Dike and Storage Volume of Bacoor Retarding Basin

Item	Optimum Value	Remarks
Location of Overflow Dike (Center)	Sta. 8+150	The section straighten by River Improvement
Crown Elevation of Overflow Dike	EL+8.35m	Under consideration of flood scale of smaller than 2-year return period
Length of Overflow Dike	25m	Adjustment results in 2-year flood
Required Storage Volume of Retarding Basin	Not less than 0.45 million m^3	Required storage volume in 2-year flood
Design Water Level in Retarding Basin	EL+9.36m	Peak River Water Level in 2-year flood=EL+9.61m

(4) Drainage Direction from Bacoor Retarding Basin

As described above, the Bacoor Retarding Basin is placed between Bacoor River and Imus River, and therefore the water stored in the Bacoor Retarding Basin can be discharged into Bacoor River or Imus River. Based on the comparison of two alternative directions of drainage outlet as described hereinafter, the whole water stored in the Bacoor Retarding Basin is determined to flow into Imus River.

(a) Drain of the Stored Water into Bacoor River

Riverbed elevation of Bacoor River at the point of downstream end of Bacoor Retarding Basin is approximately EL+7m, and the allowable bottom elevation of Bacoor Retarding Basin would need to be EL+7.50m or higher if stored water is drained into the Bacoor River. On the other hand, the Bacoor Retarding Basin has to store more than 450,000m^3 of floodwater, which require the area of 22 hectares or more, as estimated below:

450,000m^3 / (EL+9.61-EL+7.50m) = 21.43 ha --- 22 ha (round up)

To secure the area of 22 hectares or more, it is necessary to acquire the lots with operating factories and developing residential subdivisions in the area surrounding the unused land, as shown in the figure below. The acquisition of such land will lead to not only a huge compensation cost but also delay the implementation schedule. Thus, it is not difficult to drain the stored water into Bacoor River.

Fig. R 2.17 Required Area (22ha) to Drain the Stored Water into Bacoor River

(b) Drain of the Stored Water into Imus River

In consideration of riverbed elevation of Imus River around the Bacoor Retarding Basin, the allowable bottom elevation of Bacoor Retarding Basin could be set at EL+2.5m, Due to such deep bottom elevation of the retarding basin, it is possible to have larger storage volume with smaller area under this condition of bottom elevation. From this point of view, the water stored in the Bacoor Retarding Basin is designed to flow into Imus River.

The dimensions of drainage sluice shall be designed that discharge flow shall not exceed 6.7m^3/s under peak drainage condition in accordance with the drainage calculation tables shown in Table 2.4. Discharge flow from the Bacoor Retarding Basin will not affect he flow condition in the Imus River.

(5) Area and Bottom Elevation of Bacoor Retarding Basin

The design scale of Bacoor Retarding Basin is 2-year return period and storage volume shall be more than 450,000m^3 as estimated in the hydraulic analysis (refer to Table R. 2.3)

(a) The Possible Maximum Extent of the Site for Bacoor Retarding Basin

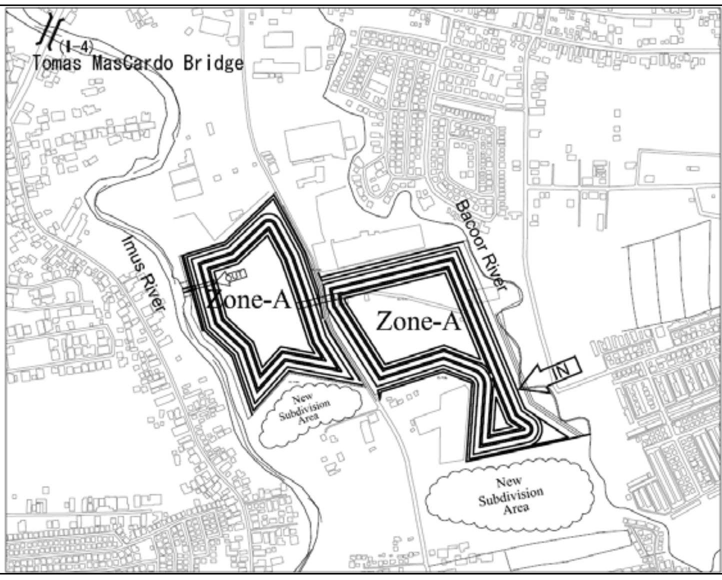
The proposed site of Bacoor Retarding Basin lies between Bacoor River on the east and Imus River on the west. The construction area shall be limited within unused area and utilize there as much as possible. Zoning is not applied and the bottom elevation of the retarding basin is set at EL. 2.5m as described above. An arterial road runs in a north-south direction through the center of the area, and some residential houses and municipal facilities exist along the road. These houses and facilities shall be relocated to maximize the site for retarding basin. Taking these conditions into account, the possible maximum area for the Bacoor Retarding Basin is estimated at 12.2 ha.

Considering such topographical restrictions and basic design policies described above, accumulated water volume (=0.41MCM) stored in the retarding basin at design water level comes short of the required storage water volume (=0.45MCM) of retarding basin as shown in the Table R. 2.28,

Table R 2.28 Major Features of Bacoor Retarding Basin with Maximum Area (Area: 12.2ha)

Zoning	Elevation (EL.m)	Partial Area	Accumulated Area	Accumulated Storage Volume	Inundation Frequency	Remarks
Bottom (Zone-A)	2.5	3.7 ha	3.7 ha ~ 8.0 ha	0 MCM ~ 0.41 MCM	Every 2 years or more frequent	Plane, Lowest Level
	2.5~9.36	4.3 ha				Slope, etc.
H.W.L	EL+9.36m	-	8.0 ha	**0.41 MCM**	Every 2 years	< 0.45MCM
Perimeter	-	4.2 ha	12.2 ha	-	-	Possible Maximum Area (Given condition)

Note: High Water Level in the Bacoor Retarding Basin with 2-year return period flood: H.W.L = EL+9.36m
Required Storage Volume=Not less than 0.45MCM (2-year return period flood)



AREA: Approx.**12.2**ha
RB-B4R: Approx. **7.0**ha
RB-B4L: Approx. **5.2**ha

LOWEST
BED ELEVATION
RB-B4R: EL+2.5m
RB-B4L: EL+2.5m

Fig. R 2.18 Plan of Bacoor Retarding Basin with Maximum Area (12.2ha)

(b) Modification to Secure Required Storage Volume of Bacoor Retarding Basin (Selected Alternative)

Notwithstanding the securement of maximum extent for retarding basin, accumulated volume has not sufficiently reached the required retarded volume. With regard this issue, some parts of slope on surrounding dikes shall be modified as the steeper slope of V:H=1:0.5 to increase storage capacity of retarding basin.

As a result, major hydraulic features and dimensions of Bacoor Retarding Basin with redesigned shape of surrounding dike are as shown in the following Table R. 2.29 and Fig. R. 2.19.

Table R 2.29 Major Features of Bacoor Retarding Basin with Revised Slope Gradient of Surrounding Dike (Area: 12.2ha)

Zoning	Elevation (EL.m)	Partial Area	Accumulated Area	Accumulated Storage Volume	Inundation Frequency	Remarks
Bottom (Zone-A)	2.5	4.8 ha	4.8ha ~ 8.5 ha	0 MCM ~ 0.46 MCM	Every 2 years or more frequent	Plane, Lowest Level
	2.5~9.36	3.7 ha				Slope, etc.
H.W.L	EL+9.36m	-	8.5 ha	**0.46 MCM**	Every 2 years	> 0.45MCM
Perimeter	-	3.7 ha	12.2 ha	-	-	Possible Maximum Area (Given condition)

Note: High Water Level in the Bacoor Retarding Basin with 2-year return period flood: H.W.L = EL+9.36m
Required Storage Volume=Not less than 0.45MCM (2-year return period flood)
A part of slope of Surrounding Dike in the retarding basin is protected by concrete block type revetment with slope gradient of V:H=1:0.5.

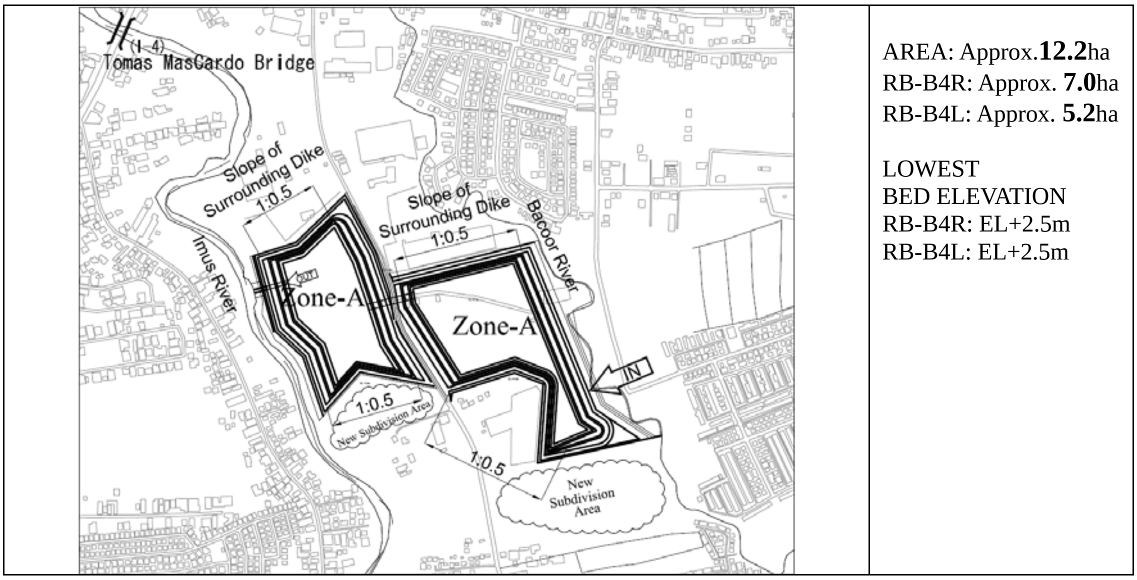


Fig. R 2.19 Plan of Bacoor Retarding Basin with Revised Slope Gradient (12.2 ha)

Hence, there is no alternative to be considered for the extent of Bacoor Retarding Basin since only the maximum extent possible manage to achieve storage of required water volume.

Major information for implementation of construction of the Bacoor Retarding Basin, such as land price, construction volume, land utilization and inundation frequency, are summarized as shown in the table below.

Table R 2.30 Major Features of Construction of the Bacoor Retarding Basin

Item		Maximum Extent of the Site with Modification of Slope Gradient
Required Land Acquisition Area		12.2ha
Land Price	Land Price by BIR [*1]	Anabu I, All other Street, RR: Php 1,500 /m^2, CR: Php 3,000 /m^2, A: Php 300 /m^2
	Market Price [*2]	Php 1,000 /m^2
	Adopted Price in M/P	Php 500 /m^2
Bottom Elevation of Basin		EL+2.5m
Maximum Excavation Depth		6.5~7.5m deep
Assumed Excavation Volume		0.45 million m^3
Assumed Embankment Volume		0.04 million m^3
Possibility of Zoning		Not Applicable
Area of Inundation every year		100%
Area of Inundation every 2 years		100%

Note: *1 : Quoted from ZONAL VALUATION, Province of Cavite (2002)
BIR: Bureau of Internal Revenue, RR: Residential Area, CR: Commercial Area, A: Agricultural Area
*2 : Maximum value from results of hearing inspection with agencies concerned.

The proposed plan of the Bacoor Retarding Basin described above had been presented to and accepted in general by the residents, officials and other stakeholders through the various meetings and discussions such as the stakeholders' meeting and the internal meetings with the Provincial Government of Cavite and DPWH.

(6) Plan for Multipurpose Use of the Bacoor Retarding Basin

The plan for the multipurpose use of the Bacoor Retarding Basin has to be established by the project proponents, the DPWH, the Provincial Government of Cavite, and the LGU that will be administrative organizations of the retarding basin although zoning cannot be applied. In this subsection, the tentative utilization plan of the retarding basin is proposed as an example based on the optimum plan of Bacoor Retarding Basin.

(a) Zoning Plan of Bacoor Retarding Basin

The available extent of site for the Bacoor retarding basin is not ample as compared with the aforesaid Imus River Basin since the site for the Bacoor retarding basin is applied for only one zone (Zone-A) as explained above. 100% of the total area is designed to be inundated with every flood. Under these conditions, the crown of access road and external areas should be made best use of recreational use. The site features for Bacoor Retarding Basin is summarized below (refer to Fig. 2.11).

Table R 2.31 Proposed Concepts of Zoning for Bacoor Retarding Basin

Zone	Area (ha)			Inundation Frequency
	Left (West) Side	Right (East) Side	Total	
Zone-A (EL+2.5m)	2.1	2.7	4.8	Every flood event
Slopes and Other Internal Areas	1.8	2.2	4.0	-
Access Road and External Areas	1.3	2.1	3.4	No Inundation
Total Area of Retarding Basin	5.2	7.0	12.2	

(b) Utilization Plan of Bacoor Retarding Basin

Land use for each zone inside the retarding basin is preliminarily proposed as below:

<u>Zone-A</u>

- Eco-Park and Community Pond

<u>Along expanded Existing Arterial Road</u>

- Area for Sunday Market
- Tree Planting / Kubo(Gazebo)

The conceptual plan of Bacoor Retarding Basin based on the above tentative use is as shown in Fig. 2.12.

2.3.6 Preliminary Design for Julian Retarding Basin (Code: RB-J1)

(1) Review on Available Site for Flood Retarding Basin along Julian River

Two flood retarding basins of “RB-J1” and “RB-J2” were proposed along Julian River in the M/P Study.

It has been confirmed in the F/S stage that the landowner of proposed site for the retarding basin of RB-J2 had made a 10-year lease contract for the land with a foreign capital investment developer, and the Local government had issued a business permit for this land. Under such updated status on the landownership, it is judged to be virtually difficult to achieve the necessary land acquisition for the site, and the retarding basin of RB-J2 has been excluded from the objectives of the preliminary design.

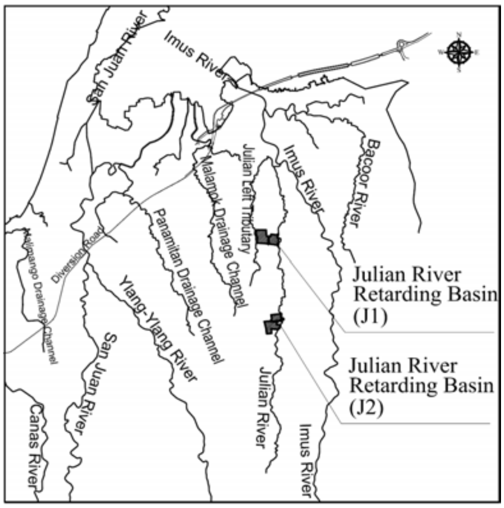
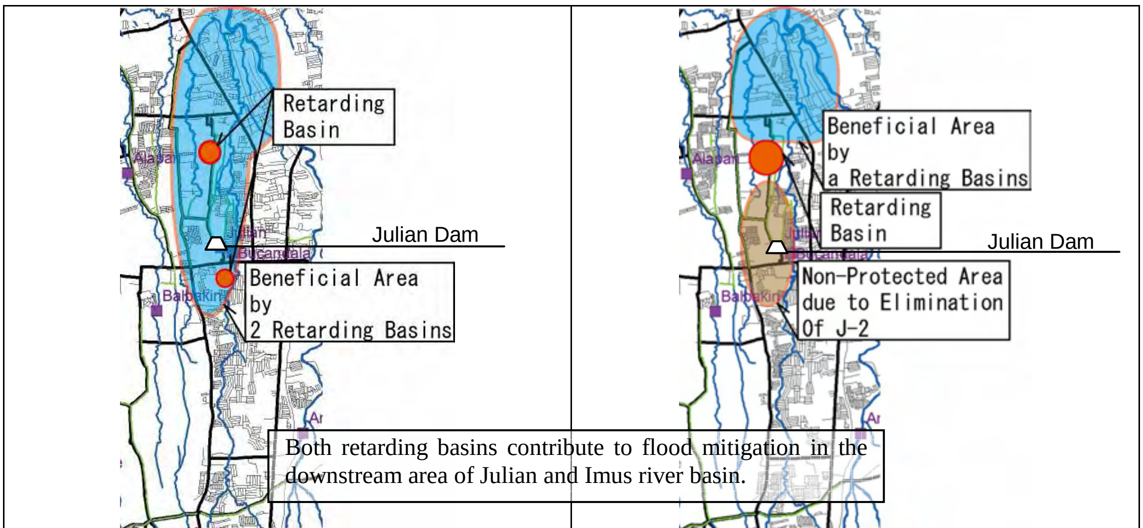


Fig. R 2.20 Location Map of the J1 and J2 Retarding Basins proposed in the M/P

The Study Team also confirmed that there exists no possible alternative site with a sizeable extent of more than 10 ha, adjacent to the site of the retarding basin of RB-J2. On the other hand, there remains a considerable extent of farmland around the proposed site of the flood retarding basin of RB-J1, and the site of RB-J1 could be maximized up to about 38 ha through the supplementary acquisition of farmland so as to compensate the exclusion of the RB-J2.

There is no substantial difference in the flood mitigation effect to the downstream stretch between the flood mitigation plan with two retarding basins (RB-J1 and RB-J2) and the plan with one retarding basin (RB-J1 alone). In case of the one retarding basin of RB-1 alone, however, the flood prone area in the upper reaches of RB-J1would be left behind because of the elimination of the flood retarding basin of RB-J2 (refer to Fig. R.2.21).

The cause of the flood in the above flood prone area is addressed to the small river flow capacity and the backwater effect by the existing Julian dam. This issue shall be dealt through the plan formulation for the partial river improvement, which follows to the construction of the flood retarding basin. The project proponent would be also required to discuss the necessity of Julian Dam and/or removal of it for the sake of flood mitigation.



Beneficial Area by Two Retarding Basins	Beneficial Area by One Retarding Basin

Fig. R 2.21 Difference of Flood Mitigation Effectiveness by Alternatives of Julian Retarding Basin

(2) Design Conditions for Flood Retarding Basin of RB-J1

As described above, the two retarding basins proposed in the M/P Study were integrated into one retarding basin at the site of RB-J1. Therefore, the preliminary design only for the Retarding Basin of RB-J1 (hereinafter referred to as the "Julian Retarding Basin") is discussed in this subsection.

The proposed site of Julian Flood Retarding Basin is located in Barangay Carsadang Bago on the left bank of Julian River Sta.2+400~Sta.3+400. The site is sandwiched between Julian River at east side and a tributary of Julian River at west side (refer to Fig, R. 2.22). Accordingly, the Julian Flood Retarding basin could function to mitigate the peak flood discharge both for Julian River at the east side of the retarding basing as well as its tributary at the west side of the basin. In order to facilitate the said function, the Julian Flood Retarding basin is divided into two parts, namely, "J1R" along Julian River and "J1L"along the tributary of Julian River.

(a) Design Flood Scale for Julian Retarding Basin

Design conditions applied in consideration of scale of Julian Retarding Basin are as follows.

Table R 2.32 Design Conditions for Consideration of Scale of Julian Retarding Basin

Description	Condition	Remarks
Basic Hydrograph	Ratio of Built-up Area: 45% (in 2020)	With On-Site Regulation Pond
Basic Flood Scale for Design	5-year Return Period Flood	
Consideration of Smaller Scaled Flood	Effective against 2-year return period flood	approx. 30% of total volume of retarding basin

Note : See Table R2.3 for details.

(b) Basic Topographical and Hydraulic Conditions of Julian Retarding Basin

The basic topographical and hydraulic conditions of Julian Retarding Basin have been compiled as follows:

Table R 2.33 Basic Topographical and Hydraulic Conditions of Julian Retarding Basin

Left Tributary of Julian River (West Side: J1L)					Julian River Main Stream (East Side: J1R)				
Item	Station	Designed Riverbed (EL.m)	Hinterland Elevation (EL.m)	Designed H.W.L (EL.m)	Item	Station	Designed Riverbed (EL.m)	Hinterland Elevation (EL.m)	Designed H.W.L (EL.m)
U/S	4+000	+4.17 m	+9.0 m	+7.60m	U/S	3+400	+4.30 m	+9.0 m	+8.90 m
O/D	3+400	+3.17 m	+7.5 m	+6.40 m	O/D	2+900	+3.30 m	+7.8 m	+7.90 m
D/S	3+000	+2.50 m	+7.0 m	+5.60 m	D/S	2+400	+2.11 m	+7.5 m	+6.90 m
Elevation of Dike Crown			EL+10.0m		Elevation of Dike Crown			EL+10.0m	
Possible Lowest Bottom of R.B			EL+3.50m*1)		Possible Lowest Bottom of R.B			EL+3.50m*1)	
Surface of Soft-Rock Stratum			EL+1~4m		Surface of Soft-Rock Stratum			EL+1~4m	
Required Area of R.B in M/P			Approx. 9ha		Required Area of R.B in M/P			Approx. 5ha + 11ha*2)	

Note: *1) Approximately [Designed riverbed elevation at downstream end of retarding basin + 1.0m]
*2) [Area of J1R]+[Area of RB-J2 in M/P]

Abbrev.: U/S: Upstream, D/S: Downstream, O/D: Overflow Dike, R.B: Retarding Basin; H.W.L: High Water Level

(c) Geological Condition around Julian Retarding Basin

The Study Area is covered broadly by Quaternary volcanic products of Taal Volcano, namely Taal Tuff and sedimentary rocks of Guadalupe Formation. The upper surface of soft rock stratum is deemed to lie 4~5m below ground surface around the Julian Retarding Basin, judging from the exposed river bank condition and the results of soil investigations carried out in the study area. (refer to Fig. 2.6 and Fig. 2.7)

The ground surface elevation is EL+7~9m and the surface elevation of soft rock layer is approximately EL+1~4m in the proposed site of Julian Retarding Basin. Judging from the position of the soft rock layer, the bulldozer with ripper or equivalent attachment will be required to excavation works for in construction of the flood retarding basin.

(3) Dimension of Overflow Dike and Storage Volume of Julian Retarding Basin

Hydraulic analysis has been conducted based on the results in the M/P and the aforesaid basic design conditions of retarding basin in section 2.2 aforementioned and section 2.6 discussed below. As the result of hydraulic analysis, appropriate the elevation and length of the overflow dike have been determined at the least cost in association with the required storage volume as shown in Fig. 2.8 attached and summarized in the table below.

Table R 2.34 Dimension of Overflow Dike and Storage Volume of Julian Retarding Basin

Item	Left Tributary of Julian River (West Side: J1L)	Julian River Main Stream (East Side: J1R)	Remarks
Location of Overflow Dike (Center)	Sta.3+400 (Adjusted to flow direction of river)	Sta.2+900 (At straight section of river stretch)	
Crown Elevation of Overflow Dike	EL+5.78m	EL+6.60m	Under consideration of 2-year flood
Length of Overflow Dike	30m	50m	Adjustment Results in 5-year flood
Required Storage Volume of Retarding Basin	Not less than 0.11 million m^3	Not less than 0.44 million m^3	Required storage volume in 5-year flood
Design Water Level in Retarding Basin	EL+6.29m (EL+6.29m)	EL+7.48m (EL+7.66m)	Elevations in parentheses are Peak River Water Level in 5-year flood

(4) Area and Bottom Elevation of Julian Retarding Basin

The Julian Retarding Basin is designed against 5-year return period flood and has the storage capacity of 550,000 m^3 in total, which is divided into 110,000 m^3 for J1L and 440,000m^3 for J1R. The Julian Retarding Basin stores the floodwater of main stream of Julian river in the J1R and the floodwater of left tributary of Julian river in J1L separately.

(a) The Possible Maximum Extent of the Site for Julian Retarding Basin

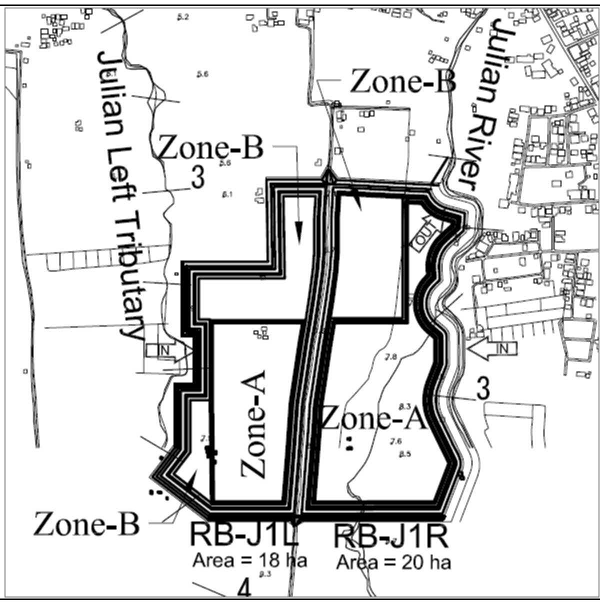
Proposed site of Julian Retarding Basin is surrounded by several existing and new subdivision sites at the north and south sides as downstream and upstream ends, and sandwiched between main stream and left tributary of Julian river on east and west.

In addition, the NIA maintenance road passes across the proposed site from North to South at almost the center of the proposed site. Under these conditions, the possible maximum extent of the site for the retarding basin is estimated at 38 hectares, which would not affect the existing residential subdivisions. According to the result of hydraulic analysis, major features and dimensions of Julian Retarding Basin for the maximum extent of the site are as shown in the following table and figure.

Table R 2.35 Major Features of Julian Retarding Basin with Maximum Area (Area: 38ha)

Zoning	Left Tributary of Julian River (West Side: J1L)				Julian River Main Stream (East Side: J1R)				Inundation Frequency	Remarks
	Elevation (EL.m)	Partial Area (ha)	Accum. Area (ha)	Accum. Volume (MCM)	Elevation (EL.m)	Partial Area (ha)	Accum. Area (ha)	Accum. Volume (MCM)		
Bottom (Zone-A)	3.5	6.0	6.0 ～ 6.7	0 ～ 0.07	3.5	9.6	9.6 ～ 11.5	0 ～ 0.28	Every 2 years or more	Plane
	3.5~4.6	0.7			3.5~6.0	1.9				Slope, etc.
Zone-B	4.6	4.0	10.7 ～ 11.7	0.07 ～ 0.39	6.0	3.5	15.0 ～ 16.4	0.28 ～ 0.50	Every 3~5 years	Plane
	4.6~ 6.29	1.0			6.0~ 7.48	1.4				Slope, etc.
H.W.L	6.29	-	11.7	0.39	7.48	-	16.4	0.50	Every 5 years	
Perimeter	-	6.3	18.0	-	-	3.6	20.0	-	-	Land Acquisit'n

Note : High water level and storage volume of the Julian Retarding Basin with 5-year return period flood:
J1R (Main Stream of Julian River): HWL=EL+7.48m, Required Storage Volume>0.44MCM
J1L (Left Tributary of Julian River): HWL=EL+6.29m, Required Storage Volume>0.11MCM



AREA: **38**ha in total
RB-J1R: Approx. **20**ha
RB-J1L: Approx. **18**ha

LOWEST
BED ELEVATION
RB-J1R: EL+3.5m
RB-J1L: EL+3.5m

Fig. R 2.22 Plan of Julian Retarding Basin with Maximum Area (38ha)

(b) Required Minimum Extent of the Site for Julian Retarding Basin

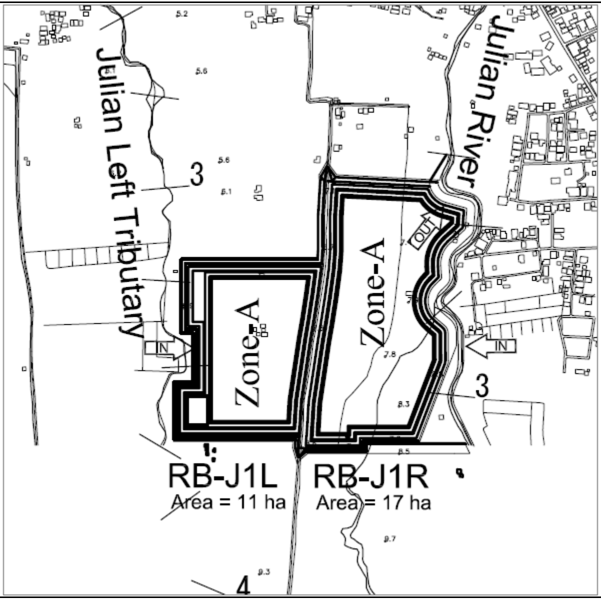
The possible lowest bottom elevation of Julian Retarding Basin could be set at EL+3.5m, which is 1m above the river bed level at the downstream end of the retarding basin. When the bottom elevation of the retarding basin is designed to be EL+3.5m and the retarding basin is not divided into the zones, the required extent of the site for the Julian Retarding Basin is minimized. The minimized area of the retarding basin is estimated at 28 hectares.

Major features and dimensions of Julian Retarding Basin with minimum area are as shown in the following table and figure.

Table R 2.36 Major Features of Julian Retarding Basin with Minimum Area (Area: 28ha)

Zoning	Left Tributary of Julian River (West Side: J1L)				Julian River Main Stream (East Side: J1R)				Inundation Frequency	Remarks
	Elevation (EL.m)	Partial Area (ha)	Accum. Area (ha)	Accum. Volume (MCM)	Elevation (EL.m)	Partial Area (ha)	Accum. Area (ha)	Accum. Volume (MCM)		
Bottom (Zone-A)	3.5	5.3	5.3	0	3.5	9.6	9.6	0	Every 2 years or more	Plane
	3.5~ 6.27	1.4	~ 6.7	~ 0.16	3.5~ 7.48	2.2	~ 11.8	~ 0.44		Slope, etc.
H.W.L	6.27	-	6.7	0.16	7.48	-	11.8	0.44	Every 5 years	
Perimeter	-	4.3	11.0	-	-	5.2	17.0	-	-	28ha in total

Note : High water level and storage volume of the Julian Retarding Basin with 5-year return period flood:
J1R (Main Stream of Julian River): HWL=EL+7.48m, Required Storage Volume>0.44MCM
J1L (Left Tributary of Julian River): HWL=EL+6.27m, Required Storage Volume>0.11MCM



AREA: **28**ha in total
RB-J1R: Approx. **17**ha
RB-J1L: Approx. **11**ha

LOWEST
BED ELEVATION
RB-J1R: EL+3.5m
RB-J1L: EL+3.5m

Fig. R 2.23 Plan of Julian Retarding Basin with Minimum Area (28ha)

(c) Optimum Extent of the Site for Julian Retarding Basin

The optimum extent of the site for Julian Retarding Basin is between the aforesaid maximum and the minimum extent of the site, and estimated at 29 hectares based on the following concepts:

- The flood retarding basin should contain the three zones namely Zone A for flood mitigation against the probable flood of 2-year return period and Zone B for 5-year return period as proposed in the foregoing Table R 2.12.
- The optimum extent of the site could be calculated based on the required storage volume of the flood retarding basin for the design scales for 2 and 5-year return period as estimated in the hydraulic analysis (refer to the foregoing Table R 2.3).

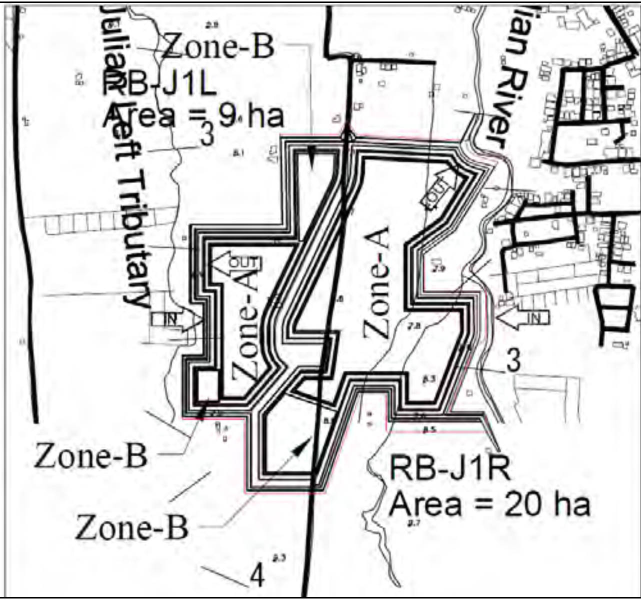
The major features and dimensions of Julian Retarding Basin for the optimum extent of the site are estimated based on the result of hydraulic analysis as Table R 2.37 and Fig. R 2.24.

Table R 2.37 Major Features of Julian Retarding Basin with Optimum Area (Area: 29ha)

Zoning	Left Tributary of Julian River (West Side: J1L)				Julian River Main Stream (East Side: J1R)				Inundation Frequency	Remarks
	Elevation (EL.m)	Partial Area (ha)	Accum. Area (ha)	Accum. Volume (MCM)	Elevation (EL.m)	Partial Area (ha)	Accum. Area (ha)	Accum. Volume (MCM)		
Bottom (Zone-A)	3.5	2.8	2.8 ～ 3.6	0 ～ 0.07	3.5	8.8	8.8 ～ 10.9	0 ～ 0.27	Every 2 years or more	Plane
	3.5~5.5	0.8			3.5~6.2	2.1				Slope, etc.
Zone-B	5.5	1.1	4.7 ～ 5.0	0.07 ～ 0.11	6.2	1.6	12.5 ～ 14.0	0.27 ～ 0.44	Every 3~5 years	Plane
	5.5~ 6.27	0.3			6.2~ 7.48	1.5				Slope, etc.
H.W.L	6.27	-	5.0	0.11	7.48	-	14.0	0.44	Every 5 years	
Perimeter	-	4.0	9.0	-	-	6.0	20.0	-	-	29ha in total

Note : High water level and storage volume of the Julian Retarding Basin with 5-year return period flood:
J1R (Main Stream of Julian River): HWL=EL+7.48m, Required Storage Volume>0.44MCM
J1L (Left Tributary of Julian River): HWL=EL+6.27m, Required Storage Volume>0.11MCM

The required floodwater volumes to be stored in each side of the Julian Retarding Basin are different, i.e., 440,000 m^3 for the J1R and 110,000 m^3 for the J1L. In order to attain these storage capacities, the NIA maintenance road needs to be realigned as illustrated in the figure below.



AREA
RB-J1R: Approx. **20**ha
RB-J1L: Approx. **9**ha

LOWEST
BED ELEVATION
RB-J1R: EL+3.5m
RB-J1L: EL+3.5m

Fig. R 2.24 Plan of Julian Retarding Basin with Optimum Area (29ha)

The above three (3) alternatives for Julian Retarding Basin are as summarized below.

Table R 2.38 Summary of Comparison of Alternative Area for Julian Retarding Basin

Item		Maximum Area		Minimum Area		Optimum Area	
Required Extent		38ha		28ha		29ha	
Land Price	Land Price by BIR [*1]	Carsadang Bago: All other Streets; RR: Php 900/m^2, A: Php 600/m^2,					
	Market Price [*2]	Php 650/m^2					
	Adopted Price in M/P	J1: Php 600/m^2, J2: Php 1,000/m^2					
Number of House Relocation [*3]		50		35		35	
Bottom Elevation of Basin (J1L/J1R)		EL+3.5m	EL+3.5m	EL+3.5m	EL+3.5m	EL+3.5m	EL+3.5m
Maximum Excavation Depth		5~6m deep		5~6m deep		5~6m deep	
Assumed Excavation Volume		1.2 million m^3		0.9 million m^3		1.0 million m^3	
Assumed Embankment Volume		0.14 million m^3		0.13 million m^3		0.13 million m^3	
Possibility of Zoning		Possible		Difficult		Possible	
Area of Inundation every year		56%		100%		61%	
Area of Inundation once in 2 years		65%		100%		91%	
Area of Inundation once in 5 years		100%		100%		100%	

Note BIR: Bureau of Internal Revenue
*1: Quoted from ZONAL VALUATION, Province of Cavite (2002)
RR: Residential Area, CR: Commercial Area, A: Agricultural Area
*2: Maximum value from results of hearing inspection with agencies concerned.
*3: Number of house relocation has increased from the number in M/P due to the expansion of area of the retarding basin and migration from area of new subdivision project in downstream area (see the results of EIA Survey).

The proposed plan of the Julian Retarding Basin described above had been presented to and accepted in general by the residents, officials and other stakeholders through the various meetings and discussions such as the stakeholders' meeting and the internal meetings with the Provincial Government of Cavite and DPWH.

(5) Plan for Multipurpose Use of the Julian Retarding Basin

The plan for the multipurpose use of the Julian Retarding Basin has to be established by the project proponents, the DPWH, the Provincial Government of Cavite, and the LGU that will be administrative organizations of the retarding basin. In this subsection, the tentative zoning and utilization plan of the retarding basin is proposed as an example based on the optimum plan of Julian Retarding Basin.

(a) Zoning Plan of Julian Retarding Basin

The Julian Retarding Basin shall be divided into two (2) zones based on inundation frequency, as summarized in the table below and shown in Fig. 2.13.

Table R 2.39 Proposed Concepts of Zoning for Julian Retarding Basin

Zone	Area (ha)		Inundation Frequency
	Left Tributary of Julian River (West Side: J1L)	Julian River Main Stream (East Side: J1R)	
Zone-A (Bottom Area)	2.8 (EL+3.5m)	8.8 (EL+3.5m)	Every Flood Event
Zone-B (Bottom Area)	1.1 (EL+5.5m)	1.6 (EL+6.0m)	Once or more in 3~5 years
Slopes and Other Internal Areas	3.3	5.4	
Access Road and External Areas	1.8	4.2	No Inundation
Total Area for Retarding Basin	9.0	20.0	Including River Slope
	29.0		

(b) Utilization Plan of Julian Retarding Basin

Tentatively, the area inside the Julian Retarding Basin can be utilized as follows:

Zone-A

- Eco-Park and Community Pond, to also serve as sedimentation trap
- Community Farmland

Zone-B

- Basketball Court(s)
- Other Sports Recreational Area
- Area for Sunday Market or Community Events

The conceptual plan of Julian Retarding Basin based on the above tentative plan is as shown in Fig. 2.14.

2.3.7 Preliminary Design Drawings

Based on the preliminary design for each retarding basin, general plans, longitudinal profiles and cross sections are preliminary prepared and drawn in Fig. 2.15~2.17 for Imus Retarding Basin, Fig. 2.18~2.20 for Bacoor Retarding Basin and Fig. 2.21~2.23 for Julian Retarding Basin respectively.

2.4 Cost Estimation

Based on the results of M/P study, cost estimates for priority components have been carried out for updating the results and for accommodating tremendous price escalation recently as well as the cost arising from new results of F/S study under consideration below:

- Fluctuation of labor rates, material unit prices, and equipment rental charges, and
- Changing and Additional Bill of Quantities based on further detailed design through F/S study

2.4.1 Basic Condition of Cost Estimate in F/S

The proposed works including administrative, compensational and other contingencies constitute the whole construction activities of three (3) retarding basins, namely Imus, Bacoor and Julian, as priority components of the Comprehensive Flood Mitigation Project in Cavite Lowland Area proposed in M/P. It is deemed that these construction works will be executed and implemented by the Department of Public Works and Highways (DPWH-PMO) in association with Provincial Government of Cavite.

(1) Constitution of Project Cost

As shown in M/P study, project cost is composed of such costs as construction base cost, compensation cost, consultancy service cost, administration cost, price contingency, physical contingency and tax.

(2) Price Level

The cost estimates have been updated on the price levels as of September 2008 based on the results of M/P.

(3) Exchange Rate

Exchange rate is fixed at:

1.0 Peso = 2.266 Yen

1.0 US$ = 105.904 Yen = 46.979 Peso

The above rate has been based on the intermediate rate of the Bangko Sentral ng Pilipinas as of September 30, 2008.

(4) Currency of Cost Estimate

The project cost component consists of foreign currency and local currency portions. Philippine Pesos will be used to describe cost amount for both the local and foreign currency portions.

(5) Classification of Foreign Portion and Local Portion

The following conditions for the classification of foreign and local currency portions are applied in the cost estimates:

<u>Local Portion</u>

- All Labor Costs,
- Part of operation cost of construction equipment,
- Part of construction material costs,
- Value Added Tax,
- Land acquisition and compensation costs,
- All costs of administration for the government staff, and
- Cost of local engineering services in Construction Cost and Engineering Service Cost.

<u>Foreign Portion</u>

- Part of operation costs of construction equipment,
- Part of construction material costs, and
- Costs of foreign engineering services.

The proportions of foreign and local currency components of the major construction materials and other unit price components are presumed as follows:

Table R 2.40 Foreign and Local Portion of Cost

	Description	Foreign Portion (%)	Local Portion (%)
1	Labor	0	100
2	Construction Equipment	70	30
3	Construction Materials		
	3.1 Oil/Lubricants	80	20
	3.2 Woods/Stone/Sand	10	90
	3.2 Cement/Concrete	70	30
	3.4 Metal Products	90	10
	3.5 Chemical Products	90	10
4	Land Acquisition	0	100
5	Administration Cost	0	100
6	Value Added Tax (VAT)	0	100

2.4.2 Unit Cost Analysis

(1) Construction Unit Cost

Costs for the construction works are estimated on a unit cost basis except some lump sum and provisional sum items. Unit costs consist of direct cost of equipment, materials and labor, indirect cost including overhead expenses, unforeseen contingencies, miscellaneous expenditures and Contractor's profit and Value Added Tax. Composition of the unit cost is as follows:

Table R 2.41 Composition of Construction Unit Cost

Item	Description	Remarks
Direct Cost	**Estimated Directly**	
	Labor	
	Material	
	Equipment	Association of Carriers and Equipment Lessors (ACEL), Inc. on 2006, edition 23
Indirect Cost	**16 % of the direct cost**	Referred to as "OPC" in DPWH's Department Order No. 57, series of 2002
	Overhead Expenses	6%
	Unforeseen contingencies	3%
	Miscellaneous expenses	1%
	Contractor's profit	6%
Value Added Tax	**12% of the sum of Estimated Direct Cost and OPC**	mandated in the DPWH Department Order No. 57, series 2002

(2) Results of Unit Cost Analysis

The result of unit cost analysis of construction works bases Estimated Direct Cost multiplied by Quantity.

The results of unit cost analysis of main work items are stipulated below:

Table R 2.42 Construction Unit Cost for Major Work Items

Item of Bill of Quantity	Unit	Determined Unit Price (Peso)		
		Foreign	Local	Total
Excavation by Bulldozer	m^3	9.6	17.8	26.4
Gabion for Overflow Dike	m^3	2,671.3	10,381.3	13,052.7
Concrete	m^3	1,088.8	2,146.9	3,235.7
Re-bar	m^3	24,806.7	39,718.7	64,525.4
Wet Stone Masonry (t=200mm)	m^3	747.2	388.5	1,135.7

Note *1: Inclusive of Indirect Cost (16% of Direct Cost)
Exclusive of VAT

(3) Cost for General and Temporary Works to be Considered Other than Items Above

It is supposed that unit costs of some working items could not be estimated unless detailed engineering design is executed. In this connection, their working cost shall be estimated in percentage terms in total construction base cost.

- Mobilization and Demobilization is expressed as a lump sum, one (1) percent of construction base cost. One (1) percent is the maximum allowable factor currently in use by the Department of Public Works and Highways per Department Order # 57.
- "Temporary Works" shall be considered and added to Estimated Direct Cost. "Temporary works" includes items such as water control works in site, temporary buildings, electrical facilities, water supply system, access road construction and maintenance, and temporary utilities. 5 % of the sum in Total Construction Base Cost is adopted.
- Constructor's Facilities and Activities tabulated below are computed and estimated as about 2% of the construction base cost.

Table R 2.43 Cost to be Estimated in Percentage Terms

Item	Cost
Mobilization and Demobilization	1 % of construction base cost
Temporary Works	5 % of construction base cost
Constructor's Facilities and Activities	2 % of construction base cost
Items included in Constructor's Facilities and Activities: Survey Works, Investigation Works Traffic Management Plan / Implementation and Operation of Traffic Management Plan Quality Management Plan / Implementation and Operation of Quality Management Plan Programming and Reporting, Health and Safety Plan, Implementation and Operation of Health and Safety Plan, Progress Photographs, Provision of Office for Engineer, Provision of Furnishings and Equipment	

(4) Contingencies

"Physical Contingency" and "Price Contingency" shall be considered.

- Five (5) % of the sum of the construction base cost, the compensation cost and the engineering service cost is considered for contingent expenses for the incidental construction tasks as "Physical Contingency" as well as Master Plan Study.
- "Price Contingency" for price escalation shall be revised since price index for construction materials drastically has risen recently. For example, steel material prices have doubled or trebled for a couple of years. However, it is difficult to predict these indexes in the future. In this connection, 5.07% for local currency and 1.95% for foreign currency in M/P are revised based on the latest indexes as follows:

Table R 2.44 Adopted Annual Price Escalation in Feasibility Study

Currency	M/P Study (%)	F/S Study (%)	Remarks
Local	5.07%	6.00%	Revision based on value during 1998 – 2008
Foreign	1.95%	2.00%	Based on consumer index during 2002-2007

2.4.3 Compensation Cost

As explained in M/P study, compensation cost consists of the costs of house evacuation and land acquisition. In M/P study, these costs has been estimated as mean value basis and the latest data obtained from agencies concerned. In this connection, these unit costs should be subject to the latest data and values, then, should be revised in F/S study as well as price contingency. Adopted values in F/S for compensation cost are enumerated below.

Table R 2.45 Adopted Compensation Cost for F/S Study

Item of Cost	Site/Condition	Unit Cost Php per m^2 for Land , Php per house/family for House			
		Adopted in	F/S Study		
		M/P Study	Zonal Value*2	Market Price*3	Adopted
Land Acquisition	Imus Retarding Basin	300*1	425	800~1,000	800
	Bacoor Retarding Basin	500*1	615	1,000~2,000	800
	Julian Retarding Basin	600*1	825	650	800
House Relocation	Formal Resident	150,000 in total per house	-	-	350,000
	Informal Dwellers		-	-	50,000
Livelihood	Support Activities		-	-	50,000

Note *1: Zonal Value classified as Agricultural Area in Zonal Valuation of Province of Cavite (1st rev in 2007)
*2: Zonal Value classified as Agricultural Area in Zonal Valuation of Province of Cavite (2nd rev in 2008)
*3: Results of hearing survey with Officers concerned based on in-real land sale in Imus Municipality

2.4.4 Administration Cost

This cost is Project Owner's expenditures for the proper project management to execute the project implementation smoothly. One (1) % of the sum of the construction cost and the compensation cost is adopted as well as M/P study.

2.4.5 Engineering Service Cost

Engineering service cost is prepared for the detailed engineering design and construction supervision services at 6% and 10% respectively of construction base cost.

2.4.6 Project Cost

Based on the above assumptions, the project cost for the priority structural flood mitigation component is estimated at Php. 2,120 million in total, which is divided into (1) Php. 756 million for the Imus Retarding Basin, (2) Php. 288 million for Bacoor Retarding Basin, (3) Php. 580 million for Julian Retarding Basin, (4) Php. 80 million for physical contingency and (5) Php. 278 million for price contingency and (6) Php. 138 for duties and taxes (VAT etc.). The breakdown of the project cost is given in Tables 2.5 to 2.7, and as tabulated below:

Table R 2.46 Project Cost for Three Retarding Basin as Priority Component

Item	Objects	No.	Description	Cost (Million Peso)
Construction Cost	Imus Retarding Basin	I-1	Construction Base Cost	376
	Bacoor Retarding Basin	I-2	Construction Base Cost	158
	Julian Retarding Basin	I-3	Construction Base Cost	298
		I-T	Subtotal-(I)	832
Compensation Cost	Imus Retarding Basin	II-1_1	Land	312
		II-1_2	House Relocation	1
	Bacoor Retarding Basin	II-2_1	Land	100
		II-2_2	House Relocation	2
	Julian Retarding Basin	II-3_1	Land	224
		II-3_2	House Relocation	5
		II-T	Subtotal-(II)	644
Engineering Service Cost	Consultancy Service	III-1	6% of (I) for D/D 10% of (I) for S/V	133
		III-T	Subtotal-(III)	133
Contingency	Physical Contingency	IV-1	5% of sum of (I)~(III)	80
	Price Contingency	IV-2	6% for local currency 2% for foreign currency	278
		IV-T	Subtotal-(4)	358
Administration Cost		V	1% of sum of (I) & (II)	15
Value Added Tax		VI		138
Grand Total		**VII**		**2,120**

2.4.7 Operation and Maintenance Cost

The operation and maintenance cost mainly consist of costs for Patrol/Inspection Work, Maintenance Work and Operation Work. These costs include facility maintenance cost, cost for the administrative and logistic support, cost for operation cost in case of flooding, cost for repair of the structures, and other miscellaneous expenses.

The annual operation and maintenance cost is estimated at Php 4.73 million upon completion of the three retarding basin as listed in the table below.

Table R 2.47 Annual Operation and Maintenance Cost for Three Retarding Basins

Work Item	Annual Cost (Million Php)	Remarks
Patrol/Inspection Work	0.01	
Maintenance Work	4.68	Inclusive of removal of sediment
Operation Work	0.04	
Total	4.73	

Details of operation and maintenance cost for the structural plan are given in Appendix 5. The necessary annual budget proposed should be assured from both budgets of DPWH, Province and LGU with approval and concurrence of FMC. Proposed O&M Manual for retarding basins is delineated in Appendix 2.

2.5 Construction Plan

2.5.1 Basic Policy of Construction Plan

(1) Scope of Works for Construction of Retarding Basin

Priority component is composed of the construction of three (3) retarding basins. Their works aims to reduce excessive floodwater toward downstream stretches in each river channel.

Each retarding basin consists of five (5) major facilities; namely storage facility (retarding area with surrounding and separating dike), intake facility (overflow dike and stilling basin), drainage facility (drainage sluice with flap gate), river structure (groundsill and revetment) and amenity facilities (inside retarding basins).

These three (3) retarding basins prioritized are scheduled to complete through the urgent project (2010-2013) as described in Master Plan study.

(2) Major Features of Facilities and Construction Procedure/Method

Major requirements for facilities in the retarding basin are as follows.

- Surrounding and separating dikes are embankment type with pavement on the crown.
- Overflow dike and stilling basin shall be constructed to take water from river channel safely and manly consists of gabion structure.
- Drainage sluice is a box culvert passing under separating dike with revetment work on the slope of the dike.
- Designated sites developed as retarding basins shall be used as a community area except during flooding.

Major part of construction work will be earthwork. Construction procedure/method of earthwork shall be as follows.

- As for embankment works, it is necessary to make sure that the compaction retains the required consistency. Earth fill work should be implemented in accordance with the compaction regulations to maintain such strength against settlement, shearing force and piping.
- Excavated materials at the pond will be used for filling material.

- Earthwork equipments are bulldozers and backhoes for excavation, dump trucks for transport, and tamping rollers for compaction.
- Volume of excavated materials is estimated approximately 3,700,000m3. 200,000 m3 of that is reused for constructing the dam and landscape facilities, etc. The remaining is transported to the dumping site, graded and compacted.

(3) Disposal and Dumping Sites

According to the discussion about disposal/dumping site/method with PPDO of Cavite, MPDO and MEO of Imus, following issues have been developed.

- Public and private land development projects are actively carried out in the Cavite Province and Municipality of Imus. However, shortage of embankment/filling material and high material price are the issues.
- It is expected that surplus soil of construction work of the retarding basins would be welcomed by those land development. If excavated soil is offered to land developers without any charge, they would utilize it as their embankment/filling material, and then disposal cost of surplus soil would not be included in the project cost.
- According to the land use plan established by the Provincial and municipal government, the area around proposed sites of the retarding basins is categorized into residential or commercial area. However, there are still some rooms, such as farmland and non-utilized area, around proposed sites of the retarding basins.

Taking conditions described above into consideration, disposal plan of surplus excavated soil in this study shall be as follows.

- On condition that surplus excavated soil would be utilized as embankment/filling material for land development, disposal cost consists of loading, hauling (average distance = 2km), unloading and spreading works in this cost estimation.
- Some amount of surplus excavated soil shall be carried into provincial planned land development site, since not every land development and the construction of retarding basins will be carried out at the same time. Average hailing distance shall be about 5km in this case.
- In case land development and construction of retarding basins are carried out at the same time, surplus excavated soil may be used as embankment material for CALA_N-S highway.

Location map of disposal and dumping sites is shown in Fig. 2.24 attached.

2.5.2 Basic Condition of Construction Schedule

The construction schedules to be prepared are based on the scope of works defined above with the working quantities for the each retarding basin through the feasibility study. Each of the scheduled activities contains labor to be assigned and equipment resources considered with the most appropriate method to the particular site conditions and requirement of the work.

In F/S study, unit construction schedules for each work item has been analyzed and fixed in this section hereinafter.

(1) Work Quantity of Major Construction Work Items

The major construction work items are divided into following five (5) portions by location: (1) Construction of retarding basin (i.e. Earth works, Excavation works), (2) Construction of the intake facilities (i.e. construction of overflow dike and stilling basin), (3) Construction of drainage facilities (i.e. construction of drainage sluice and revetment), (4) River Improvement and ancillary works including installation of groundsill structure, and (5) Construction of the amenity facilities. The work items and their work volumes are as listed below:

Table R 2.48 Major Construction Works for Three Retarding Basins

Work Item	Description of Work	Unit	Work Quantity		
			Imus Retarding Basin	Bacoor Retarding Basin	Julian Retarding Basin
Retarding Basin	Excavation	$mil.m^3$	2.0	0.6	1.1
	Embankment	$th.m^3$	30	19	115
	Pavement of Access Road	m^2	9,150	6,660	11,330
	Concrete Pavement	m^3	-	2,280	-
	Concrete Ditch Installation	m^3	850	930	1,190
	Connecting Culvert	m^3	-	1,000	-
	Grass Sodding on Slope	$th.m^2$	60	21	59
Overflow Dike and Stilling Basin	Installation of Gabion with filter cloth	m^2	2,700	1,172	3,200
Drainage Sluice	Box Culvert	m^3	630	230	470
	Flap Gate	L.S.	1	1	1
River Improvement	Revetment (Wet Stone Masonry)*2	m^2	4,130	1,360	3,280
	Revetment (Rubble Stone Masonry)*2	m^3	-	3,000	2,500
	Renovation of NIA Canal	L.S.	-	-	1
	Concrete for Ground Sill	L.S.	1	1	1
Amenity Facilities	Basketball Court	court	2	-	2
	Eco-Park	L.S.	1	1	1
	Open Space*3	ha	11.4	-	3.0
	Preparation of Community Farm incl. grading, fertilization and etc	L.S.	1	-	1
	Gazebo/Resting-Place/Kubo	L.S.	1	1	1
	Tree Planting (Strip)	tree	150	100	100

Note : *1 : $mil.\ m^3$: million cubic meter, $th.m^3$: thousand cubic meter, $th.m^2$: thousand square meter
*2 : Wet Stone Masonry: Slope(V:H=1:2.0~3.0), Rubble Stone Masonry: Slope(V:H=1:0.5)
*3 : For Zone-B and Zone-C

(2) Climate Condition at Construction Sites

The characteristic of climate at the project area is dominated by the rainy season from May to October and dry season for the rest of the months. The total rainfall from May to October accounts for about 80% of the annual rainfall.

(3) Available Working Time

In determining the number of working days available for construction activities, the following factors are considered:

- Working day per week, Working hours per day
- Public Holiday
- Rainfall
- Type of Construction Activity

(a) Working Day per Week, Working Hours per Day

The normal workweek consisting of six (6) working days is adopted for developing all calendars in the sure track program. All construction schedules are based on an 8-hour per a working day.

(b) Public Holiday

The following days are excluded from the working calendars as public holidays:

Holiday	Date
New Year's Day	January 1
Maundy Thursday	On day in March / April
Good Friday	On day in March / April
Labor Day	May 1
Independence Day	June 12
National Heroes Day	August 30
All Souls Day	November 1
Bonifasio Day	November 30
Christmas Day	December 25
Rizal Day	December 30
Special Holiday	December 31
Sub-total of Public Holiday	11 days

In addition, an allowance is made for four (4) extra days that may be declared non-working by government on account of special events.

Thus, total number of non-working days accounts for 15 days in this study.

(c) Daily Rainfall and Annual Working Day

The time lost due to rainfall was based from the rainfall data and the number of rainy days record at the Science Garden; Quezon City during 1987-1998. It is recognized that the effect of rain on different types of construction activities will vary.

The schedule of time losses for the key activities due to atmospheric condition is summarized below:

Table R 2.49 Rainfall Intensity and Average Number of Days with Rainfall

Daily Rainfall	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Days
Over 10mm	0.42	0.25	0.42	0.92	4.33	8.00	11.92	11.92	11.33	6.25	3.50	2.75	62.00
Over 50mm	0.08	0.00	0.00	0.00	0.67	1.50	2.50	2.58	2.17	1.42	0.42	0.33	11.67

Source : Science Garden, PAGASA (1987-1999)

The ratio of rainfall days per an anual year is:

$$62/365 = 0.17$$

The number of rainy day at Sunday and Public Holiday are:

$$(52+15)\times 0.17 = 11.39\ days$$

Therefore,

Rainy day at weekday are:

$$62 - 11.39 = 50.61\ days \approx 51\ days$$

For the rainfall more than 50 mm, will cause a suspension for 1 day for structure excavation, backfilling, slope protection, drainage work and pavement work.

The suspension days forsuch works above are:

$$11.67 \approx 12\ days$$

The total number of working days available annually for different activities is established by incorporating all assessed time losses into the eight (8) items shown in the following table:

Table R 2.50 Annual Working Day for Major Work Items

Work Item	Sunday	Public Holiday	Rainy at Weekday	Suspension Day	Annual Working day
Structural Excavation	52	15	51	12	235
Gabion Works	52	15	51	12	235
Embankment/Backfill	52	15	51	12	235
Concrete Work	52	15	51	-	247
Revetment Work	52	15	51	-	247
Grading Works	52	15	51	-	247
Canal Facility Work	52	15	51	12	235
Road Work	52	15	51	12	235

(4) Work Productivity/Efficiency

Major equipment items were selected based on the equipment capacity quoted from the publication of the Association of Construction and Equipment Lessors, Inc. (Equipment Guidebook 2001, edition 22, ACEL). Labor requirement were assessed using a mix of productivity rates provided through the current practice and the rates recorded on similar overseas projects.

(a) Earth Work

The performance of the construction machine is assumed as listed in the flowing table taking the most suitable machine combination and the reuse of the excavation soil.

Based on the performance of the construction machine, the construction period of earthwork was estimated. Due to huge volume of earth work, critical paths are attributed to the construction schedule of earth work for each retarding basin.

Table R 2.51 Performance of Construction Machines in Earth Work

Item of Earth Work	Major Equipment	Performance Capacity	Remarks
Common Excavation	Bulldozer (32t)	146 m^3/hr	
Loading	Backhoe (1.0m^3)	104 m^3/hr	
Hauling	Dump Track (10t)	30.8 m^3/hr	Distance : 0.5km
	Dump Track (10t)	8.0 m^3/hr	Distance : 8km
	Dump Track (10t)	6.7 m^3/hr	Distance : 12km
Grading & Compaction	Bulldozer (21t)	100 m^3/hr	Disposal site, Road work
Compaction of Embankment	Tamping Roller	55 m^3/hr	Road work

(b) Concrete Work and Gabion Work

Concrete works and gabion works are also main construction works other than earth work. The construction period of concrete of the small structure and placing work of gabion are estimated on the basis of the following assumptions:

Table R 2.52 Performance of Main Construction Work

Item of Work	Daily Capacity	Remarks
Concrete Work	60 m^3/day/party	Depending on Concrete Pump
Gabion Work	75 m^2/day/party	t=500mm, Equivalent to 37.5 m^3/day/party
Revetment Work (1:2.0)	38 m^2/day/party	Wet Stone Masonry
Revetment Work (1:0.5)	13 m^3/day/party	Concrete Block

2.5.3 Construction Schedule

In accordance with the program and strategy in M/P, the entire construction period for the major work components of the optimum structural plan was assumed as shown in the following table.

Table R 2.53 Entire Construction Schedule for Three Retarding Basins

Work Item		2008	2009	2010	2011	2012	2013
Civil Works	Construction of Imus Retarding Basin				■	■	■
	Construction of Bacoor Retarding Basin				■	■	
	Construction of Julian Retarding Basin				■	■	■
Engineering Service	Detailed Design & Bidding Procedure			▒ ★			
	Supervision				■	■	■
Compensation	Land Acquisition and House Relocation			■	■	■	

Note: ★: Bidding

The construction schedule was further prepared based on the aforesaid work volumes and basic conditions for construction as shown in Table 2.8 attached. As a result, it is appropriate construction schedule for three retarding basins to be completed by the year 2013.

2.6 Flood Inundation Simulation Analysis

2.6.1 Simulation Condition

Flood inundation simulation analysis was conducted in order to compute the benefit of the priority project. The priority project, which is the target of feasibility study, includes flood retarding basins along Imus River (RB-I1-b), Julian River and its left tributary (RB-J1), and Bacoor River (RB-B4).

River improvement is conducted within the limited section around overflow weir and simulation was carried out under the present condition of river channel. Runoff calculation was conducted under two conditions i.e. present land-use and future land-use with on-site flood regulation pond.

- River channel: Present (surveyed in 2007 by JICA Study Team)
- Off-site Flood Retarding Basin: Imus River, Julian River and Bacoor River
- Runoff condition: Present land use, Future land use with on-site flood regulation pond
- Damage condition: River overflow

2.6.2 Simulation Case

Three above-mentioned flood retarding basins were built into the simulation model according to the parameter decided by the aforementioned hydraulic analysis, and 14 cases of flood simulation were conducted as shown in the table below. (Refer to Chapter 5 in Vol.1 Master Plan Study for the flood simulation model and the calculation method)

Table R 2.54 Simulation Case

Case	Counter Measure	Scale of flood under Present Land use							Scale of flood under 2020 Land use						
		2	5	10	20	30	50	100	2	5	10	20	30	50	100
	Without project	done in M/P Study							done in M/P Study						
FS00	**With project (F/S)**	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	With project (M/P)	done in M/P Study							done in M/P Study						

2.6.3 Simulation Result

The target of this priority project is Imus River. Table 2.9 shows the simulation result of Imus River in detail while the flood inundation area of each case is shown in Fig. 2.25. For comparison, the result of the conditions without project ('without') and with master plan project ('M/P') are also shown in the table in order to present the benefit computed from the difference between the condition without project and with priority project.

The inundation area becomes narrower and the depth becomes shallower because of the performance of mitigation effect by flood retarding basin as shown in Fig. 2.25.

2.6.4 Mitigation Effect of Flood Retarding Basin

The off-site retarding basin alone could storage a certain volume of flood runoff discharge reducing the inundation depth and duration, even when the flood exceeds the design scale. Thus, the off-site flood retarding basin contributes a certain extent of flood mitigation regardless to the flood scales. This flood mitigation effect is further expected to increase in the future land use status, because the current intensive land development would cause expansion of the built-up area and increment of the peak flood runoff discharge in the future.

From the above points of view, the effects of the off-site flood retarding basin was estimated through the hydraulic simulation, and the area and number of houses, which would reduce the flood inundation depth/duration due to the effect of the off-site flood retarding basin are estimated as below:

Table R 2.55 Potential Area and Number of Houses Effected by Flood in Imus River Basin

Return Period	Area Effected by Priority Project (km^2)		Number of Houses Effected by Priority Project (unit)	
	Present Land Use	Future Land Use in 2020	Present Land Use	Future Land Use in 2020
2-yr	8.39	9.40	6,911	15,652
5-yr	11.75	12.46	11,459	23,928
10-yr	13.78	14.35	14,534	28,520
20-yr	15.59	16.22	16,373	33,437
30-yr	16.43	18.46	17,013	37,943
50-yr	17.46	19.98	18,007	39,439
100-yr	19.64	20.93	19,464	41,782

The simulated storage volume under the condition with priority project is summarized below.

Table R 2.56 Simulated Storage Volume and River Water Level with Priority Project

Item	RB-I1-b (10-year)		RB-B4 (2-year)		RB-J1R (5-year)		RB-J1L (5-year)	
	w/ M/P	w/ priority	w/ M/P	w/ priority	w/ M/P	w/ priority	w/ M/P	w/ priority
Storage Volume (MCM)	1.52	1.52	0.45	0.45	0.44	0.34	0.11	0.11
River Water Level (EL.m)	12.03	12.03	9.61	9.61	7.66	7.06	6.29	6.25

The result of storage volume of RB-J1R is smaller than expected. Flood retarding basin is functional because the river water level at each point of flood retarding basin is same or lower than the design water level. Details of mitigation effects of flood retarding basins are summarized in Table 2.10.

Discharge hydrograph in Fig. 2.26 shows that the flood retarding basin contributes to the reduction of discharge in the present river channel but inflow from upstream is smaller than expected. This shows that river overflow occurred at upstream.

Fig. 2.27 shows the longitudinal water level of the target river. According to this, Imus River has protected against the probable 10-year flood except for the downstream area of Binakayan Bridge.

River overflows occur at KP1+000 to KP4+000, KP4+500 to KP5+000 (near SM Bacoor) and KP5+200 to KP5+800 (near Brgy. Real II) of Bacoor River. As for Julian River, the section downstream of RB-J1 is protected against the probable 5-year flood but flood inundation occurs even for 2-year return period in the section upstream of Bucandala Dam.

2.7 Economic Evaluation of Project

2.7.1 Estimation of Damages Caused by Current Flood

The following items are assumed as the flood damages to be counted for the economic evaluation. Selection of these items together with the unit value and the damage ratios for each of them are based on the clarification made in the Master Plan Study (refer to subsection 8.1 in Vol. 1).

(1) Damages to buildings and to household effects, durable assets and inventory stocks in built-up area,

(2) Income losses due to cleaning of building and/or houses and business suspension,
(3) Damages to social infrastructures (roads, bridges, and drainage ditches),
(4) Losses of Interruption of transport service and/or detour losses,
(5) Damages to industrial estate,
(6) Damages to agricultural crops and
(7) Saving to expenses for supporting evacuees.

The unit value of the above items as estimated in the Master Plan Study have been adjusted to the updated price level as 2008 by the "Consumer Price Index (CPI)" and the "Producer Price Index (PPI)".

The available Consumer Price Index (CPI) in National Capital Region (NCR), which is adjacent to the Study Area, is applied for all the above damages except damages to industrial estate. The CPI in the NCR in 2007 was 144.4, when the CPI in 2000 as the base year is assumed at 100. The monthly record of CPI in 2008 is available only until October, and the CPIs in November and December are estimated by extrapolation of the data recorded from January to October, and then the average annual CPI in 2008 is estimated. The recorded and estimated monthly CPIs are as shown bellow.

Table R 2.57 Recorded and Estimated Monthly CPI in NCR in 2008

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.*	Dec.*	Ave.
148.4	148.0	149.8	152.9	154.6	157.0	158.6	158.7	157.7	157.2	159.0	159.5	155.1

Note: * Estimated by extrapolation of the recorded CPIs
Source: Official Home Page of National Statistic Office of Philippines in Website.

As shown above, the annual average CPI has increased 144.4 in 2007 to 155.1 in 2008, whereby the price escalation ratio from 2007 to 2008 is estimated at 7.42 % (=155.1/144.4). This estimated escalation rate is applied for price adjustment to all the damage items except that for industrial estate.

Producer Price Index (PPI) is applied for price adjustment of the damage for industrial estate. The national average of PPI, which is solely available in Philippines, is used to the Study. The PPI in the Philippines in 2007 was 168.4 when the CPI in 2000 as the base year is assumed at 100. The monthly record of on PPI in 2008 is available only until September, and the PPIs in October, November and December are estimated by extrapolation of the recorded data, and then average annual PPI in 2008 is estimated as estimated below.

Table R 2.58 Recorded and Estimated Monthly CPI in NCR in 2008

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.*	Dec.*	Ave.
167.3	175.5	169.9	170.0	173.1	176.7	179.7	179.5	180.5	179.8	180.4	181.0	175.5

(Note) * Estimated by extrapolation of the recorded PCPIs
Source: Official Home Page of National Statistic Office of Philippines in Website.

As shown above, the annual average PPI has increased 168.4.4 in 2007 to 177.5 in 2008, whereby the price escalation ratio from 2007 to 2008 is estimated at 4.22 %. This estimated escalation rate is applied for price adjustment of the damage of the industrial estate.

2.7.2 Estimation of Probable Flood Damages in Each Return Period

The depth and area of the probable flood inundation are estimated for both of the cases of "Without-Project" and "With-Project" through the hydraulic simulation (refer to subsection 2.6 in this Report). Then, the number of the houses and the extent of the farmland to be inundated are estimated through overlaying the simulated flood inundation area with the satellite image of the Study Area. Based on the results of the said estimations together with the aforesaid unit prices and the damage rates of the flood damageable items, the probable damages for the "Without-Project" and the "With-Project" under the present and future land use conditions are estimated as listed in the following four Tables:

Table R 2.59 Probable Flood Damages by Return Period in Case of "Without-Project" under the Present Land Use

(million Pesos)

Return Period	Direct Damages				Indirect Damages			Damage in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension	Total	
2-year	1,124	69	1	1,194	123	73	196	1,390
5-year	2,089	133	2	2,224	223	136	359	2,583
10-year	2,898	163	2	3,063	305	187	492	3,555
20-year	3,360	198	2	3,559	352	217	569	4,128
30-year	3,551	225	2	3,778	370	231	601	4,379
50-year	3,782	273	2	4,058	395	248	642	4,700
100-year	4,131	274	3	4,408	430	269	699	5,107

Table R 2.60 Probable Flood Damages by Return Period in Case of "With-Project" under the Present Land Use

(million Pesos)

Return Period	Direct Damages				Indirect Damages			Damage in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension	Total	
2-year	883	57	1	940	97	57	154	1,094
5-year	1,785	74	1	1,859	192	113	305	2,164
10-year	2,446	99	1	2,546	259	155	415	2,961
20-year	2,993	182	1	3,176	277	194	471	3,647
30-year	3,229	215	1	3,446	338	210	548	3,994
50-year	3,531	258	2	3,791	369	231	600	4,391
100-year	3,817	258	2	4,078	398	249	647	4,725

Table R 2.61 Probable Flood Damages by Return Period in Case of "Without-Project" under the Future Land Use

(million Pesos)

Return Period	Direct Damages				Indirect Damages			Damage in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension	Total	
2-year	2,606	291	1	2,898	284	177	461	3,358
5-year	4,493	603	1	5,097	478	311	789	5,885
10-year	5,569	825	1	6,395	588	390	978	7,374
20-year	6,735	1,167	1	7,903	707	482	1,189	9,092
30-year	7,790	1,451	1	9,243	816	564	1,380	10,622
50-year	8,166	1,548	1	9,715	854	593	1,446	11,162
100-year	8,744	1,711	1	10,457	913	638	1,551	12,008

Table R 2.62 Probable Flood Damages by Return Period in Case of "With-Project" under the Future Land Use

(million Pesos)

Return Period	Direct Damages				Indirect Damages			Damage in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension	Total	
2-year	2,086	163	0	2,249	228	137	365	2,614
5-year	3,781	346	0	4,128	405	252	657	4,784
10-year	4,853	599	0	5,453	515	333	848	6,301
20-year	6,102	820	0	6,921	642	422	1,064	7,985
30-year	7,229	1,137	1	8,367	759	510	1,269	9,636
50-year	7,633	1,267	1	8,902	800	543	1,343	10,244
100-year	8,129	1,386	1	9,515	850	581	1,431	10,946

The "With Project" is made by the off-site flood retarding basins. However, the off-site flood retarding basin alone without the downstream river improvement could not get rid of the probable flood damage for the smaller recurrence probabilities. On the other hand, since the off-site flood retarding basin could store a certain extent of the flood runoff discharge regardless to the flood scale, it could contribute a certain effect of flood mitigation even against the larger flood scale. Due to these reasons, the flood damage in case of "With Project" occurs even in case of 2-year return period. On the other hand, the Project could reduce the probable flood damage of even 100-year return period as compared with the damage value under "Without-Project" as shown in the above Tables.

2.7.3 Estimation of Economic Benefit

The annual average damages are estimated from the above probable flood damages and their corresponding recurrence probabilities. The estimation is made for the cases of "With-out-Project"/ "With-Project" and the "present conditions"/"future land use conditions in 2020". The results of estimation are as shown in the following four Tables:

Table R 2.63 Annual Average Damage in Case of Without-Project under Present Land Use Condition

(million Pesos)

Return Period	Annual Average Probability of Exceedence	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Damages
2-year	0.5000	0.5000	1,390	695	347
5-year	0.2000	0.3000	2,583	1,986	596
10-year	0.1000	0.1000	3,555	3,069	307
20-year	0.0500	0.0500	4,128	3,842	192
30-year	0.0333	0.0167	4,379	4,254	71
50-year	0.0200	0.0133	4,700	4,539	61
100-year	0.0100	0.0100	5,107	4,903	49
Annual Average Damage					**1,623**

Table R 2.64 Annual Average Damages in Case of With-Project under Present Land Use Condition

(million Pesos)

Return Period	Annual Average Probability of Exceedence	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Damages
2-year	0.5000	0.5000	1,094	547	274
5-year	0.2000	0.3000	2,164	1,629	489
10-year	0.1000	0.1000	2,961	2,563	256
20-year	0.0500	0.0500	3,647	3,304	165
30-year	0.0333	0.0167	3,994	3,820	64
50-year	0.0200	0.0133	4,391	4,193	56
100-year	0.0100	0.0100	4,725	4,558	46
Annual Average Damages					**1,349**

Table R 2.65 Annual Average Damages in Case of Without-Project under Future Land Use Condition

(million Pesos)

Return Period	Annual Average Probability of Exceedence	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Damages
2-year	0.5000	0.5000	3,358	1,679	840
5-year	0.2000	0.3000	5,885	4,622	1,387
10-year	0.1000	0.1000	7,374	6,630	663
20-year	0.0500	0.0500	9,092	8,233	412
30-year	0.0333	0.0167	10,622	9,857	164
50-year	0.0200	0.0133	11,162	10,892	145
100-year	0.0100	0.0100	12,008	11,585	116
Annual Average Damages					**3,726**

Table R 2.66 Annual Average Damages in Case of With-Project under Future Land Use Condition

(million Pesos)

Return Period	Annual Average Probability of Exceedence	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Damages
2-year	0.5000	0.5000	2,614	1,307	654
5-year	0.2000	0.3000	4,784	3,699	1,110
10-year	0.1000	0.1000	6,301	5,543	554
20-year	0.0500	0.0500	7,985	7,143	357
30-year	0.0333	0.0167	9,636	8,811	147
50-year	0.0200	0.0133	10,244	9,940	133
100-year	0.0100	0.0100	10,946	10,595	106
Annual Average Damages					**3,060**

The economic benefit of the project is expressed as the differences between the above annual average damages for the "Without-Project" and the "With-Project". Based on the annual average damages as listed above, the economic benefits are estimated at 274 million pesos/year(=1,623-1,349) under the present land use conditions as of 2003 and 666 million pesos/year (=3,726-3,060) under the future land use in 2020, respectively.

The Project (i.e., the construction of the off-site flood retarding basin) is scheduled to complete in 2013. In the cash stream foe economic evaluation, the economic benefit is assumed to break out after the completion year, and linearly increase in proportion of the changes from 2003 to 2020 until the end of the project life (assumed as 50 years).

2.7.4 Estimation of Economic Cost

The conversion factors to estimate the economic cost of the Project from the financial cost include the following items:.

(1) **Standard Conversion Factor (SCF):** The Standard Conversion Factor (SCF) of 0.97166, which is estimated on the bases of the international trade statistics in the Master Plan Study, is applied to the Feasibility Study.

(2) **Personal Income Tax:** The project cost in general consists of those for equipment and materials, and for manpower as personnel expenses and labor cost. Of these components, the cost for manpower contains the personal income tax, which shall be deducted from the financial cost for estimation of the economic cost. This personnel income tax is assumed as 5 % for the labor and 12 % for consultant services as the minimum rate according to the Tax Code of the Philippines[1].

(3) **Shadow Wage Rate:** The shadow wage rate is applied as 0.60 for unskilled labors who are employed for the Project with referring to those applied in the similar projects in the Philippines,

(4) **Shadow Price of Land**: The conversion rate for the shadow price of land is assumed as 0.50 in the Mater Plan Study. The proposed site for the priority project is, however, deemed to possess the high value, and the rate of 0.90 is applied in the Feasibility Study.

(5) **Value Added Taxes:** The value added tax (VAT) of 12 % is applied as the conversion factor according to the tax code of Philippines.

(6) **Corporate Profit Tax:** The rates of net profit of corporations as contractors against contract amount in the Philippines are almost in a rage of 10 % to 20 %. Taking these rates of profit into account, the representative rate for net profit of contractors is assumed as 15%. The corporate income tax is imposed to the net profit, and this tax is also assumed as one of transfer items. The conversion factor for this tax is assumed as 32% with referring to the tax code in Philippines.

The economic cost for the project initial investment is estimated as shown in Table below assuming the above conversion factors and the financial cost as described in the foregoing subsection 2.4.

Table R 2.67 Financial Cost and Economic Cost for Initial Investment

(million Peso)

Cost		Total	Annual Disbursement					
			2008	2009	2010	2011	2012	2013
Financial Cost	(Excl. Price Escalation)	1,826	0	83	283	586	578	295
	(Incl. Price Escalation)	2,120	0	88	310	670	693	360
Economic Cost	(Excl. Price Escalation)	1,526	0	71	229	479	492	254

Remarks:

Share Rate of Cost for Equipment and Materials:	80.00%	of LC Portion
Cost for Labor:	20.00%	of LC Portion
Standard conversion factor:	0.97166	of Cost for Equipments and Materials
Value Added Tax:	12.00%	of total amount of FC and LC Portion
Shadow Wage Rate:	0.60	of Labor Cost
Personal Income Tax for Labor:	5.00%	of Labor Cost after Taken into consideration of Shadow Wage Rate
Personal Income Tax for Engineering Service:	12.00%	of Cost for Engineering Services in LC Portion
Corporation Income Tax:	32.00%	of Net Profit of Contractors
Shadow Price of Land:	0.90	of Compensation Cost
Contractor's Net Profit Rate:	15.00%	of the Total Construction Base Cost (assumed as contract amount)

As shown in Table above, the economic cost for the project initial investment is estimated at 1,526 million pesos in total. In addition to this initial investment cost, the Operation and Maintenance Cost (the OM Cost) is incurred after the completion of the construction. The economic cost of the OM Cost is estimated from the financial O&M cost in the same way as the above initial investment cost, and 5 million pesos/year is estimated as the economic cost for O&M.

[1] “Republic Act No.8424 on Tax Reform Act of 1997” in the “National Internal Revenue Code” (NIRC).

The objective structure of the off-site flood retarding basin could last for the assumed project life of 50-year without replacement, and therefore, the replacement cost is not counted into the economic cost.

2.7.5 Economic Evaluation of the Project and Conclusion

Economic evaluation for the Project is made through cash balances between the aforesaid economic cost and economic benefit over the project life as listed below.

Table R 2.68 Calculation of Indices Including EIRR for Evaluation of Project

(million Peso)

Calendar Year	Year in Order	Economic Cost			**Reference**: Increasing Pattern of Annual Economic	Benefit Derived from Construction of Retarding Basin	Cash Balance
		Economic Cost	O/M Cost	Total Cost			
2003	-5			0	274	0	0
2004	-4			0	297	0	0
2005	-3			0	320	0	0
2006	-2			0	343	0	0
2007	-1			0	366	0	0
2008	Base Year	0		0	389	0	0
2009	1	71		71	412	0	-71
2010	2	229		229	435	0	-229
2011	3	479		479	458	0	-479
2012	4	491		491	481	0	-492
2013	5	253	1	253	504	0	-255
2014	6	0	5	5	528	528	523
2015	7	0	5	5	551	551	546
2016	8	0	5	5	574	574	569
2017	9	0	5	5	597	597	592
2018	10	0	5	5	620	620	615
2019	11	0	5	5	643	643	638
2020	12	0	5	5	666	666	661
2021	13		5	5		666	661
2022	14		5	5		666	661
≀	≀	≀	≀	≀		≀	≀
2061	53		5	5		666	661
2062	54		5	5		666	661
2063	55		5	5		666	661
Total		1,526	230	1,755		32,815	31,059
Applied Discount Rate: 15 % according to a regulation of the nation.							
NPV --				847		1,770	924
EIRR --							25.95%
B/C --							2.09

As listed above, the Economic Internal Rate of Return (EIRR) of the priority project is estimated at 25.95 %. NEDA has recommended the "Social Discount Rate (SDR)" of 15%, which is assumed as the minimum requirement for project implementation. The estimated EIRR is far higher than the SDR, and therefore, the economic viability of the Project could be verified.

2.7.6 Sensitivity Analysis

The project cost may change because of influence to commodity prices, and the land price in particular would be the greatest impact to the project cost. The Province Government had issued the detailed official land value[2] for each of barangay in 1994, 2002 and 2007 as shown in Table below.

[2] "Zonal Valuation, Province of Cavite" issued by Bureau of Internal Revenue (BIR), the Province of Cavite.

Table R 2.69 Past Price Trend of Land in Subjected Area for Project Listed in Official Land Value

Unit: Peso/m^2

Land Use	Barangay	Location Detailed	1994	2002	2007
Residential Zone	Anabu 1	Parkplace Village	700	800	1,350
		Parkplace Village Expansion	1,000	2,000	3,000
	Carsadang Bago	Camerino Subdivision (Subd.)	750	1,000	1,500
		Palazzo Bello	750	1,000	1,500
		Remedios Lasquete Subd.	750	1,000	1,500
		Villa Lasquete	750	900	1,350
	Tanzang Luma (B. Na Tubig)	Bahayang Pag-Asa Subd.	1,500	3,500	3,500
		Better Life Subd.	1,500	2,500	3,375
		Imus Blvd.	2,000	3,500	4,875
		Along Gen. Aguinaldo Highway	3,000	3,500	4,875
		Sala Subd.-Toll Bridge Bacoor	2,500	3,500	4,875
		Polet Homes	1,500	2,500	3,375
		Sampaguita Subd.	1,500	2,500	3,375
		Southern City 1	1,500	2,500	3,375
		All Other Streets	1,000	1,500	2,650
	Average Land Price		**1,380**	**2,147**	**2,965**
Agricultural Zone	Anabu 1	Whole	300	300	425
	Carsadang Bago	Whole	350	600	825
	Tanzang Luma (B. Na Tubig)	Whole	350	450	615
	Average Land Price		**333**	**450**	**622**
Commercial Zone	Tanzang Luma (B. Na Tubig)	NWSS Pumping Station –Highway	6,000	6,000	8,500
		Along Gen. Aguinaldo Highway	5,000	6,000	8,500
		Sala Subd.-Toll Bridge Bacoor	6,000	6,000	8,500
	Average Land Price		**5,667**	**6,000**	**8,500**

Source: "Zonal Valuation, Province of Cavite" issued by Bureau of Internal Revenue (BIR), the Province of Cavite.

As listed above, the land value of the residential zone and the commercial zone are 4.8 times and 13.7 times of the agricultural zone, respectively. The whole of the proposed project sites are, currently, used as the agricultural land. Nevertheless, should the land use states at the proposed project sites be changed to the residential or commercial area, the project becomes to be definitely non-feasible judging from the above difference of the land prices.

It is further noted that that the land developer had bought up about 52% of the whole project sites. Because the Municipality has not approved the change of the present land status for agricultural use at the project site, the present agricultural land could be preserved.

However, the land developer as the landowner of the proposed project site may not accept selling of their land with the officially appraised land price or even the prevailing market price. The land acquisition cost estimated in the Study is based on the prevailing market price of the land, while the actual cost may increase depending on the results of negotiation with the land developer, which leads to increment of the project economic cost. Moreover, there is a possibility of the overestimate of the economic benefit, because of a certain extent of error in estimation of the benefit.

From the point of views, the sensitivity analysis was made. The results of the analysis are as summarized below:

Table R 2.70 Summary of All the Results of Sensitivity Analysis

Cost \ Benefit	Base	-10 %	-20 %	-30 %
Base	25.95%	24.10%	22.15%	20.09%
+15 %	23.52%	21.80%	20.00%	18.09%
+30 %	21.53%	19.92%	18.24%	16.46%
+45 %	19.87%	18.36%	16.78%	15.11%

As listed above, the increment rate of 45% for the project cost would barely promise the aforesaid SDR of 15%, and therefore, it could be the critical level of the project economic viability. The land acquisition cost would take about 40% of the whole project cost, and therefore, the said increment rate of 45% for the entire project cost almost corresponds to increment rate of 100% for the land acquisition cost. In another words, the economic viability of the project could be verified, when the land acquisition cost for the project site could be made within a limit of 100% increment of the present market value.

2.8 Recommendations for Land Acquisition and Resettlement Plan

2.8.1 Resettlement Policy

The implementation of the proposed flood retarding basin as priority flood mitigation projects will necessitate substantial land acquisition, which will likely create significant social and economic impacts. In order to mitigate these potential impacts, JICA's Guidelines for Social and Environmental Consideration (2004) calls for resettlement to be undertaken as an integral component of the proposed interventions. Therefore, recommendations are put forward that will facilitate the preparation and implementation of a full-scale Resettlement Action Plan (RAP) in the succeeding stages of project development. The RAP preparation shall be guided by the Land Acquisition, Resettlement and Indigenous Peoples Policy of the Department of Public Works and Highways (DPWH). The LARRIPP or simply the "Resettlement Policy" (revised in 2007), now serves as the overall framework that governs land acquisition, payment of compensation and entitlement, and resettlement of PAPs and vulnerable communities affected by all types of DPWH projects.

These recommendations are also in conformity with international best practice as observed by bilateral and multilateral funding agencies, including the World Bank (WB), the Asian Development Bank (ADB) and the Japan Bank for International Cooperation (JBIC), which uphold in principle that:

(1) Involuntary resettlement should be avoided or minimized where feasible by exploring all viable project options;

(2) Displaced persons should be compensated for their losses at full replacement cost prior to actual relocation;

(3) The absence of formal legal title to land by some affected groups should not be a bar to compensation;

(4) Displaced persons should be assisted during relocation and should be supported during the transition period after relocation to help them re-establish their social and economic base;

(5) The affected communities should be fully informed and consulted on resettlement and compensation options;

(6) Particular attention should be paid to the needs of the poorest affected persons, including those without legal title to assets, female-headed households and other vulnerable groups; and

(7) Involuntary resettlement should be conceived and executed as part of a development project and resettlement plans should be prepared with appropriate time-bound actions and budget.

2.8.2 Impacts of Land Acquisition and Resettlement

As will be discussed below, the extent of land acquisition in order to secure the right of way (ROW) of the proposed flood retarding basins is rather substantial. This is likely to cause five categories of socio-economic impacts on project-affected persons (PAPs), namely: (1) physical displacement of PAPs; (2) loss of assets and production base; (3) loss or diminution of livelihood and income-earning opportunities; (4) loss of basic social services and community structures; and (5) disintegration of social support networks and relationships.

At the same time, the influx of new settlers is likely to induce adverse impacts on the host or receiving communities, including the following: (1) land speculation; (2) increased population and in-migration; (3) bigger administrative responsibilities for receiving LGUs; (3) competition over limited natural, social and economic resources, livelihood opportunities and existing social services.

2.8.3 Scope of Land Acquisition and Resettlement

(1) Land Acquisition

More or less 81.2 hectares of agricultural land is needed to construct the three flood retarding basins. The proposed sites are all located in the Municipality of Imus. The biggest area consists of 40.0 ha, which is intended for Retarding Basin I1 (See Fig. 2.28). It is located in Barangay Anabu I-G. Except for some patches of rice paddies in the middle portion, the area consists mostly of grazing lands. On the other hands, areas on the opposite bank of Imus River have been developed as residential areas. As for distribution status of houses in the proposed site, several houses, such as houses for farmer tilling rice paddies and a cluster of houses of informal settlers along the Imus River, are scattered. A paved road passing through north side along the site has been improved and the alignment of proposed CALA_N-S has been set along the south east fringe area of the site. Taking into consideration such status, proposed area is strained to the development activities. The second biggest area will be site of Retarding Basin J1, which consists of 29.0 ha (See Fig. 2.30). Located in Barangay Carsadang Bago, it is largely devoted to rice production. Circumferences of the proposed site have been developed as residential areas except for the proposed site. In the site, a few farmers' houses with structures for their relatives or formal/informal tenants are located. In addition, a cluster of shelters for informal setters who are working for construction site of new subdivision project in adjacent area exists. The smallest area is for Retarding Basin B4 in Barangay Tanzang Luma VI, which consists of 12.2 ha (See Fig. 2.29). Most of the area is presently idle grassland that serves as pasture for a few backyard livestock. There are 8 houses for formal settlers and 3 shelters for informal setters in/around this proposed site.

Based on survey results of the Environmental Impact Assessment (EIA) study, two land development firms own a big portion of the proposed retarding basin sites and therefore qualify as a major stakeholder or interest group. One land developer, namely Earth and Style Corporation owns more or less 26.0 ha or approximately 65% of the proposed retarding basin area in Barangay Anabu I-G (Fig. 2.31). The other developer, namely ACM Land Holdings, Inc. owns about 17.0 ha or roughly 59% of the proposed area in Barangay Carsadang Bago (Fig. 2.33).

(2) Scope of Resettlement

Based on satellite imageries (2002 to 2004) and field reconnaissance surveys, the Study Team initially identified about 14 houses/structures that will likely be displaced by the flood retarding basins. However, a subsequent social survey commissioned as part of the EIA Study showed that there are actually 46 potential project-affected persons (PAPs) due to the proposed projects (Table R 2.71). By definition, project-affected persons refer to person or persons, household, a firm or a private or public institution who, on account of the execution of the project, would have their right, title or interest in all or any part of a house, land, crops and trees or any fixed and moveable asset acquired or possessed, in full or in part, permanently or temporarily (DPWH, LARRIPP, 2007). The potential PAPs thus include all the landowners as well as residents, business establishments and institutions that occupy, conduct business or operate in the area, regardless of their legal ownership status with respect to affected properties.

In order to analyze the impacts on their economic assets, the PAPs are categorized in two, namely: (1) the resident PAPs or those who are actually living inside the area; and (2) the non-resident PAPs or those that do not live but are simply engaged in economic activities, doing business or operating in the area. The first category of PAPs includes (i) formal settlers who own the land and the structure they live in inside proposed RB area; (ii) tenant and tenant-farmers who own the structures but not the land; they either reside only or reside and engage in farming inside the proposed RB area with the expressed consent of the land owner; and (iii) informal settlers who own neither the land nor structure they occupy; they include squatters (those who occupy the structures for residential purposes only, either as sub-tenant or rent-free occupant) and encroachers (those who till the land) without the expressed consent of the land owner. The second category of PAPs includes three groups: (i) the non-resident owners of the land who are either farming the land themselves, or earning incomes from the use and occupancy by another person/s; (ii) the non-resident tenant or non-tenant families who do not own the land but are farming in the area; and (iii) the institutions or business establishments that conduct business or operate in the area.

The social survey was commissioned to identify the properties and structures that are likely to be affected by the attendant land acquisition. It also aims to obtain the socio-economic profile of the potential PAPs. The following table summarizes the distribution of would-be affected structures and the potential PAPs based on the results of the social survey.

Some 14 structures are likely to be demolished; these include 12 houses, one motor pool building and a plant nursery. This number involves five (5) houses in Carsadang Bago; only one (19 house will be demolished in Anabu I-G and six (6) houses in Tanzang Luma VI.

Table R 2.71 Estimated Number of Potential Project-Affected Persons (PAPs) of the Proposed Off-site Retarding Basin

River	Barangay	Affected Struc-tures	Resident PAPs				Non-Resident PAPs					Total of PAPs (4)+(9)
			(1) Formal Settler	(2) Tenant / Tenant Farmer	(3) Informal Settler	(4) Sub-Total (1)~(3)	(5) Land Owner	(6) Tenant Farmer	(7) Public Insti-tution	(8) Businees Establish-ment	(9) Sub-Total (5)~(8)	
Imus	Anabu I-G	1	-	1	-	**1**	8	8	-	1	**17**	18
Julian	Carsadang Bago	5	2	3	-	**5**	6	7	-	1	**14**	19
Bacoor	Tanzang Luma VI	8	4	2	-	**6**	1	-	1	1	**3**	9
Total		*14*	*6*	*6*	*0*	**12**	*15*	*15*	*1*	*3*	**34**	*46*

Source: JICA EIA Study, 2008

There are 12 resident households (HH) that presently occupy the proposed project sites. Of these, six (6) HH are formal settlers who claim to own the land and structure they occupy; six (6) HH are tenants and tenant-farmers who live inside the project area and are at the same time engaged in farming activities.

Thirty-four (34) PAPs do not reside in the area but own the land and/or derive incomes from the use, occupancy or economic activities on such lands by another party. This includes 15 land owners with relatively small land holdings, 15 tenant-farmers, the two land development companies already identified, one candy factory, namely Hany's, and the municipality of Imus.

As described above, the project will require 12 resident households, who will be subject to resettlement and 30 land owners/tenant farmers, who do not reside in the area but own the land and/or derive incomes from the use, occupancy or economic activities on such lands. The LARIPP defines all of these 42 resident households as the PAPs. At the same time, the LARIPP requires preparation of a full-scale Resettlement Action Plan (RAP), when the number of the PAPs is over 200 individuals.

All in all, the above number of 42 residents households translates to about 200 individuals, using the province's average household size of 4.78 (NSO, CY 2000). The number may slightly increase due to natural population growth rate and in-migration before the start of projects construction in 2011. Accordingly, a full-scale Resettlement Action Plan (RAP) is required during the detailed design stage of the projects.

It is assumed that only 12 resident households will be subject to resettlement. All in all, this number of translates to about 60 individuals, using the province's average household size of 4.78 (NSO, CY 2000). The number may slightly increase due to natural population growth rate and in-migration before the start of projects construction in 2011. A full-scale Resettlement Action Plan (RAP) should be prepared during the detailed design stage of the projects.

The most number of potential resettlers will come from Carsadang Bago. There are five (5) resident HH, which is 42% of the resettling population, six (6) non-resident land owners, seven (7) non-resident tenant famers and one land developer (ACM) from this site whose properties and structures will be affected by land acquisition. In Anabu I-G, there are one (1) resident family, eight (8) non-resident land owners, eight (8) non-resident tenant farmers and one land developer (Earth and Style) who will be affected. In Tanzang Luma VI, there are six (6) resident families who may be displaced as well as one non-resident land owner and a candy factory who stand to lose their land. The municipal government also owns a motor pool and a plant nursery in Tanzang Luma VI, both of which will likely be removed and re-established elsewhere.

2.8.4 Socio-Economic Conditions of Potential PAPs

A social survey was commissioned as part of the Environmental Impact Assessment (EIA) in order to obtain the socio-economic profile of the resettling families and private land owners who are likely to be affected by the land acquisition. Seventy-seven (77) respondents were interviewed among potential PAPs identified above and resident households around the proposed off-site flood retarding basin. The socio-economic profile of these interviewee is presented below. A more detailed socio-economic survey should be undertaken to adequately characterize the resettling PAPs after they shall have been identified during the census-tagging activities. This will be explained later in Sub-section 2.8.6.

None of the non-resident land owners were interviewed, since they were not accessible during the time of the survey. Some useful information was gathered from the two land development companies through key informant interviews; this will be discussed later. ACM sent a representative during one of the stakeholder meetings. Follow up dialogues with this stakeholder group should be pursued in the next stage of the project as part of the social preparation process.

(1) Population and Demographic Characteristics

(a) Household Size

The household sizes of the interviewees are shown in the table below.

Table R 2.72 Size of Households of Social Survey Respondents

Basin Location	Household Size											Total No. of Households
	1-2	%	3-4	%	5-6	%	7 or more	%	NR*	%	
Anabu I-G	1	6%	12	75%	3	19%					16
Carsadang Bago	11	20%	19	35%	12	22%	9	17%	3	6%	54
Tanzang Luma VI	2	29%	2	29%	1	14%	1	14%	1	14%	7
TOTAL	***14***	***18%***	***33***	***43.%***	***16***	***21%***	***10***	***13%***	***4***	***5%***	***77***

*NR = no response

Source: JICA EIA Study, 2008.

In Anabu I-G, most (75%) of the families have three to four members; the biggest families (19%) have 5-6 members and the smallest (6%) has only 1 or 2. Carsadang Bago and Tanzang Luma VI have relatively bigger families: only 35% and 29%, respectively have 3-4 members; 20% and 29%, respectively have only 1-2 members. In both barangays, no less than 42% of the families have more than 5 members. The biggest families belong to 16% of the residents of Carsadang Bago and Tanzang Luma, which have 7 or more family members.

The figures appear to be consistent with recent census data (NSCB, CY 2000), which puts the average household size at 4.62 and 4.77 members per household in Imus and Bacoor, respectively.

(b) Gender Distribution

The following table shows the gender distribution of household heads. In all three sites, 88% of the household heads are male; only 12% of the households are headed by a female.

The few female-headed households would need extra help to get their social and economic base rehabilitated after involuntary displacement. This is because females rely heavily on social networks and institutional support in order to effectively carry out the dual function of caring for the children and providing for the family's basic needs. Moreover, women have more limited access to economic opportunities compared to their male counterparts.

Table R 2.73 Gender Distribution of Household Heads

Basin Location	Gender				
	Male	%	Female	%	Total
Anabu I-G	14	88%	2	13%	16
Carsadang Bago	48	89%	6	11%	54
Tanzang Luma VI	6	86%	1	14%	7
TOTAL	***68***	***88%***	***9***	***12%***	***77***

Source: JICA EIA Study, 2008.

(c) Age Structure

The following table shows the gender-disaggregated age distribution of the household heads and their spouses.

Male household heads and their spouses are generally younger than the female family heads. Most of them are still in their reproductive and economically active age, considering that 62% are aged 50 years old and below. The biggest age group (24%) belongs to male household heads aged 30 years and younger. Those aged 31-40 comprise 16%, while those aged 41-50 comprise 22%. Only about 16% are senior citizens aged over 60 years.

Similarly, most (77%) of their spouses are still in their reproductive years. Only 20% are past child bearing age.

Table R 2.74 Age Distribution of Household Heads and Spouses

Basin Location	Age												
	<20-30 yrs	%	31-40	%	41-50	%	51-60	%	>60	%	No Response	%	TOTAL
MALE HOUSEHOLD HEADS													
Anabu I-G	5	36%	1	7%	3	21%	2	14%	3	21%			14
Carsadang Bago	10	21%	9	19%	12	25%	10	21%	6	12%	1	2%	48
Tanzang Luma VI	1	17%	1	17%			1	17%	2	33%	1	17%	106
TOTAL	***16***	***24%***	***11***	***16%***	***15***	***22%***	***13***	***19%***	***11***	***16%***	***2***	***3%***	***68***
SPOUSES													
Anabu I-G	4	29%	2	14%	5	36%	2	14%	1	7%			14
Carsadang Bago	11	23%	9	19%	17	36%	6	13%	3	6%	1	2%	47
Tanzang Luma VI	1	25%			1	25%			1	25%	1	25%	4
TOTAL	***16***	***25%***	***11***	***17%***	***23***	***35%***	***8***	***12%***	***5***	***8%***	***2***	***3%***	***65***
FEMALE HOUSEHOLD HEADS													
Anabu I-G					1	50%	1	50%					2
Carsadang Bago					1	17%	2	33%	3	50%			6
Tanzang Luma VI					1	100%							1
TOTAL					***3***	***33%***	***3***	***33%***	***3***	***33%***			***9***
SPOUSES													
Anabu I-G							1	100%					1
Carsadang Bago							1	100%					1
Tanzang Luma VI													0
TOTAL							***2***	***100%***					***2***

Source: JICA EIA Study, 2008

In contrast the female household heads and their spouses are significantly older than their male counterparts. In general, most (66%) of the female household heads are past their child bearing age while all (100%) of their spouses are nearly past their economically productive years. Only 33% are still in their productive years (41-50 years old). About 33% of the female household heads are aged 51-60 years old. The other one-third of the female household heads is comprised of senior citizens aged above 60 years old. Poor female-headed households are extremely vulnerable to impoverishment as a result of involuntary displacement. These households will need special attention, more so because many of the female heads belong to the elderly population.

Among the interviewees, there are only 48 households or 62% of the interviewees which have other members, besides the working heads of the household and their spouses, who contribute to the family's income stream. At the average household size of 4.8, this could translate to a high dependency rate, where as much as 45% of household members are not gainfully employed or economically active.

As shown in the following table, most (67%) of the other earning family members are young adults aged 20-30 years old. Those aged 31-40 years old comprise a smaller percentage (17%) and very few (4%) are aged 41-50. The age distribution seems to show that the income earning capacity of affected households is limited to the productive potential of the few economically active members of the population. To preclude impoverishment among vulnerable households such as the poorest of the poor, access to employment and income earning opportunities should be improved. At the same time, their capability to engage in economic activities should be enhanced through appropriate knowledge development and skills trainings.

Table R 2.75 Age Distribution of Other Income-Earning Household Members

Basin Location	Age												
	<20-30 yrs.	**%**	**31-40**	**%**	**41-50**	**%**	**51-60**	**%**	**>60**	**%**	**No Response**	**%**	**TOTAL**
Anabu I-G	3	60%	2	40%									5
Carsadang Bago	26	67%	6	15%	1	3%					6	15%	39
Tanzang Luma VI	3	75%			1	25%							4
TOTAL	***32***	***67%***	***8***	***17%***	***2***	***4%***					***6***	***12%***	***48***

Source: JICA EIA Study, 2008

(2) Social Conditions

(a) Educational Attainment

The following table shows the educational attainment of the household heads and their spouses.

Table R 2.76 Educational Attainment of Household Heads

Basin Location	Educational Attainment																
	A	%	B	%	C	%	D	%	E	%	F	%	G	%	NR	%	TOTAL
	Male Household Head																
Anabu I-G	6	43%			6	43%			1	7%			1	7%			14
Carsadang Bago	23	48%	1	2%	16	33%	1	2%	3	6%			1	2%	3	6%	48
Tanzang Luma VI	2	33%							1	17%			1	17%	2	33%	6
TOTAL	***31***	***46%***	***1***	***2%***	***22***	***32%***	***1***	***2%***	***5***	***7%***			***3***	***4%***	***5***	***7%***	***68***
	Spouse of Male Household Head																
Anabu I-G	8	57%			2	14%			2	14%	1		1	7%			14
Carsadang Bago	17	35%			18	78%	1	2%	4	8%	1		1	2%	6	13%	48
Tanzang Luma VI	1	25%			1	25%									2	50%	4
TOTAL	***26***	***39%***			***21***	***32%***	***1***	***2%***	***6***	***9%***	***2***	***3%***	***2***	***3%***	***8***	***12%***	***66***
	Female HH Head																
Anabu I-G	1	50%			1	50%											2
Carsadang Bago	5	83%			1												6
Tanzang Luma VI					1												1
TOTAL	***6***	***67%***			***3***	***33%***											***9***
	Spouse of Female HH Head																
Anabu I-G					1	100%											1
Carsadang Bago	1	100%															1
Tanzang Luma VI																	
TOTAL	***1***	***50%***			***1***	***50%***											***2***

Note: A : Elem. School Undergraduate; B : Elementary School Graduate; C : High School Undergraduate; D : High School Graduate; E : College Undergraduate; F : College Graduate; G : Others / Vocational School; NR : No Response

Source: JICA EIA Study, 2008.

The educational level of most of the interviewees is quite low. The male household heads and their spouses have higher educational qualifications compared to the female household heads and their spouses. A few of the male household heads (7% and 4%, respectively) have gone to college and vocational schools. A significant percentage (46%) only reached the elementary level. About 32% went to high school but only 2% finished the secondary level.

Like their husbands, the female spouses are better equipped compared to the spouses of female household heads in terms of educational attainment, although educational attainment is still inadequate for employment. Almost 16% of them went to tertiary schools; of these, 9% are college undergrads, 3% finished college education and 3% had vocational training.

In general, the female household heads and their spouses have lower educational qualifications than their counterparts. All of them were not even able to graduate high school. Most (67%) of the female household heads were elementary school undergraduates while only 33% finished primary school. Among their spouses, only 50% finished elementary level.

In terms of geographic distribution, the interviewees from Anabu I-G and Carsadang Bago have better educational qualifications compared to interviewees from Tanzang Luma VI. In both locations, more than half of the male household heads and their spouses have finished elementary education. Of these, 35% attained high school education and almost 11% have acquired higher tertiary and vocational education.

The following table shows the educational attainment of other income-earning members of the family. About 44% attended but did not finish high school while some 33% went to college. Only 6% were able to get a college or vocational degree.

Table R 2.77 Educational Attainment of Other Income-Earning Members

Basin Location	Educational Attainment																
	A	%	B	%	C	%	D	%	E	%	F	%	G	%	NR	%	TOTAL
Anabu I-G	1	12%			1	12%			2	25%	1	13%					5
Carsadang Bago	2	48%			18	2%			13	6%			1	2%	5	6%	39
Tanzang Luma VI					2	50%			1	25%	1	25%					4
TOTAL	***3***	***6%***			***21***	***44%***			***16***	***33%***	***2***	***4%***	***1***	***2%***	***5***	***11%***	***48***

A : Elem. School Undergraduate
B : Elementary School Graduate
C : High School Undergraduate
D : High School Graduate
E : College Undergraduate
F : College Graduate
G : Others / Vocational School
NR : No Response

Source: JICA EIA Study, 2008.

(b) Tenurial Characteristics

With respect to land tenure and ownership of real properties, improvements and other assets, the results of this interview survey are still inconclusive. At best the responses presented below are only indicative and could only serve as preliminary information. It is crucial after the conduct of census-tagging (C/T) activities to ascertain the actual tenurial status among PAPs, in order to determine their eligibility to receive compensation and other entitlements. Verification must be done prior to the preparation of the master list of PAPs based on titles or claims to properties presented by concerned PAPs. Legality of claims will be checked against the official documents and records of the Municipal/Provincial Assessor, the Registry of Deeds, the DENR-Land Management Bureau (LMB) and/or the Land Registration Authority (LRA), as the case may be.

As a policy, DPWH provides cash compensation to legitimate owners of land, structure and other improvement including crops, trees and perennials on affected real properties based on current fair market value. Agricultural lessees are entitled to disturbance compensation, while renters, sharers and rent-free occupants are only assisted financially or in kind during demolition, transfer and transition period in the new settlements. The compensation policy and eligibility criteria will be discussed more thoroughly in Section 2.8.6.

(i) Ownership of Lot

The following table shows the status of land ownership according to survey respondents. The percentage of “no response” (NR) is noticeably high among both settlers and farmers (42% and 30%, respectively). This would indicate that a significant number of respondents are hesitant to reveal their actual tenurial status. Of those who responded otherwise, 39% of settlers and 61% of farmers (i.e., those who live as well as engage in farming inside the area) claim that the lots occupied by their residential structures belong to them or the immediate members of their family. Only a few respondents (16%) admit that the land is owned by a private entity. Of these, only 5% of settlers and 3% of farmers claim to be tenants or sub-tenants of some private individuals who are paying rent for the use of the land. A bigger number (14% of settlers and 10% of farmers) admit that they are rent-free occupants about 4% presumably enjoy other forms of occupancy arrangement with the landowner.

Table R 2.78 Lot Ownership among Surveyed Households

Basin Location	A	%	B	%	C	%	D	%	E	%	F	%	NR	%	No. of Households
SETTLERS															
Anabu I-G	3	43%							3	43%			1	14%	7
Carsadang Bago	10	35%					2	7%	2	7%			15	52%	29
Tanzang Luma VI	2	100													2
Sub-total	***15***	***39%***					***2***	***5%***	***5***	***14%***			***16***	***42%***	***38***
FARMERS															
Anabu I-G	4	44%											5	56%	9
Carsadang Bago	16	64%					1	4%	3	12%	3	12%	2	8%	25
Tanzang Luma VI	4	80%							1	20%					5
Sub-total	***24***	***61%***					***1***	***3%***	***4***	***10%***	***3***	*8%*	***7***	***18%***	***39***
TOTAL	***39***	***50%***					***3***	***4%***	***9***	***12%***	***3***	***4%***	***23***	***30%***	***77***

Note : A : Own Lot D : Private (Rent) NR : No Response
B : Relative E : Private (Rent-free)
C : Government F : Others

Source: JICA EIA Study, 2008.

(ii) Ownership of House

As to house ownership, again a significant percentage of the respondents (42% of settlers and 49% of the farmers, respectively) failed to provide concrete answers. While 45% of the settlers claim that they own the house structures where they live, only 39% of farmers say that they or an immediate family member owns the house structure. Only a few (4%) admit to occupying the house for free; almost 9% enjoy some other form of occupancy arrangement, possibly as sub-tenant. (Refer the table below.)

Table R 2.79 House Ownership among Surveyed Households

Basin Location	A	%	B	%	C	%	D	%	E	%	F	%	NR	%	No. of Households
SETTLERS															
Anabu I-G	3	43%							3	43%			1	14%	7
Carsadang Bago	13	45%									2	7%	14	48%	29
Tanzang Luma VI	1	50%											1	50%	2
Sub-total	***17***	***45%***							***3***	***8%***	***2***	***5%***	***16***	***42%***	***38***
FARMERS															
Anabu I-G	6	67%											3	33%	9
Carsadang Bago	4	16%									5	20%	16	64%	25
Tanzang Luma VI	5	100%													5
Sub-total	***15***	***39%***									***5***	***13%***	***19***	***49%***	***39***
TOTAL	***32***	***42%***							***3***	***4%***	***7***	***9%***	***35***	***45%***	***77***

Note: A : Own House D : Private (Rent) NR : No Response
B : Relative E : Private (Rent-free)
C : Government F : Others

Source: JICA EIA Study, 2008

(iii) Migration Pattern

As shown in the following table, more than half of the interviewees have been staying in the area since birth while 26% have been living there for more than one year. Only a few families arrived within a year.

Table R 2.80 Years of Stay in the Area

Basin Location	Years of Stay										
	A	**%**	**B**	**%**	**C**	**%**	**D**	**%**	**NR**	**%**	**TOTAL**
Anabu I-G	1	6%			4	25%	10	63%	1	6%	16
Carsadang Bago	3	5%	3	6%	18	33%	28	52%	2	4%	54
Tanzang Luma VI					4	57%	3	43%			7
TOTAL	***4***	***5%***	***3***	***4%***	***26***	***34%***	***41***	***53%***	***3***	***4%***	***77***

Note: A : Less than a year D : Since birth
B : One year NR : No Response
C : More than a year

Source: JICA EIA Study, 2008

Of the interviewees who were not born in the area, more than half (55%) are migrants from nearby barangays, as shown in the table below. A relatively big percentage (30%) came from other provinces. Only a few were from other towns of Cavite.

Table R 2.81 Place of Origin

Basin Location	Place of Origin								
	A	%	B	%	C	%	NR	%	TOTAL
Anabu I-G			1	100%					1
Carsadang Bago	13	48%	3	11%	10	37%	1	4%	27
Tanzang Luma VI	5	100%							5
TOTAL	***18***	***55%***	***4***	***12%***	***10***	***30%***	***1***	***3%***	***33***

Note: A : Nearby barangay, B : Other towns of Cavite, C : Other provinces, NR : No Response

Source: JICA EIA Study, 2008.

(iv) Housing Characteristics

The following table describes the materials of which the house structures are made. In general, not a few houses were observed to be made of semi-concrete (39%) or concrete materials (13%). Many others were constructed from makeshift or salvaged or improvised housing materials (38%). Among the non-farming households, more than 50% of dwellings are makeshift structures. In contrast, farmer-households appear to be better off because 51% and 15% of their houses, respectively, consist of semi-concrete and concrete materials.

The implications are significant in terms of compensation for these structures at replacement cost at the time of project construction. Semi-concrete and concrete units will definitely cost a lot more than those made of makeshift materials.

Table R 2.82 Housing Materials

Basin Location	A	%	B	%	C	%	D	%	NR	%	No. of Households
SETTLERS											
Anabu I-G	5	72%	1	14%	1	14%					7
Carsadang Bago	13	45%	9	31%	3	10%	3	10%	1	4%	29
Tanzang Luma VI	2	100%									2
Sub-total	***20***	***53%***	***10***	***26%***	***4***	***10%***	***3***	***8%***	***1***	***3%***	***38***
FARMERS											
Anabu I-G			5	55%	3	33%			1	12%	9
Carsadang Bago	7	28%	13	52%	3	12%			2	8%	25
Tanzang Luma VI	2	40%	2	40%					1	20%	5
Sub-total	***9***	***23%***	***20***	***51%***	***6***	***15%***			***4***	***10%***	***39***
TOTAL	***29***	***38%***	***30***	***39%***	***10***	***13%***	***3***	***4%***	***5***	***6%***	***77***

Note: A : Makeshift/Salvaged Materials C : Concrete NR: No Response
B : Semi-concrete D : Others

Source: JICA EIA Study, 2008

(v) Access to Basic Utility Services

Access to potable water supply is generally good, as shown in the following table. More than 74% of the settler interviewees and 76% of farmer families get their domestic water supply from their own deep well (49%), communal deep well (23%) or communal faucet (4%). One house even has a piped-in water system. Some who could afford (17%) augment their water supply with mineral water for drinking purposes. A few households pay to share the water supply source from their neighbors.

Table R 2.83 Access to Potable Water Supply

Basin Location	A	%	B	%	C	%	D	%	E	%	F	%	TOTAL
SETTLERS													
Anabu I-G			1	11%	5	56%	1	11%	1	11%	1	11%	9
Carsadang Bago					7	28%	12	48%	5	20%	1	4%	25
Tanzang Luma VI							2	50%	1	25%	1	255	4
Sub-total			***1***	***3%***	***12***	***31%***	***15***	***40%***	***7***	***18%***	***3***	***8%***	***38***
FARMERS													
Anabu I-G			1	10%	1	10%	5	50%	2	20%	1	10%	10
Carsadang Bago	1	4%			4	17%	17	71%	2	8%			24
Tanzang Luma VI			1	20%	1	20%	1	20%	2	40%			5
Sub-total	***1***	***3%***	***2***	***5%***	***6***	***15%***	***23***	***60%***	***6***	***15%***	***1***	***2%***	***39***
TOTAL	***1***	***2%***	***3***	***4%***	***18***	***23%***	***38***	***49%***	***13***	***17%***	***4***	***5%***	***77***

Note: A: Piped-in Connection C: Communal Deep well E: Mineral Water
B: Communal Faucet D: Open Deep well F: Others

Source: JICA EIA Study, 2008.

Only 70 households have access to electricity; seven households do not. Of those who do, 77% have their own household connections. The rest taps their power supply from neighbors.

Table R 2.84 Access to electricity

Basin Location	A	%	B	%	NR	%	No. of Households
Anabu I-G	2	40%	3	60%			5
Carsadang Bago	20	80%	5	20%			25
Tanzang Luma VI					3	100%	3
Sub-total	***22***	***67%***	***8***	***24%***	***3***	***9%***	***33***
Anabu I-G	7	78%	1	11%	1	11%	9
Carsadang Bago	22	92%	1	4%	1	4%	24
Tanzang Luma VI	3	75%	1	25%			4
Sub-total	***32***	***86%***	***3***	***8%***	***2***	***5%***	***37***
TOTAL	***54***	***77%***	***11***	***16%***	***5***	***7%***	***70***

Note: A: Own NR: No response
B: Shared

Source: JICA EIA Study, 2008.

Water and power supply facilities should be available in the resettlement sites in much the same way as these are readily accessible to PAPs in their present locations.

(3) Economic Conditions

(a) Livelihood and Income Sources

The following table shows the primary sources of income and livelihood of household heads and their spouses.

Male HH heads generally have better and more varied jobs than female HH heads. Across all three sites, the male household heads are predominantly farmers (38%). Many others are vehicle drivers (22%). Only a smaller percentage (15% each) is employed in government or private offices. Some 15% have on-and-off jobs in construction doing masonry and carpentry works. A few others are into sales (3%), machine and automotive works (1.5%) and doing odd jobs such as mowing lawns, pruning trees, cleaning and repairing appliances, etc. (1.5%).

In terms of geographic distribution, Carsadang Bago has the most number of male HH heads who are engaged in farming (16), driving transport vehicles (11) and technical or mechanical jobs (10). In Anabu I-G, a significant percentage (43%) is engaged in agriculture, (36%) are gainfully employed in offices and 21% are vehicle drivers. In Tanzang Luma, 67% of the male family heads are farmers and 16% are vehicle drivers; 17% are jobless.

In contrast 56% of female HH heads have no means of livelihood. Most (22%) of those who earn their keeps are doing odd jobs such as laundry, house cleaning, manicure/pedicure services for neighbors and the like. The rest are engaged in farming (11%) or rely on monthly pension (11%). The situation is almost similar among female spouses, most (75%) of whom are stay-at-home wives and mothers with no incomes of their own. Only 6% of the female spouses are office workers and 6% are engaged in direct selling, small-scale business or managing sari-sari stores.

Table R 2.85 Primary Livelihood and Income Sources of Household Heads and Spouses

Basin Location	**Income Level**																		
	A	**%**	**B**	**%**	**C**	**%**	**D**	**%**	**E**	**%**	**F**	**%**	**G**	**%**	**H**	**%**	**I**	**%**	**Total**
Male Household Head																			
Anabu I-G	5	36%			6	43%	3	21%											14
Carsadang Bago	5	10%	2	4%	16	33%	11	23%	10	21%	1	2%	1	2%			2	4%	48
Tanzang Luma VI					4	67%	1	16%									1	17%	6
Sub-total	***10***	***15%***	***2***	***3%***	***26***	***38%***	***15***	***22%***	***10***	***15%***	***1***	***1.5%***	***1.0***	***1.5%***			***3***	***4%***	***68***
Spouses																			
Anabu I-G	1	7%			1	7%							2	14%			10	72%	14
Carsadang Bago	3	7%	4	8%									4	9%			35	76%	46
Tanzang Luma VI													1	20%			4	80%	5
Sub-total	***4***	***6%***	***4***	***6%***	***1***	***2%***							***7***	***11%***			***49***	***75%***	***65***
Female Household Head																			
Anabu I-G					1	50%							1	50%					2
Carsadang Bago															1	17%	5	83%	6
Tanzang Luma VI													1	100%					1
Sub-total					***1***	***11%***							***2***	***22%***	***1***	***11%***	***5***	***56%***	***9***
Spouses																			
Anabu I-G	1	100%																	1
Carsadang Bago	1	100%																	1
Tanzang Luma VI																			
Sub-total	***2***	***100%***																	***2***

Note: A: Employment; B: Business/Sales; C: Agriculture (Farm); D: Driving; E: Carpentry/Masonry/Construction; F: Technical/Machine Works; G: Odd Jobs; H: Pension; I: Jobless

Source: JICA EIA Study, 2008.

On the other hand, the following table shows the sources of income of other working members of the resettling families. This group represents only 48 of the resettling families; this means that by and large, only 62% of the interviewees have additional members contributing to the gross earnings of the family. More than one-third of the interviewees are fully dependent on the family heads and their working spouses, as the case may be. More than 56% of other income-earning members are gainfully employed in public or private offices. About 12% are vehicle drivers and 13% earn by doing odd jobs. The few remaining members (19%) are involved in business, technical or mechanical works, agricultural or construction activities.

Table R 2.86 Income Sources of Other Earning Family Members

Basin Location	**Source of Income**																		
	A	**%**	**B**	**%**	**C**	**%**	**D**	**%**	**E**	**%**	**F**	**%**	**G**	**%**	**H**	**%**	**I**	**%**	**Total**
Male Household Head																			
Anabu I-G	7	88%			1	13%													8
Carsadang Bago	17	44%	3	8%	1	3%	6	15%	3	8%	1	3%	5	13%					36
Tanzang Luma VI	3	75%											1	25%					4
TOTAL	***27***	***56%***	***3***	***6%***	***2***	***4%***	***6***	***12%***	***3***	***6%***	***1***	***2%***	***6***	***13%***					***48***

Note: A: Employment; B: Business/Sales; C: Agriculture (Farm); D: Driving; E: Carpentry/Masonry/Construction; F: Technical/Machine Works; G: Odd Jobs; H: Pension; I: Jobless

Source: JICA EIA Study, 2008.

Aside from their primary livelihood, the surveyed households have other sources of income to augment the family's finances, such as shown in the table below. For most settlers and farmers, income augmentation comes largely from part-time employment, presumably in private companies or individuals. A significant percentage of respondents derive secondary incomes from farming activities (19%) and unspecified economic undertakings (21%). Only a few (8%) from both groups obtain secondary incomes from business enterprise.

Table R 2.87 Secondary Income Sources of Surveyed Households

Basin Location	**Source of Income**										
	A	**%**	**B**	**%**	**C**	**%**	**D**	**%**	**NR**	**%**	**Total**
SETTLERS											
Anabu I-G	2	29%	2	29%			3	42%			7
Carsadang Bago	2	7%	16	55%	3	10%	5	17%	3	10%	29
Tanzang Luma VI			1	33%					2	67%	3
Sub-total	***4***	***10%***	***19***	***49%***	***3***	***8%***	***8***	***20%***	***5***	***13%***	***39***
FARMERS											
Anabu I-G	4	44%	4	44%			1	11%			9
Carsadang Bago	6	24%	8	32%	3	12%	6	24%	2	8%	25
Tanzang Luma VI	1	25%	1	25%			1	25%	1	25%	4
Sub-total	***11***	***29%***	***13***	***34%***	***3***	***8%***	***8***	***21%***	***3***	***8%***	***38***
TOTAL	***15***	***19%***	***32***	***42%***	***6***	***8%***	***16***	***21%***	***8***	***10%***	***77***

Note: A: Farming — D: Other Sources
B: Employment — G: No Response
C: Business/Sales

Source: JICA EIA Study, 2008

(b) Income Levels

The following table shows the per capita monthly income among the surveyed resident settlers and farming households. The data reflect incomes from both primary and secondary sources of the household heads, working spouses and other economically active family members, who significantly contribute to the household's composite earnings.

During the census year 2000, the annual per capita poverty threshold and per capita food threshold in the Province of Cavite was estimated at Php 14,965 and Php 9,457, respectively. For the year 2007, these were projected to be Php 20,952 and Php 13,240, respectively, by multiplying the price escalation rate of 1.4 during the period 2000-2007. Hence, the current monthly per capita poverty threshold and per capita food threshold in the project area are estimated at Php 1,746 and Php 1,103, respectively.

Table R 2.88 Per Capita Monthly Income among Surveyed Households

Basin Location	**Income per Capita**														
	A	**%**	**B**	**%**	**C**	**%**	**D**	**%**	**E**	**%**	**F**	**%**	**NR**	**%**	**No. of Households**
SETTLERS															
Anabu I-G	3	43%	1	14%	1	14%	2	29%							7
Carsadang Bago	4	14%	4	14%	8	28%	3	10%	2	7%	2	7%	6	21%	29
Tanzang Luma VI	1	33%	1	33%									1	33%	3
Sub-total	***8***	***21%***	***6***	***15%***	***9***	***23%***	***5***	***13%***	***2***	***5%***	***2***	***5%***	***7***	***18%***	***38***
FARMERS															
Anabu I-G	2	22%			2	22%			1	11%	3	33%	1	11%	9
Carsadang Bago	5	20%	4	16%	5	21%	4	16%	2	8%	1	4%	4	16%	25
Tanzang Luma VI	1	25%									1	25%	2	50%	4
Sub-total	***8***	***21%***	***4***	***11%***	***7***	***18%***	***4***	***11%***	***3***	***8%***	***5***	***13%***	***7***	***18%***	***38***
TOTAL	***16***	***21%***	***10***	***13%***	***16***	***21%***	***9***	***12%***	***5***	***6%***	***7***	***9%***	***14***	***18%***	***77***

Note: A: Php 1,100 & Below — D: Php 3,001 – 4,000 — NR: No Response
B: Php 1,101 – 1,700 — E: Php 4,001 – 5,000
C: Php 1,701 – 3,000 — F: Php 5,000 & Above

Source: JICA EIA Study, 2008.

Based on these poverty indicators, 34% of the interviewees are poor and 21% of them could hardly earn enough to meet their food threshold level. Nearly 36% of the resident settlers live below poverty level and about 21% can barely eat three decent meals a day.

Similarly, 32% of the farm tenant families live below poverty and 21% live below the food threshold level.

The families just described are considered among the poorest of the poor. Without a sound livelihood development and income restoration program to rehabilitate them, these vulnerable families are prone to further impoverishment due to involuntary displacement as a result of the project.

(c) Dependency

The profile of interviewees with dependent children below the age of 18 is shown in the table below. They comprise the economically dependent or non-earning members of the surveyed households.

The figures indicate that most of the families, both among resident settlers (76%) and farmers (71%) have only one to two dependent children. Only 25% of all the families have 3-4 children.

Table R 2.89 Number of Dependent/Non-earning Children

Basin Location	Number of Dependent Children										
	1-2	%	3-4	%	5-6	%	7-8	%	>8	%	Total
SETTLERS											
Anabu I-G	4	67%	2	33%							6
Carsadang Bago	17	77%	5	23%							22
Tanzang Luma VI	1	100%									1
Sub-total	***22***	***76%***	***7***	***24%***							***29***
FARMERS											
Anabu I-G	7	88%	1	13%							8
Carsadang Bago	12	67%	6	33%							18
Tanzang Luma VI	1	50%							1	50%	2
Sub-total	***20***	***71%***	***7***	***25%***					***1***	***4%***	***28***
TOTAL	***42***	***74%***	***14***	***25%***					***1***	***2%***	***57***

Source: JICA EIA Study, 2008

The low economic dependency rate is a positive note. This could mean that there are lesser mouths to feed and fewer numbers to send to school. Except perhaps for the poorest of the poor and the female-headed households, resettlement does not threaten to put more pressure on the family's scarce resources. The livelihood and income restoration efforts for the extremely vulnerable PAPs should consideration.

(d) Skills Inventory

A skills inventory of the PAPs was not included in the social survey. However, most of the PAPs are involved in agricultural activities and therefore may not possess other skills for employment in other livelihood options. Nevertheless, a thorough skills assessment should be carried out in order to adequately profile the employment qualifications and income-earning skills of PAPs. This should be matched with the results of environmental scanning of the resource base, opportunities and support mechanisms available in the host communities. The process will help facilitate the identification of livelihood and vocational trainings necessary to equip the resettling families towards more sustainable economic activities after relocation.

2.8.5 Potential Resettlement Sites for the PAPs

At most, only 1.0 ha of land will be needed to provide a suitable resettlement site to accommodate all the 12 identified potential resident PAPs, assuming that only resident households will be subject to resettlement. This area will include adequate spaces for socialized housing structures as well as basic support infrastructures such as roads, drainage, water supply and power lines. It may also include spaces for public schools, wet market, chapel, health center, day care, basketball court, multi-purpose hall, materials recovery facility (MRF) and such other social amenities as may be necessary to help restore the social and economic base of PAPs.

In order to preclude the acquisition of residential land for resettlement site, which may prove costly, the DPWH may develop existing or potential resettlement sites identified during the Master Plan Study. For this purpose, institutional arrangements will be defined in a Memorandum of Understanding (MOU) between DPWH and the provincial government of Cavite and/or the municipal government of Imus, concerned private entities (NGOs or land developers) and the PAPs. Either way, the development of resettlement sites may be conceived as a component of the proposed projects and financed out of the loan package, subject to negotiations with the funding agency (JBIC). Resettlement site development may include land upgrading, provision of basic housing units and construction of basic support infrastructures such as road networks, water supply, power distribution lines and drainage. Social support infrastructures such as health centers, school buildings, multi-purpose halls, and waste disposal facilities may also be constructed, as necessary. These facilities shall conform to standards and criteria set forth in Batas Pambansa 220 for socialized and economic housing structure.

Of the potential sites identified during the Master Plan Study, three sites are found to be suitable as alternative relocation areas for the potential PAPs. These sites are primarily intended for beneficiaries of the local government's shelter program, which gives priority to informal settlers who were displaced by the on-going demolition along so-called "danger areas". The availability and status of the potential resettlement sites are described in the table below and discussed hereafter. The location map is found in Fig. 2.34. Altogether, the sites have an aggregate area of 16.3 hectares. If developed in time prior to project construction, any of these sites could readily accommodate the influx of new resettlers.

Table R 2.90 Existing and Potential Sites identified for Ongoing and Future Resettlement Programs within the Province of Cavite

Location	Area (ha)	Beneficiaries	Status	Remarks
1 Pamayanang GK ng Imus, Barangay Alapan II, Imus	(2.3) 1.5	Poorest of the poor families in blighted slum areas of Imus	▪ First batch of resettlers (32 HH) is already in place ▪ Second batch of resettlers (32 HH) to be relocated before the end of 2008.	▪ 1.5 ha is still available for development as relocation site. This is considered as the best option: it will satisfy the demand for within-town resettlement by the PAPs from Imus who will be displaced by the construction of retarding basins. The location is within a distance of 3-5 km from the PAPs present residence.
2 Barangay Pasong Kawayan II, Gen. Trias	(53.0) 13.5	Homeless government employees, factory workers and minimum wage earners who are bon fide PAG-IBIG members	▪ Inaugurated in early 2008 after the successful loan negotiation with a government bank. ▪ Land develop-ment is now in progress through a private developer. ▪ The PHDMO plans to develop 25%-30% of the area to provide socialized housing units for informal settlers.	▪ The site is considered as the second best option, since site development is already underway. Also it offers the advantage of proximity to possible employment opportunities in nearby industrial and commercial estates. However, this site is about 11-13 km away from the PAP's present residence and will entail out-of-town relocation. ▪ Aside from PAPs from Imus who will be displaced by off-site retarding basin, the site may also accommodate other PAPs from Bacoor, Imus and Kawit who will be displaced later on by river improvement and drainage works in these areas.
3 Barangay Toclong, Kawit	(7.3) 1.3	Inland fisher folks and coastal communities affected by recent demolition in danger areas and areas that have been identified for priority development	▪ The PHDMO is now negotiating with a landowner to purchase 1.3 ha as relocation site for coastal communities. ▪ In addition, the municipal LGUs of Kawit and Bacoor are also negotiating with other land owners to purchase 4.0 ha and 2.0 ha of land, respectively, within this same barangay.	▪ Due to proximity (3-5 km), this may be the third likely resettlement option for the PAPs who will be displaced by the retarding basins, although it will entail out of town movement of families. However negotiation to purchase the land is still underway. ▪ Aside from the PAPs from Imus who will be displaced by off-site retarding basin, the site may also accommodate PAPs from Bacoor and Kawit who will be displaced later on by river improvement and coastal dike.
Total	***16.3***			

Note: Area in the brackets indicates whole area of each resettlement site.
Areas without brackets are available area for the new resettlement.

Source: PHDMO, 2007; Couples for Christ, 2008; LGU-MPDCs, 2008.

(1) Barangay Alapan II, Imus

The Imus municipal government has already developed a portion of the 2.3 hectare land in Barangay Alapan II as resettlement site for poor squatter families. The site used to be an abandoned municipal dumpsite. It is now known as "Pamayanang GK ng Imus" after a church-based NGO (Couples for Christ), introduced the *Gawad-Kalinga* shelter program. Under the GK, private partners (individuals, international organizations and corporations) provided building materials and financial support for the construction of duplex housing units, provision of initial lighting system and water supply and establishment of a “Sibol” pre-school facility (Fig. 2.36). As a counterpart, the relocatees provided several hours of labor as sweat equity. Volunteers from nearby medical schools conduct medical missions periodically to provide basic health care. Some idle lots are being prepared for community-based vegetable gardening.

The current beneficiaries belong to the poorest of the poor who were relocated from the blighted areas of Imus. The first batch of relocatees consists of 32 households; the next batch, consisting of 32 more families, is due to relocate before the end of 2008. The land is under a stewardship arrangement with the LGU; thus, beneficiaries will neither pay a rent nor own the lots. However, they are now assured of a secure home and a more liveable community.

About 1.5 ha of this area is presently idle; therefore, it may be cost-efficient and practical to develop this remaining land to accommodate all the potential PAPs from Imus. This site is considered as the best option, as it will satisfy the demand for within-town resettlement by the PAPs from Imus. The site is within a distance of 4.0 km, 3.2 km and 4.7 km from the retarding basins I1, J1 and B4, respectively. Later on, it may also host the potential PAPs from Imus who will be displaced by the proposed river improvement and drainage works under the Master Plan.

Access roads from the town proper to the site are excellent. Nearby and along the way to the site, residential subdivision sprawl has already started. However, road systems and drainage inside the relocation site need improvement and upgrading. More social facilities such as elementary school, chapel, health center, and covered courts may be needed later in view of the anticipated influx of incoming resettlers. If the DPWH, the municipal LGU and the GK partners can come to an agreement, the land development including additional infrastructure and social amenities prescribed by BP 220 may be included as a component of the project, which may be funded out of the loan proceeds.

(2) Barangay Pasong Kawayan II, General Trias

A 53-hectare land in Barangay Pasong Kawayan II, General Trias was acquired by the provincial government in early 2008 for its shelter program for homeless Caviteños. The scale model and development plans of this resettlement site have been prepared. Land development works are already in progress. Housing development will include construction of economic housing structures (duplex units) for as many as 6,700 families (refer to Fig. 2.37).

The target beneficiaries include *bona fide* Home Development Mutual Fund (Pag-IBIG) members who have the capacity to pay a reasonable monthly amortization so as to guarantee loan repayment. This would ensure recoupment of the development cost and thereby sustain the shelter development program of the province.

Some 25% to 30% of the area will be developed to provide socialized housing units to informal settlers who were affected by demolition along the danger areas. In which case, there is a very good chance that the Pasong Kawayan II site will be able to accommodate all the 84 families from Bacoor and Imus who will be displaced by the proposed off-site retarding basins. The site would likely be ready for occupancy by the time construction starts in 2011. If the DPWH, the provincial government, interested NGOs and the PAPs can come to an agreement, the DPWH may take responsibility for land development including housing units, basic infrastructure (roads, water supply, power and drainage as required by BP 220) and social amenities. As mentioned, these items may be included as a component of the project, the cost of which may be financed out of the loan proceeds.

This resettlement site would be advantageous to PAPs in terms of proximity to government centers, hospitals, schools, markets and other social support infrastructures. It is also within convenient distance from possible places of employment in nearby industrial estates and business parks located in the municipality, where more than 40 companies presently operate.

The only possible disadvantage is that the site is almost 11 km and 13 km away from the point of origin of resettling PAPs from Imus.

(3) Barangay Toclong, Kawit

The provincial government is now negotiating with a landowner to acquire 1.3 ha of land in Barangay Toclong, Kawit. The site is meant for relocating communities from coastal and fish pond areas that were affected by recent demolition activities. Likewise, the municipal governments of Kawit and Bacoor are negotiating with the owners of 2.0 ha and 4.0 ha of land, respectively, in other parts of Barangay Toclong. Later on, these sites may also host the PAPs from Imus and Kawit who will be displaced by the proposed river improvement and coastal dikes under the Master Plan.

Toclong is another feasible site and, owing to its proximity, may be a more acceptable resettlement option to PAPs than the one in Barangay Pasong Kawayan II in Gen. Trias. It is only 3.0 km, more or less from Anabu I-G and Carsadang Bago and 4.5 km from Barangay Tanzang Luma VI. If either of the LGUs agrees to purchase the lot for this resettlement site before the start of construction activities, the DPWH may negotiate to develop the land and provide basic infrastructure and social amenities as the projects' counterpart. Again, these improvements on land may be financed out of the loan proceeds.

(4) Alternative Site other than Three Sites above: Barangay Carsadang Bago, Imus

Alternatively, DPWH as the proponent has an option to acquire the land for resettlement site development through national government (GOP) funds. However, while on-site resettlement is ideal, the cost of residential land in highly urbanizing areas of Imus may be prohibitive. Nevertheless, the possibility of providing only one resettlement site for all the PAPs should be seriously considered during the detailed design stage. Based on outcomes of public consultation meetings, on-site or nearby location within the same municipality appears to be the option most preferred by PAPs. A likely candidate site is an area of land next to one of the retarding basins, possibly retarding basin J1 in Carsadang Bago. This site will be roughly 2-3 km away from the location of the PAPs in retarding basins I1 and B4. A resettlement site near retarding basin J1 offers the greater advantage of having to resettle on-site the PAPs from Carsadang Bago, who comprise the biggest number, 55 families or 65% of the total resettling population.

2.8.6 Recommended Procedures, Strategies and Measures for Resettlement

During the detailed design stage, a full-scale resettlement action plan (RAP) shall be formulated to address the impacts of displacement on affected families pursuant to the DPWH LARRIP Policy and consistent with the JICA's and other bilateral agencies' policy on involuntary resettlement. The over-arching goal is to ensure that the social and economic base of PAPs is improved or, at the very least, restored to pre-project levels. Fig.2.35 is a strategic framework that would serve as a procedural guide for the preparation and implementation of the RAP during the project cycle.

Usually, the DPWH commissions a local consulting firm to prepare the RAP and provide technical assistance in its implementation. Implementation and monitoring of the RAP shall be undertaken by a RAP implementation committee (RIC) in parallel with the project time frame. The RIC shall be organized by the DPWH with the technical assistance of the consultants. This will be discussed in more detail in Sub-section 2.8.7.

Resettlement is a process consisting of three stages: the pre-relocation stage, the relocation stage and the post-relocation stage. The activities, strategies and measures that would be involved in each stage have been discussed extensively in the Master Plan Study Final Report. The most crucial resettlement activities in relation to the proposed retarding basin projects are summarized below.

(1) Pre-Relocation Stage

(a) Social Preparation

The success of the resettlement will hinge on the effectiveness of social preparation activities. This consists of reiterative consultation meetings with PAPs and concerned barangay and municipal officials. This will help clarify misconceptions and level off expectations with respect to the impending relocation, particularly on matters of demolition, resettlement, and compensation, among others. More importantly, social preparation will allow room for PAPs to meaningfully participate in consensus building and decision-making about the options available to them.

(b) ROW Acquisition

Right of way acquisition will involve the following activities:

- Parcellary survey and mapping to delineate the limits of the ROW and segregate the project area from adjacent real property
- Census survey-cum-structure tagging (C/T) operation to identify legitimate PAPs
- Verification of legal ownership of land and tenurial status of PAPs
- Preparation of master list of eligible PAPs
- Socio-economic survey to obtain the socio-economic profile of a representative sample of PAPs
- Inventory and assessment of extent to which PAPs' assets (land and improvements thereon including structures, trees, perennials and crops) are affected
- Appraisal of the current fair market value or replacement cost of affected assets
- Negotiation and payment of the corresponding compensation and/or entitlement to eligible PAPs

(c) Compensation and Other Entitlement

The compensation and entitlement will be subject to negotiation with the PAPs and the Appraisal Committee. The services of the provincial or municipal Appraisal Committee may be tapped for the purpose of determining the fair market value of affected real properties and improvements. This committee is usually chaired by the provincial or municipal assessor, as the case may be, with the provincial/municipal BIR revenue officer and the provincial/municipal engineer sitting as members. Alternatively, a private appraisal committee may be commissioned by the DPWH.

(i) Eligibility Criteria

Only those PAPs residing, doing business, cultivating land or having rights over resources within the project area as of C/T survey date will be eligible for compensation and/or other entitlement, regardless of their tenurial status. The unit of entitlement shall be the household, institution or business establishment represented by the individual or juridical person having legal and established ownership of the affected assets.

Pursuant to RA 7279 or the Urban Development and Housing Act (UDHA), the resettlement assistance shall be extended to the informal settlers if they are underprivileged and homeless Filipino citizens who do not own any real property, whether in urban or rural areas. Professional squatters and squatting syndicates, who attempt to exploit the compensation as pretending the residents, are not eligible for any compensation or resettlement assistance. Neither are the informal settlers, who have been awarded government housing programs and therefore, entitled the resettlement assistance. .

(ii) Entitlement Matrix

Table 2.11 is the compensation matrix that governs land acquisition in DPWH projects pursuant to the LARRIP Policy (2007). Compensation is defined according to degree of impact on economic assets, as follows:

- Land and Structure. PAPs who stand to lose 100% of their fixed assets, whether land or structures, will receive full cash compensation at fair market value for affected property. PAPs who will incur partial loss of fixed assets will be entitled to full compensation, only if the remaining assets are no longer viable for continued use. Conversely, PAPs will be compensated only for the affected portion of the assets if the remaining assets are still viable for continued use.
- Crops, Trees and Perennials. PAPs shall be allowed sufficient time to harvest their crops. Otherwise, regardless of tenure status, PAPs are entitled to cash compensation at present market value for damaged crops, trees and perennials.
- Other Improvements. Cash compensation for affected portion of improvements that will be severely or marginally damaged.
- Leased Agricultural Land. Pursuant to Sec. 7 of Republic Act 6389 of 1971 (Code of Agrarian Reform), agricultural lessees are entitled to the payment of disturbance compensation equivalent to five times the average gross harvest in the last five years. Moreover, Sec. 18 of Executive Order 1035 of 1985 entitles displaced tenants/occupants of agricultural lands to financial assistance equivalent to the value of the gross harvest for one year, based on the average annual gross harvest for the last three preceding crop years, but in no case less that Php 15,000.00/ha.
- Business Loss. PAPs will be entitled to income rehabilitation assistance not exceeding Php 15,000.00 for severely affected businesses.
- Others Forms of Entitlement. Assistance to PAPs who do not own the land (e.g., tenants, renters of house structures) will be in the form of inconvenience allowance (amounting to Php 10,000.00) for relocation and reconstruction of their dwellings; rental subsidy equivalent to the average monthly rental for similar structure; rehabilitation assistance equivalent to Php 15,000.00 (in the form of skills training, if the present livelihood is no longer viable and the PAP will have to engage in new income-earning opportunity) and transportation allowance (if they opt to return to their province of origin).

(d) Resettlement Site Development

The location of resettlement site should be acceptable to PAPs. Acceptability often hinges on: (1) proximity to origin; (2) proximity to employment and livelihood opportunities; (3) accessibility; (4) carrying capacity in terms of population, services and environmental resources; (5) proximity to social infrastructure, especially schools and health facilities. On these criteria, on-site resettlement within the respective LGUs would appear to be the best option to avoid the impoverishment of vulnerable PAPs.

As explained in the previous section, an area near RB J1 in Carsadang Bago would be the most ideal resettlement site, if all the PAPs would agree to resettle there. Alternatively, the remaining undeveloped portion of the GK relocation site in Barangay Alapan II may be developed for all the PAPs, by virtue of a Memorandum of Agreement (MOA) with the municipal government and the GK partners. The use of the existing resettlement sites is a less costly alternative to acquiring new resettlement sites.

The resettlement site in Barangay Pasong Kawayan II in Gen. Trias is also a likely candidate. In order to develop and operate a portion of this site, the DPWH should sit down and negotiate with the concerned LGUs and partner agencies the terms for sharing resources and delineating institutional responsibilities. The mutual agreements will be perfected through a MOA between the parties.

(e) Shelter Development

Low-cost housing is an incentive that would entice PAPs to relocate or move away from the proposed project sites. To ease the financial burden that house construction would entail, the proponent (DPWH) in coordination with the LGU should tap into all possible sources of funds for low-cost housing assistance and provide housing beneficiaries easier access to both individual and community-based arrangements to finance shelter development. However, shelter development plans should consider PAPs' preferences, affordability and willingness to pay. While it may be easier to provide a uniform package for all, some PAPs may prefer economic housing while the low-income groups may be able to afford the cheaper options such as socialized housing, lots only, lot/house rental, rent-to-own schemes, etc.

There are several strategies by which resettlement and shelter development can be made more affordable to PAPs. In Cavite's experience, effective linkaging and partnerships have proven successful in addressing housing needs due to involuntary resettlement. Two models are worthy of emulating, namely: (i) the Gawad Kalinga Program and (ii) the Habitat for Humanity. Both programs subscribe to the holistic approach in shelter development, where communities are organized, assisted in building houses and neighborhood facilities through sweat equity and empowered to re-build their lives with dignity around self-help initiatives and community-based undertakings.

(i) Gawad Kalinga

Gawad Kalinga (GK) translated in English means to "to give care", and it is an alternative solution to the blatant problem of poverty in the Philippines. GK's vision for the Philippines is a slum-free, squatter-free nation through a simple strategy of providing land for the landless, homes for the homeless, food for the hungry and as a result providing dignity and peace for every Filipino.

GK started in 1995 as a daring initiative by Couples for Christ, a church-based NGO, to rehabilitate juvenile gang members and help out-of-school youth in squatter relocation areas. It has now evolved into a movement for nation-building. Together with its partners, Gawad Kalinga is now in the process of transforming lives with the goal of building 700,000 homes in 7,000 poverty stricken communities around the world in 7 years (2003-2010). Local and multi-national corporations began to engage with Gawad Kalinga, thus propelling the movement into a massive scale. To date Gawad Kalinga is in over 900 communities all over the Philippines and in other developing countries. Gawad Kalinga is more than about building houses for the poorest of the poor. It is about providing a decent home by transforming people and communities.

A holistic approach guided the setting up of Gawad Kalinga's key program in Shelter and Site Development. Through TATAG, GK builds colorful, durable and secure homes for the poorest of the poor. TATAG in the Filipino language means "to build" or "to establish." The program also provides other physical structures such as pathwalks and drainage systems, water and toilet facilities, a school, a livelihood center, a multi-purpose hall and a clinic. In some areas, other structures such as basketball courts and libraries are also constructed once basic infrastructure needs are set up. Even the very act of building homes and common facilities teaches new masonry and carpentry skills since the poor "pay" for their homes through "sweat equity" or by building their neighbor's house side by side with the GK volunteers. This not only builds community spirit but also contributes to greater peace.

Some of GK's prominent resettlement projects in Cavite are showcased in

Barangay Alapan II, Imus and Barangay Aguado, Trece Martires City, as shown in Fig. 2.36.

(ii) Habitat for Humanity

Taking a different approach from the scheme of GK, the Habitat for Humanity Philippines provides another model of holistic shelter development work. HFHP builds and rehabilitates simple, decent houses with the help of homeowners (known as "home partner") families, volunteer labor, and donations of money and materials. Habitat houses, however, are sold to home partner families at no profit. Home partners repay through affordable, zero-interest, inflation-adjusted mortgage loans. These monthly mortgage payments are pooled into a so-called "Fund for Humanity" so that the amortization of one house will help build another ("House-for-a-House" principle). Other than new house construction, HFHP also undertakes house renovation or rebuilding and provides community infrastructure needed to improve access to power and water supply,

Unlike the GK, Habitat for Humanity is not a "giveaway" program. In addition to an initial down payment of one-third of the house cost and monthly mortgage repayments, homeowners invest hundreds of hours of their own labor - "sweat equity" -- into building their Habitat house and the houses of others. Additional "muscle" for construction comes from volunteers from local affiliates, partner corporations and organizations, universities, schools, and youth groups. Volunteers even come from other countries, from as far away as Europe and the United States.

Habitat for Humanity's work is accomplished at the community level by affiliates -- independent, locally-run, non-profit volunteer groups, called the Friends of Habitat. These affiliates include LGUs, youth groups, corporations, churches or faith-based organizations, other NGOs, etc. Each affiliate co-ordinates all aspects of Habitat home building in its area. The affiliate selects prospective partner families and secures suitable sites. Homeowners are chosen based on their level of need, their ability to repay the loan and their willingness to work in partnership with Habitat. The affiliate organizes mortgage services, fund-raising and donations of materials, and manpower for constructing houses.

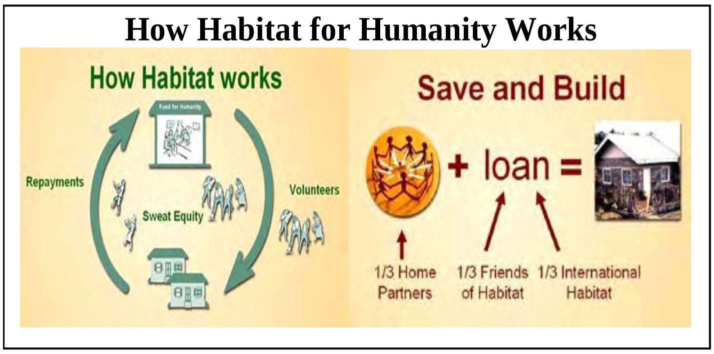


Fig. R 2.25 Schematic diagram showing HFHP's shelter development program.

Donors may choose to sponsor one third of a home partner's house costs; the home partner saves up the other third while the international Habitat community provides the rest. Thus, a concrete house with area of 25-30 square-meters that costs PhP70,000 today can be built for a donation of only PhP 25,000. This funding scheme called "Save and Build" helps potential home partners better afford a house and to promote a savings culture among them (refer the figure above).

The Habitat concept underlies the development of a shelter project known as Isaiah Village located in the Municipality of Maragondon, Cavite. This time, the community partner of HFHP is a local NGO, the Naic Shoreline Kabalikat sa Kaunlaran Foundation.

(iii) Community Mortgage Program

Aside from GK and Habitat programs, an improved Community Mortgage Program can be adopted in the resettlement sites. The CMP is a low-income home financing program conceived by the National Housing Authority (NHA). It gives homeless low-income earners and informal settlers in blighted and priority development areas a chance to own homesteads. Under this program, several beneficiaries will organize themselves into a community association to be able to acquire an undivided privately owned tract of land through community mortgage or micro-financing scheme. A crucial requirement is the willingness of the owner/s of the proposed CMP site to put up the property for sale and the willingness of beneficiaries to corporately acquire the resettlement land.

The LGUs, the NHA, a private developer or an NGO may act as initiator of a CMP project on behalf of interested beneficiaries. A model CMP is a now a GK village called Barangay Aguado Neighborhood Association in Bgy. Aguado II, Trece Martires City. The site is a 1.63 ha privately owned property, which now hosts single detached economic housing units for 183 families who were displaced by the Ninoy Aquino International Airport Project (NAIA) in 1995. The beneficiaries collectively pooled their financial compensation package in order to pay the down payment on the land. The municipal LGU assisted in securing guarantee for loan to pay the balance, which the homeowner's association continues to collect from the members until the full amount is paid. It also helped with land development and provision of good roads, individual water supply and electricity connections. The Gawad Kalinga adopted the association in 2000 and improved the community by donating materials for housing improvement, construction of alley pathways, street lights, a multi-purpose hall, a worship center, and a pre-school called "Sibol" (see Fig. 2.36). Values formation education is at the core of the community's success.

(iv) Private Developers

Private land developers play an active role in the provision of shelter for the Caviteños. Land development firms have the technical expertise and material, manpower and financial resources that may not be readily available to their government counterparts. The success of partnership with this interest group has been proven over time by the experience of NHA in their various housing projects in Cavite. The provincial government plans to harness the strength of such partnership by inviting private developers to participate by way of socialized housing credits.

(v) Home Development Mutual Fund (HDMF)

The Home Development Mutual Fund is more popularly known as Pag-IBIG Fund. Pag-IBIG is an acronym which stands for Pagtutulungan sa Kinabukasan: Ikaw, Bangko, Industria at Gobyerno. This means that Pag-IBIG Fund is a cooperation of four sectors of the society, namely, the individual member, the banks, the industries and the government. Its primary aim is to provide contributing *bona fide* members with adequate housing through an effective savings scheme. The Fund is being administered by the National Housing Authority. Initially limited to employees of government who are members of the Government Service Insurance System (GSIS) and employees of private companies who are members of the Social Security System, membership has now expanded to also benefit the self-employed groups with informal income, the overseas Filipino workers, and non-earning spouses.

Pag-IBIG has evolved from an institution primarily for savings and housing into a fund facility that covers almost all other needs. It's recent innovations include programs for short-term multi-purpose loans, corporate housing development, direct home lending, social housing development loan, joint venture with land developers, group land acquisition (such as the CMP), and grants-in-aid for Resettlement Assistance Program for LGUs (RAP-LGU), among others.

(2) Relocation Stage

(a) Demolition and Eviction

The Urban Development and Housing Act of 1992 (UDHA) provides that summary eviction proceedings may be initiated against "professional squatters" or members of "squatting syndicates" without benefit of any resettlement assistance. Nevertheless, the RAP should prescribe guidelines and procedures governing humane conduct of demolition and eviction of PAPs, consistent with the UDHA's intents. Emphasis is placed on the adequacy of social preparation and consultation activities. As far as possible, PAPs should be allowed to voluntarily dismantle their structures to ensure minimum damage and reuse of salvageable materials. The RAP should also incorporate measures to preclude future encroachment and re-occupation of cleared areas.

(b) Transport and Movement of PAPs

Relocation of PAPs should only be made when resettlement sites are ready for occupancy, along with basic amenities, especially water and power supply. The RAP should specify the schedules, logistics, procedures and institutional responsibilities for identification and transport of people and belongings, including arrangements for temporary services (food, water, emergency medical care, waste management, and other provisions) en route to, upon arrival and during transition period at the new site. A contingency plan should be prepared, in anticipation of possible resistance to demolition and relocation by certain PAPs and nuisance groups.

(3) Post-Relocation Stage

Project-induced displacement affects the social support systems and income earning capacities of PAPs. Often, financial compensation and resettlement assistance alone are not sufficient to re-establish them. Post-relocation strategies and measures are further needed to re-establish the social and economic base of PAPs more quickly.

Cavite has been the favorite destination of government relocation programs since the '70s. Thus, backed by years of experience and riding the tide of rapid urbanization, shelter agencies could harness a number of possible restoration and rehabilitation options for PAPs. Interestingly in Cavite, the success stories in resettlement are often due to effective partnership and linkaging between the LGUs, national line agencies, NGOs and the people's organizations. The relocation efforts with respect to the priority retarding basin projects should replicate, if not improve on, the resettlement models that are already proven to work.

Some of the possible social rehabilitation and livelihood development programs that may be considered during the RAP preparation are discussed below. These programs should be studied in greater depth and tailor suited to the specific needs and socio-economic conditions of the resettling families and their host communities. Particular attention should be paid to PAPs' absorptive capacity in terms of motivation and aspiration, knowledge and skills, social and political environment, organizational and leadership capability, needs and demands.

(a) Social Rehabilitation and Re-integration

The social support networks of PAPs should be re-established at the relocation site and the social services made available to them through community efforts. A sound community organization/ community development and social integration program will hasten this process. The holistic programs of the GK and Habitat provide a model worthy of replicating in the potential resettlement sites.

Aside for community build, GK includes the following among its key programs:

(i) *Child and Youth Development* - GK provides values-based education for pre-school children, aged 3 to 6 years old through its program called SIBOL, which means "to grow" in the Filipino language. For street children aged 7 to 13 years old, there are academic tutorials, sports, creative workshops and values formation program through SAGIP, which means "to save a life" in Filipino. There are also scholarships, counseling and rehabilitation program for juvenile delinquents through the SIGA program, to help them live productive lives without committing them to rehab institutions. SIGA in the Filipino language means "to light."

(ii) *Health* - LUSOG, meaning "healthy" in Filipino, is GK's program for community health care. Volunteer team of doctors and paramedical practitioners conduct feeding and health education programs to arrest malnutrition and improve hygiene.

(iii) *Productivity* - Through GAWAD KABUHAYAN (translated to "to give livelihood" in Filipino), GK conducts livelihood and skills training, provides start up capital and materials for microfinance and micro-enterprise, and assists in the marketing of the GK communities' products. Food self sufficiency is highly encouraged by teaching technology for backyard farming, urban agriculture and poultry-raising.

(iv) *Values formation/Community Empowerment* - Every GK community is organized into a KAPITBAHAYAN Neighborhood Association, which is established to inculcate stewardship and ensure accountability, cooperation and unity. Guidelines for community living are decided upon by the members, and new leaders who espouse the values of the association start to emerge. Peace is achieved not by force, but by mutual adherence to an agreed set of values. This new culture is the key to the community's sustainability, and sets the community on the road to self reliance.

(v) *Environment* - GK empowers the poor to become caretakers of the environment instead of being its exploiters. GK teams plant fruit-bearing trees in and around GK communities and produce seedlings for tree-planting. They also educate the poor in solid waste management in partnership with environment groups and government agencies. GK also provides clean, potable water for domestic use in order to improve the quality of life for the poor.

(vi) *Tourism* – Some GK communities showcase the best of the Filipino--warmth, hospitality, and the many colors and dimensions of Filipino culture. The aim is to make every GK Village a tourist spot showcasing the inherent uniqueness of each community. GK develops performance arts, painting, sculpture and literature to strengthen the community's sense of identity and pride in the Filipino heritage.

For its part, Habitat for Humanity is also deeply involved in community development other than organizing and coordinating volunteer building activities. Shelter development is intrinsically linked to a strong nurturing and values-formation component through Adopt-a-Community program, which promotes a culture of savings and works at the same time for land tenure. Some of the more specific community-based programs include education, livelihood, skills training, savings & microfinance, preventive health care and herbal medicine, garbage recycling, and environmental advocacy. More recently, Habitat started a building for peace program among war-torn communities involving Muslim and Christians in Mindanao.

The holistic shelter development models just described all help to re-establish the resettlers' sense of belonging and hasten the process of integrating the newcomers into the life of the community. In most of these efforts, the receiving LGUs and receiving communities have played a major role in facilitating this social rehabilitation process. Host barangays/municipal LGUs were called upon to extend the social services to meet the added burden for health care, schools, sport/recreational activities as well as maintenance of peace and order, harmony and livability in the resettlement sites.

(b) Livelihood and Income Restoration Program

(i) Livelihood and Employment Development

Windows of economic and income-earning opportunities should be readily available and accessible such that the economic rehabilitation of PAPs will be hastened. Based on the initial profile, the some households that are headed by females and senior citizens are extremely vulnerable to further impoverishment interviewees include more than 50% of households that belong to the poorest of the poor; a third of the families that belong to the female-headed households, and more than 15% that are headed by senior citizens who are 60 years old and above and are beyond their economically productive years.

The poorest of the poor could benefit from the flagship livelihood programs of the province under the auspices of the Provincial Cooperative, Entrepreneurial and Livelihood Development Office (PCLEDO) in partnership with government support agencies (TESDA, DECS, DTI, etc.), the academe, financial institutions, industries and NGOs. Agri-aqua production, coined as Maliksing ISDA (Integrated Sustainable Development Aquaculture) are among these flagship programs, which introduces rice-and-tilapia culture, backyard fish farming, fresh and marine water fish caging. A variation of this program, “ISDABest” trains and loans out fishing boats, fishnets and other paraphernalia, and fish/prawn fingerlings to beneficiaries, which include poor farmers and fisherfolks. Some LGUs and NGOs conduct sewing classes, computer literacy, automotive mechanics and adult education programs for mothers and out-of-school youths.

The PCLEDO also regularly holds the Techno-Livelihood Caravan among poor communities, in coordination with the concerned municipal governments. Known as the “Pangkabuhayang Pagsasanay sa Pamayanan,” the caravan serves as a convergence for cooperative, livelihood and entrepreneurial development. It showcases income-earning options available and the home-made products that low-income families can produce commercially in their backyards. The products include food items (chocolate, cold cuts, boneless bangus, tinapa, fish/squid balls, spicy dried anchovies, fish nuggets, *siomai, tahong chicharon,* crispy crustaceans and seaweeds snacks, fruit preserves, coated candies, etc.) and handicrafts or novelty items (decorative balloons, fashion accessories, flower arrangement, candle-making, liquid soap and conditioner, perfume, disinfectant, etc.). Fig. 2.38 shows photos of PCLEDO’s Techno-Livelihood Caravan held recently in November 2008 in the municipality of Gen. Mariano Alvarez (GMA).

Part of the Gender and Development Plan of the province for 2005-2010 is ensuring equal access by women to labor and employment opportunities through the promotion of self-employment and home-based entrepreneurial activities. Hands-on trainings are now being provided to organized women’s groups through the initiative of the PCLEDO. There are also special livelihood and vocational programs for physically abused and battered women and children.

The menu of livelihood options presently available to female-headed households include micro-enterprise such as buy and sell, direct selling, sari-sari stores, and backyard production. More and more women are now earning through commercial production food products, handicrafts and novelty items, thanks to PCLEDO. NGO-supported livelihood in dried fish production, backyard gardening and vending are also potential sources of income for women. More women are also being equipped for employment in garment factories, microchips and IT industries that now abound in the industrial estates of Cavite.

There is a senior citizens' office established in each municipality as well as a provincial office where the concerns of the elderly are addressed. Still in its infancy, the programs include health and medical assistance, discounts on fare, food, medicines and medical services, and adult literacy. Appropriate livelihood program for the elderly still need to be explored.

However, as already mentioned there is still a need to conduct a more focused socio-economic survey among the identified PAPs to tailor-suit the livelihood options to their present occupations and skills, training and preference. At the same time, an environmental scanning of the host communities will give particular consideration to: (1) resources available in the resettlement area; (2) other relevant programs and projects of the different government and private institutions; (3) for land-based economic activities, availability and size of agricultural area; (5) population carrying capacity; and (6) proximity to urban centers and places of work, among others.

As discussed in Section 2.8.4, a bigger number of the resettling households from all three sites derive their income and livelihood from farming and related agricultural activities. The PAPs would need to engage in new employment and income-earning activities if they will be resettled in areas where land-based activities are limited or related agricultural employment opportunities are scarce. In such case, their skills should be upgraded to match new employment opportunities within the vicinities of the relocation site.

(ii) Skills Development

A thorough skills inventory will be derived from the socio-economic survey. This will provide the basis for a more focused skills development program aimed at upgrading the capability of PAPs to find employment and income-earning opportunities. In particular, there is a need to know the PAPs' specific conditions as to: (1) present livelihood activities and other income sources; (2) special skills, (3) livelihood skills/vocational trainings attended, (4) suitable additional livelihood skills/vocational trainings preferred, (5) natural resources (e.g., tenable land, fisheries and other environmental resources) and institutional support (e.g., micro-credit, training facilities and other social networks) available in the relocation site.

Not a few PAPs are skilled in construction, technical and mechanical works. The few office workers are equipped to handle blue collar jobs and clerical work. With further honing of technical, computer and labor skills, these PAPs would be better qualified and could be given priority for employment in project-related construction works.

(iii) Access to Credit

Inadequate funds for re-capitalization of disrupted business and livelihood, establishment of new ventures, and micro-financing for extremely vulnerable groups would constitute a big challenge to re-establishing the economic base of PAPs.

Through the PCLEDO, LGUs, DTI and partner NGOs, the PAPs can be organized into cooperatives to improve their access to micro-credit and thereby enhance capital formation and market opportunities should be improved. Specifically, access of the poor and women-headed households to affordable financing windows should be enhanced for capital generation. More public and private financial institutions, through improved NGO-LGU partnerships, can be lured to invest in industry-specific lending, savings mobilization and other self-help, community-based fund-sourcing and capital build-up activities. Again, the experiences of Gawad Kalinga and Habitat for Humanity in livelihood, skills development and capital formation are worth replicating in the resettlement sites.

(c) Estate Management

(i) Lot Award and Disposition

The RAP should outline the manner and procedure by which the LGU will dispose or award the lots and/or housing structures to qualified beneficiaries. The LGU's responsibility will also include securing the tenurial status of PAPs by way of delivery of titles and legal documents to prove ownership. At present, the shelter program in the province needs more teeth to address the vicious cycle of squatting. The practice by beneficiaries of selling their rights or titles to resettlement units only to end up squatting again continues to be a challenge even to experienced shelter agencies such as the NHA.

(ii) Cost Recovery

The RAP should define the schemes and mechanisms by which the LGU expects to recover cost of investments for resettlement land and/or housing development will be recovered.

At present, government shelter agencies have to grapple with the issue of sustainability owing to the difficulty in guaranteeing loan repayment and the recoupment of cost of land/housing development from beneficiaries. Such is the experience with the Bgy. Langkaan CMP. Poor repayment is also a problem in many NHA resettlement sites within private subdivisions, according to officials of these agencies.

(iii) Conservancy and Maintenance

The RAP should clarify agency responsibility for conservancy and maintenance of physical structures. As observed during the Study Team's site visits, basic infrastructure in many resettlement sites are in dire need of repair and maintenance. In contrast, sites under GK and Habitat for Humanity programs fare a lot better. This is because the communities themselves take responsibility for conservancy and maintenance, including beautification activities. This model approach should be replicated in future communities of PAPs to ensure the livability of the resettlement site and its surrounding environment.

2.8.7 Implementation Arrangement

(1) Organization of Resettlement Task Force

An inter-agency resettlement task force (IRTAF) will be organized to oversee the preparation and implementation of the RAP. The proposed organizational structure of the IRTAF is shown in Fig. 2.39.

The Provincial Housing Development and Management Office (PHDMO) or the Municipal Planning and Development Coordinator (MPDC) of Imus, as the case may be, shall be the lead agency of the IRTAF, while the DPWH shall serve as co-chair. The RAP Implementation Committee (RIC) shall be the implementing arm of the IRTAF. Membership of public and private housing and support agencies in the different sub-committees under the RIC will ensure meaningful collaboration in the task of re-establishing the PAPs, including the following:

- National Housing Authority (NHA)
- Department of Social Welfare and Development (DSWD),
- Department of Trade and Industry (DTI)
- Technical Education and Skills Development Authority (TESDA)

- Philippine National Police (PNP)
- Philippine Commission for the Urban Poor (PCUP)
- Urban Poor Affairs Office (UPAO)
- Concerned municipal and barangay LGUs
- Non-government organizations (NGOs)
- People's organizations (POs)

The PAPs should be adequately represented in this body and accorded the right to be heard and to decide on resettlement issues affecting them. In particular, the PAPs' right to equal protection of the law shall be guaranteed through grievance redress procedures and mechanisms. The RIC shall include a Grievance Redress and Arbitration Committee where legitimate complaints could be heard and conflicts over compensation and entitlements could be resolved. The PAPs shall be represented with full voting powers in such committee.

Non-government organizations play a vital role in shelter development. Aside from the movers behind the GK and Habitat for Humanity, there are other international NGOs that are presently in tandem with local government and private entities to empower the poor Caviteños and uplift their social and economic conditions. World Vision works with a local NGO, namely Children's Helper Project, Inc. (CHPI) to help poor communities in Noveleta, Cavite City, and Trece Martires City through environmental advocacy, children's sponsorship, education, and provision of water supply facilities and small-scale livelihood assistance to coastal fishing communities.

Moreover, financial intermediaries in Cavite are beginning to rely more and more on the community partnerships of church-based organizations and people's organizations to make credit windows available for home-based micro-enterprise. Among them, government financial institutions like the Land Bank of the Philippines (LBP) and private banks such as the Capitol City Rural Bank are potential sources of micro-financing for livelihood development among PAPs. CCRB loans out a 6-mo recyclable amount of Php 5,000 to Php 25,000 at very affordable interest rates. The loans support small-scale businesses involving buy and sell, direct selling, variety stores, backyard production and multi-purpose cooperatives, among others. World Vision through its affiliate, Community Economic Ventures (CEV, a national NGO) also provides micro-finance for livelihood and entrepreneurial development among the poor communities in various parts of Cavite.

(2) Budget and Time Frame

International guidelines require that resettlement shall be undertaken as a component of the project. Hence, the RAP shall include a realistic estimate of the costs entailed by resettlement planning and implementation from cradle to grave, including restoration programs aimed to re-establish the social and economic base of PAPs. Loan proceeds and GOP counterpart funds for these purposes shall be earmarked and made available as necessary.

Resettlement activities should be undertaken in parallel with construction activities. The timely availability of funds will help in avoiding delays in project execution. Specifically for land acquisition, payment of compensation and entitlement and generally for implementation of the RAP.

With proper coordination of project schedule, PAPs would be given sufficient time to harvest their crops and re-establish their dwellings prior to demolition and transfer to their new location.

(3) Monitoring and Evaluation

A Monitoring and Evaluation (M&E) plan will be prepared as part of the RAP to ensure regular and periodic collection, analysis and reporting on the progress throughout the resettlement cycle. In-house monitoring shall be done to assess the extent to which resettlement objectives as set out in the RAP are achieved. A Monitoring Sub-committee shall be organized under the RIC for the purpose of in-house monitoring. Monitoring will take place against the activities, entitlements, time frames, budget and target benefits of the resettlement program throughout the project cycle and beyond.

An external monitoring agency may be necessary to evaluate the benefits that accrue to the PAPs as a result of the project in general and the resettlement implementation in particular. A local NGO, an academic institution or a local consulting firm may be commissioned for this purpose.

Table 2.12 is a tentative list of indicators that may be used for monitoring and evaluation. The monitoring results will be useful for management decision support and feedback system.

2.9 Environmental Impact Assessment

2.9.1 Introduction

(1) Objective Projects and Area for EIA Study

The environmental impact assessment is made based on the guidelines of the Government of the Philippines and JICA as agreed in the "Implementation Arrangement for the Study" between the Government of Philippines and JICA. The priority projects as selected through the Master Plan Study include: (a) I-1 flood retarding basin in the Imus River, (b) B-4 flood retarding basin in the Bacoor River and (c) J-1 flood retarding basin in the Julian River. The total area for these retarding basin is 81.5ha and the target flood mitigation effect of the priority project is achieved, only when all of the said three (3) flood retarding basins are completed.

According to the JICA Guideline, the priority project proposed in the Study is classified as Category B requiring only the initial environmental examination (IEE) but not necessarily environmental impact assessment (EIA). However, the guideline of the Philippines requires the EIA when the project contains the construction of reservoir, which has the extent of more than 25ha. Since the flood retarding basins proposed in the priority area exceeds 25ha as described above, the EIA is made for the priority project.

The EIA study area covers the above three flood retarding basins and their surrounding areas of which environmental elements might be affected by the projects. Location and main features of the objective projects are shown in the table below.

For their layouts, see Fig. R 2.15(for I-1), Fig. R 2.19(for B-4) and Fig. R 2.24(for J-1) in Section 2.3, and Fig. 2.15(for I-1), Fig. 2.18(for B-4) and Fig. 2.21(for J-1) in Subsection 2.3.7.

Table R 2.91 Main Features of Three Retarding Basins

Name	Basin Area (ha)	Basin Depth (m)	Municipality	Barangay
I-1	40.0	9	Imus	Anabu – I G
B-4	12.2	6	Imus	Tanzang Luma
J-1	29.0	5	Imus	Carsadang Bago
Total	81.2			

(2) Scope of Work

The EIA study covers the following works.

(a) Identification of environmental elements which might be affected by the projects,

(b) Study on the baseline environmental conditions,

(c) Prediction of environmental impacts,

(d) Examination of environmental mitigation measures,

(e) Preparation of environmental management plan

The EIA study is conducted to meet both guidelines of the GOP and JICA according to the Implementation Arrangement agreed upon between DPWH/Provincial Government of Cavite and JICA.

2.9.2 Environmental Scoping

The environmental elements for the EIA study were identified by the two-dimensional matrix method, based on the results of IEE in the master plan study and field reconnaissance. The matrix was prepared for both construction and operation phases. The adverse impacts were classified as score A to C, namely, (A) stands for large impact, (B) for medium impact, (C) for uncertain, and No Score for no or negligible impact. The scoping matrix is shown in Table 2.13

The environmental elements to be assessed in the EIA study were identified through the above-mentioned scoping as shown in the table below. These environmental elements were agreed in principle through the discussions of the fourth stakeholder meeting held in July 12, 2008.

Table R 2.92 Objective Environmental Elements for EIA Study

Environmental Element		Description
Pre-construction/Construction Phase		
Social Environment	(1) Land Acquisition	Land acquisition of the retarding basin area
	(2) Temporary Land Acquisition	Temporary land acquisition for such ancillary works as spoil bank and construction road
	(3) House Relocation	Relocation of existing houses in the retarding basin area
	(4) Loss of Employment	Loss of employment caused by land acquisition and resettlement
	(5) Disruption of Road	Intersection of roads by construction of the retarding basin
	(6) Disruption of Irrigation Water Use	The retarding basin will intersect irrigation canals, causing the disruption of irrigation water use.
Natural Environment	(1) Groundwater Lowering	Groundwater lowering due to excavation of the retarding basin and it might affect the existing shallow well uses in the neighboring area.
	(2) Clearance of Riverbank Trees	Construction of the retarding basin will require the clearance of riverbank trees on some river sections.
Public Hazard	(1) Air Pollution	Generation of dust by earth works such as excavation, transportation and dumping of soils during construction period
	(2) Water Pollution	River water turbidity due to riverbank/riverbed excavation works during construction period.
	(3) Noise	Noise caused by the operation of construction equipment during construction period
	(4) Traffic Disturbance	Traffic disturbance caused by excavated soil transportation and reconstruction of intersected road during construction period.
Operation Phase		
Social Environment		No notable element
Natural Environment		No notable element
Public Hazard	(1) Solid Waste	Illegal garbage dumping into the retarding basin
	(2) Water Pollution	Wastewater discharge to the retarding basin through illegally connected drainage pipes.

2.9.3 Study on the Baseline Environmental Conditions

The existing environmental conditions are adopted as the baseline for the environmental impact assessment of the proposed projects.

(1) Overall Existing Environmental Conditions

The overall existing environmental conditions of the master plan study area (Imus, San Juan and Canas river basins with a total area of 407.4 km^2) had already been established in the master plan study. The studied environmental items are listed in the table below. For details, see Vol. 1, Chapter 2 and Chapter 3.

Table R 2.93 Studied Environmental Items in the Master Plan Study

Category	Environmental Item	Sub-environmental Item
Social Environment	Population	
	Land Use	
	Economic Profile	Employment, Residential Subdivision, Industrial Estate, Commercial Shop, Tourism, Agriculture, Aquaculture, Family Income
	Water Use	Surface Water, Groundwater
Natural Environment	Topographic Conditions	
	Meteorology/Hydrology	Climate, Tide
	River Conditions	River System, River Features, Flow Capacity
	Flood Conditions	River-overflow Flood, Inland Flood, Flood Inundation Area
	Ecology	Fauna, Flora, Protected Area, River Ecology, Mangrove Area
	Oceanography	Current, Sediment Deposit
	Sediment Runoff	
	Geological Conditions	Stratigraphic Features, Geological Structure
Public Hazard	River Water Pollution	Water Quality, Riverbed Material Quality
	Solid Waste	Domestic Waste, Industrial Waste, Health Care Waste

(2) Supplementary Survey on Existing Environmental Conditions

To grasp the existing environments of the EIA study area in more detail, some supplementary surveys were conducted. The results are described below.

(a) River Water Quality

The water quality of the Imus, Bacoor and Julian rivers were observed at the downstream locations of the retarding basins two times during October to November in 2008. The results are shown in the table below.

Table R 2.94 Sampling Analysis of River Water Quality

River/Location	Sampling Date	PH	DO (mg/l)	BOD (mg/l)	TSS (mg/l)	Oil/Grease (mg/l)	Total Coliform (MPN/100ml)
Imus River: Aguinaldo Highway Bridge (3 km downstream of I-1 Retarding Basin)	10/22/08	7.8	3.7	5.0	6.0	1.1	$38x10^5$
	11/28/08	8.5	2.6	14.0	2.0	3.0	$33x10^4$
	Average	8.2	3.2	9.5	4.0	2.1	$21x10^5$
Bacoor River: SM Bacoor Bridge (5 km downstream of B-4 Retarding Basin)	10/22/08	7.5	0	62	18	< 1.7	$82x10^6$
	11/28/08	8.3	0	100	29	3.6	$49x10^5$
	Average	7.9	0	81	24	2.7	$43x10^6$
Julian River: Toclong Bridge (2.5 km downstream of J-1 Retarding Basin)	10/22/08	8.1	3.3	7.5	6.0	< 2	$46x10^5$
	11/28/08	8.6	1.4	16.0	2.0	10.0	$49x10^4$
	Average	8.4	2.4	11.8	4.0	6.0	$25x10^5$
DENR Criteria for Class C Water		6.5-8.5	5.0 <	< 7 (10)*	**	< 2	$< 5x10^3$

Note: *: Figure outside parenthesis is for rainy season and that in parenthesis, for dry season
**: Not more than 30 mg/l increase

(b) Existing River Water Use

In the master plan study, no river water use was identified for the downstream reaches of the three retarding basins in the Imus, Bacoor and Julian rivers except the blackish water intake from the Imus River to Bacoor fishponds. This was validated by field reconnaissance and interview with local people.

(c) Existing Fauna and Flora

The existing species of plant and wild life in and around the three project sites were identified by field inspection and interview with local residents in September, 2008. The three retarding basin areas are predominantly covered by various kinds of grass with some farming crops (rice, corn and vegetable). Trees are mostly growing on the riverbanks of the Imus, Bacoor and Julian rivers.

(i) Vegetation:

The following 17 species of vegetation are commonly observed in and around the three retarding basins. There are no endangered or vulnerable species to be protected.

Kulape (*Axonopus compressus*), Humidicola/Korniva (*Brachiaria humidicola*), Para grass/Signal grass (*Brachiaria sp.*), Karaparapak (*Calopogonium mucunoides*), Centro (*Centrosema pubescens*), Galud-galud (*Cynodon spp.*), Karikuy-ritkuk (*Desmodium sp.*), Lindi (*Dicanthium sp.*), Malabalatong (*Flemingia sp.*), Madre de cacao (*Gliricidia sp.*), Cogon grass (*Imperata cylindrica*), Kangkong (*Ipomaea aquatica*), Makahiya (*Mimosa pudica*), Guinea grass (*Panicum maximum*), Sakata (*Paspalum conjugatum*), Centro grande (*Pueraria sp.*) and Talahib (*Saccharum spontaneum*). Note: outside of parentheses: common name, within parentheses: scientific name

These vegetation species are mostly available as pasture/grazing and hay/forage for domestic animals. Some species can be used for medical purposes and food.

(ii) Tree:

The trees growing on riverbanks of the Imus, Bacoor and Julian were surveyed for river sections of 1 km upstream and 2 km downstream of the respective project sites. Trees of 24 species were identified by the survey. The species, height, volume and major possible uses of the trees are shown in the table below.

Table R 2.95 Identified Riverbank Tree Species of Imus, Bacoor and Julian Rivers

Common Name (*Scientific Name*)	Height (m)	Quantity	Major Possible Uses
Acacia/Rain Tree (*Samanea Saman*)	4 - 15	Moderate	Timber
Aratilis (*Muntingia calabura*)	4 - 6	Low	Food, firewood
Balete/Banyan Tree (*Ficus indica*)	6 - 12	Low	Ornament,
Kaatoan bangkal (*Anthocephalus chinensis*)	6 – 10	Low	Medicinal use
Kawayan/Bamboo (*Phyllostachys sp.*)	8 – 23	High	Timber, ornament, food, furniture
Bayabas/Guava (*Psidium guajava*)	4 – 5	Low	Food
Bignay (*Antidesma bunius*)	4 – 5	Low	Food
Caimito/Star Apple (*Chrysophyllum cainito*)	6 - 15	Moderate	Food, timber
Camachile/Jungle Jalebi (*Pithecellobium dulce*)	3 - 15	Moderate	Food, tannin extract
Chesa/Eggfruit (*Pouteria lucuma*)	4 - 7	Low	Food, timber
Coconut (*Cocos nucifera*)	7 - 15	Moderate	Food, oil extract, roof thatch
Duhat (*Syzygiumcumini*)	6 -10	Low	Food, timber, wine/vinegar make
Guyabano (*Annona muricata*)	3 - 4	Low	Food, timber, firewood
Indian Fir Tree (*Polyalthia longifolia*)	6 - 10	Low	Ornamental, firewood, food for birds
Ipil ipil (*Leucaena leucocephala*)	5 - 15	High	Fodder, charcoal, flooring, paper pulp
Is-is (*Ficus ulmifolia*)	4 - 5	Low	Food for birds/small animals
Kalios/Siamese Rough Bush (*Streblus asper*)	6 - 10	Low	Paper pulp (Thailand)
Kamias (*Averrhoa bilimbi*)	4 – 6	Low	Food
Mabolo/Kamagong (*Diospyros blancoi*)	12 – 18	Low	Food, timber (but regulated by law)
Mangga/Mango (*Mangifera indica*)	6 – 12	High	Food, wood carving
Neem Tree (*Azadirachta indica*)	9 – 15	Low	Cosmetic oil extract
Sampaloc/Tamarind (*Tamarindus indica*)	10 – 20	High	Food, timber, ornament
Santol (*Sandoricum koetjape*)	10 – 20	Moderate	Food, wood carving
Tibig (*Ficus nota*)	6 -10	Low	Food

Note: 1):Out of parentheses are common name, within parentheses, scientific name
2): Quantity: Low: 1 - 15 trees, Moderate: 16 - 30 trees, High: above 30 trees

Among the above 24 species, Kamagong and Is-is are endemic tree species of Philippines and they are considered endangered or vulnerable.

Kamagong is an endangered species as listed in DAO 2007-1 of DENR and protected by a law of Philippines. It is prohibited to cut Kamagong without a special permit (special private land timber permit) of the Bureau of Forestry, DENR. It is also considered as a vulnerable species by the IUCN (International Union of Conservation of Nature and Natural Resources) red-list. Is-is is considered to be a vulnerable species by the World Conservation Monitoring Center since logging and shift cultivation have decreased its population to a considerable extent.

The above two species are growing on the two riverbank sites of the Julian River. One Kamagong tree and one Is-is tree are on the river bank of the project site. One Kamagong tree is on the river bank 350 m downstream from the project site.

(iii) Wild Life:

The fishes, birds, mammalians, reptilians and amphibians living in and around the project sites were also identified through field inspection and interview with local people. Those are listed in the table below.

Table R 2.96 Identified Wild Life Species in and around the Project Sites

Class	Species	
	No.	Common Name (*Scientific Name*)
Fish	6	Biya (*Gobius criniger*), Tilapia (*Oreochromis sp.*), Dalag (*Channa striata*), Hito (*Clarias sp.*), Gourami (*Trichogaster sp.*), Janitor Fish (*Pterygoplichthys pardalis*)
Bird	7	Olive-backed Sunbird (*Nectarinia sp.*), Blue-capped Kingfisher (*Actenoides hombroni*), Tagak/Egret (*Egretta eulophotes*), Barn Swallow (*Hirundo rustica*), Philippine Bulbul (*Hypsipetes philippinus*), Pygmy Swiftlet (*Collocalia sp.*), Tree Sparrow/Maya (*Passer montanus saturatus*),
Mammalian	3	Fruit Bat (*Ptenochirus jagorii*), Rice-field Rat (*Rattus argentiventer*), Shrew Mouse (*Crocidura grayi*)
Reptilian	5	Gecko/Tuko (*Gekko gecko*), House Lizard (*Hemidactylus frenatus*), Philippine Cobra (*Naja philippinensis*), Sawa/Reticulated Python (*Pythin riticulatus*), Brown Snake (*Lamprophis sp.*)
Amphibian	2	Frog (*Rana*), Toad (*Bufo marinus*)

Among the above 23 species, blue-capped kingfisher is listed as a vulnerable species in DAO 2004-15 of DENR. This species is endemic to Mindanao and mainly lives in primary forest.

(d) Existing Groundwater Use (shallow well)

The excavation of the retarding basins might lower groundwater table in the surrounding areas, affecting the existing shallow well uses. An inventory survey was conducted for the existing shallow wells within the areas bordered by a distance of 500 m from the fringe of the proposed retarding basin during August to September, 2008.

Majority of the wells are covered and served by motor or manual pumps, making it difficult to measure the well depth and well water level. Hence, the inventory was prepared based on the information given from the well owners. Further, a well driller providing services in the area was interviewed to validate the information taken from the well owners.

A total number of the surveyed shallow wells are 80 with the breakdown of 5 for I-1 retarding basin, 39 for B-4 retarding basin and 36 for J-1 retarding basin. The inventory contains the information of location, ownership, water use, estimated well depth, estimated drawdown depth (water level depth measured from ground surface, but mostly unknown), distance from the fringe of the retarding basin and pumping system. The results are shown in Vol. 4, Appendix 4-4. For location of the surveyed wells, see satellite images in Vol. 4, Appendix 4-4.

Among them, 12 wells (2 for I-1 retarding basin, 10 for B-4 retarding basin and none for J-1 retarding basin) are located within the areas covered by a distance of 100 m from the fringe of the respective retarding basins. The inventories of the above 12 wells are shown in the table below.

Table R 2.97 Shallow Wells Located in the Surrounding Areas of the Retarding Basin (Less than 100 m distance from fringe of retarding basin)

Well No.	Located Barangay	Owner	Water Use	Well Depth	Drawdown Depth	Distance from Site	Pumping System
I-1 Retarding Basin							
4	Anabu 1-G	Serapio IIas	D, W	30-60 ft	Unknown	77 m	Motor
5	Anabu 1-G	Honesto Gonzales	W	30-60 ft	Unknown	90 m	Manual
B-4 Retarding Basin							
1	Buhay na Tubig	Reynaldo Bautista	D, W	80-100 ft	Unknown	48 m	Motor
2	Buhay na Tubig	Martin Bautista	D, W	80 ft	Unknown	55 m	Motor
3	Buhay na Tubig	Silvino Bautista	D, W	80 ft	Unknown	58 m	Motor
4	Buhay na Tubig	Kag. Celso Bautista	D ,W	80 ft	Unknown	64 m	Motor
19	Buhay na Tubig	Catalina de Quiroz	W	30-40 ft	Unknown	16 m	Manual
20	Buhay na Tubig	Public Use	W	60-80 ft	Unknown	16 m	Manual
21	Buhay na Tubig	Blue Circle Builders	W	100 ft	Unknown	45 m	Manual
22	Buhay na Tubig	Queen of Angels Learning Center	W	100-120 ft	Unknown	65 m	Motor
23	Buhay na Tubig	Queen of Angels Learning Center	W	40-60 ft	Unknown	70 m	Manual
27	Buhay na Tubig	Southhills Animal Clinic	W	40-60 ft	Unknown	55 m	Manual
J-1 Retarding Basin		No well is identified					

Note: (1) Water Use: D: drinking, W: washing (2) Drawdown Depth: depth between water level and ground surface

(e) Noise

A sampling survey of noise level was conducted for the surrounding residential areas of the three retarding basins at two sites each during the day time of a week-day in October, 2008. The noise level was observed by using a standard noise sampler based on the method prescribed in the Presidential Decree 984. The sampling was made for each site at a certain time of the morning, noon and evening, respectively.

Results of the sampling survey are shown in the table below.

Table R 2.98 Noise Level in the Surrounding Residential Areas of the Projects

Project	Sampling Location	Sampling Time	Min.(dB)	Max.(dB)	Ave.(dB)
I–1 Retarding Basin	Parkdale Classic 1 Subdivision, Bgy. Anabu 1-B	Morning (8:50 am)	45.2	55.5	50.4
		Noon (2:40 pm)	46.9	74.6	60.8
		Evening (6:00 pm)	49.3	64.9	57.1
	Liwayway Homes Bgy. Anabu 1-C	Morning (9:20 am)	45.3	61.0	53.2
		Noon (3:00 pm)	50.6	67.0	58.8
		Evening (6:20 pm)	45.5	63.9	54.7
B-4 Retarding Basin	Queen of Angels Learning Center, Bgy. Buhay na Tubig	Morning (6:40 am)	54.3	75.3	64.8
		Noon (11:40 am)	62.4	84.1	73.3
		Evening (3:50 pm)	58.9	78.3	68.6
	DSM Subdivision (near Imus Motor Pool), Bgy. Mambog I	Morning (7:00 am)	52.1	69.7	60.9
		Noon (11:30 am)	60.6	86.1	73.4
		Evening (4:20 pm)	70.7	85.9	78.3
J-1 Retarding Basin	Grand Residences, Bgy. Carsadang Bago II	Morning (8:10 am)	48.8	58.1	53.5
		Noon (1:40 pm)	45.9	64.0	55.0
		Evening (5:10 pm)	46.4	55.9	51.2
	Villasis Subdivision Bgy. Bayan Luma I	Morning (7:50 am)	46.0	58.2	52.1
		Noon (2:00 pm)	49.5	72.2	60.9
		Evening (5:20 pm)	47.2	71.4	59.3
Average			51.4	69.2	60.3

Note: 1) Three trials were done at each sampling time. The above noise data are the average of three trials.
2) Sampling date: October 22, 2008

(f) Traffic Volume of Roads

A traffic volume survey was conducted for the surrounding roads of the three retarding basins to identify possible transportation routes of the excavated soils and to check possible additional traffic volume of dump truck. The traffic volume was observed at five stations of the five roads during September to October, 2008. Locations of the observation are shown in Fig. 2.40.

Hourly traffic volume by type of vehicles was observed during the day time from 6 am to 8 pm of a week-day for each station. The vehicles were classified by nine types as follows.

Private vehicle I (jeep, van and other similar type), private vehicle II (sedan, ordinary car and other similar type), passenger vehicle I (jeepny and multicab), passenger vehicle II (tricycle and pedicab), truck I (big truck), truck II (small truck), vehicle for hire (taxi, van and other similar type), bus (public bus and tourist bus) and others (single motorbike)

Results of the traffic volume observation are shown in Vol. 4, Appendix 4-5.

The above nine types of vehicles are collectively reclassified into five types in terms of size and speed of vehicles as follows to well meet the objectives of the traffic analysis.

Vehicle type I (private vehicle I, private vehicle II and vehicle for hire), vehicle type II (passenger vehicle I), vehicle type III (passenger vehicle II), vehicle type IV (truck I, truck II and bus) and vehicle type V (single motorbike).

On the other hand, the operation time of the construction works is assumed to be from 8:00 am to 5:00 pm. The peak hourly traffic volume by vehicle type during 8:00 am to 5:00 pm at five stations is shown in Table 2.14.

2.9.4 Impact Assessment and Mitigation Measures

Major impacts on the environmental elements by the project were predicted and possible mitigation measures against the impacts were examined when the impacts exceed the allowable limits. The results are described below.

(1) Pre-construction/Construction Phase:

(a) Land Acquisition

(i) Land Acquisition of Retarding Basin Area

The existing land use of the three retarding basins was surveyed by field inspection with GPS. The land use is categorized into rice field, upland (corn, vegetable, others), grassland and others. The land use of each retarding basin is shown in the table below.

Table R 2.99 Existing Land Use of the Retarding Basins

Retarding Basin	Rice Field (ha)	Upland (ha)	Grassland (ha)	Others (ha)	Total (ha)
I-1	1.6 (0.0)	3.4 (2.5)	33.5 (28.2)	1.5 (0.6)	40.0 (31.3)
B-4	0.0 (0.0)	0.7 (0.0)	7.9 (0.0)	3.6 (0.0)	12.2 (0.0)
J-1	22.8 (11.7)	1.3 (1.1)	3.0 (2.8)	1.9 (1.6)	29.0 (17.2)
Total	24.4 (11.7)	5.4 (3.6)	44.4 (31.0)	7.0 (2.2)	81.2 (48.5)

Note: 1) Others include housing lots, bushes, etc.
2) Areas within parentheses are the developer own land.

The land is owned by a comparatively few owners. About 31 ha or 78% of the I-1 project area (40 ha) is owned by a land developer (Earth and Style Corporation) and the remaining 9 ha is owned by seven resident farmers and one non-resident owner. All the B-4 project area (12.2 ha) is owned by four resident farmers, one non-resident owner, one public institution and one business establishment. About 17 ha or 58% of J-1 project area (29 ha) is owned by a land developer (ACM Land Holdings, Inc.) and the remaining 12 ha is owned by five resident farmers and three non-resident owners.

As shown in the table, a considerable portion of the developer's land is temporarily being cultivated by farmers with or without expressed consent of the developer in J-1 retarding basin.

For the delineation of the land use and developer own land, see Fig. 2.31, Fig. 2.32 and Fig. 2.33 in Section 2.8.

(ii) Temporary Land Acquisition

As described in the following Sub-section (i): “Traffic Disturbance”, the whole excavated soils can be appropriated for reclamation of the future subdivision development areas. Hence, no special spoil bank is necessary. Further, the excavated soils can be transported to the land reclamation sites by using the existing public roads.

Hence, temporary land acquisition for the construction of spoil banks and transportation roads is not necessary.

(iii) Number of Affected Farmers

Number of the affected farmers is estimated to be 27, consisting of 6 owner-operated farmers and 21 tenant farmers. Those are broken down by each project as shown in the table below.

Table R 2.100 Number of Affected Farmers

Category	I-1 Project	B-4 Project	J-1 Project	Total
Owner-operated Farmer (no.)	-	4	2	6
Tenant Farmer (no.)	9	2	10	21
Total	9	6	12	27

(b) House Relocation

Totally, 14 structures (12 house buildings and 2 public buildings) are affected in which 12 families reside. Number of the affected house buildings and resident households in each retarding basin are shown in the table below. On the other hand, the affected non-resident PAPs (project affected persons) of the three retarding basins include 15 landowners, 15 tenant farmers, one public institution and three business establishments. For details, see Section 2.8.

Table R 2.101 Affected House Building and Resident Household

Item		I-1 Project	B-4 Project	J-1 Project	Total
Affected House Building (no.)		1	8	5	14
Affected Resident Household (no.)		1	6	5	12
	Formal Settler	-	4	2	6
	Tenant Resident	1	2	3	6
	Informal Settler	-	-	-	-

Note: 1) Formal settler: owns land and house building, and engaged in farming or other jobs.
2) Tenant resident: owns house building but not land, and engaged in farming or other jobs.
3) Informal settler: owns neither land nor house building, residing as sub-tenant or rent-free occupant and tills land without consent of landowner or engaged in other jobs.

Totally, 12 households have to resettle themselves at new settlements. For details, see Section 2.8.

(c) Loss of Employment and Generation of Job Opportunity

(i) Loss of Employment

The affected 27 farmers will lose their jobs. They need to find new tenant farmlands or change their jobs. However, the other affected persons who are engaged in other jobs may be able to continue the present jobs if they are resettled at a site not distant from the original place. There are three (3) possible resettlement sites of which the most viable one is located at Barangay Alapan II, Imus Municipality. It is 3~5 km distant from the three retarding basins. The site area is about 1.5 ha which is large enough to accommodate for all the affected 12 households.

For details on the income restoration measures and resettlement sites of the PAPs, see Section 2.8.

(ii) Generation of Job Opportunity

The construction works of the retarding basins will require a considerable number of simple laborers for such works as traffic control, site clearance, earth works, revetment works, sodding works and other miscellaneous works. The required average manpower is estimated as follows: 50 persons/day for three years in I-1 project, 45 persons/day for two years in B-4 project and 55 persons/day for three years in J-1 project.

This is a positive impact to increase employment of local people. The employment loss of affected persons can be mitigated by this generation of job opportunity to some extent although it is temporary.

(d) Disruption of Infrastructures and Water Use

(i) Intersection of Road

B-4 retarding basin intersects the Buhay na Tubig road (provincial road) which passes through the center of the retarding basin in the northwest-southeast direction. The intersected distance is about 200 m. However, this road is maintained as present. Conversely, the retarding basin consisting of two ponds is designed. Two ponds are constructed on both sides of the road and hydraulically connected by a box culvert installed under the road.

Hence, the retarding basin will not affect the traffic condition of the road except during the construction period of the box culvert. This adverse effect can be mitigated by constructing a temporary detour road within the retarding basin area.

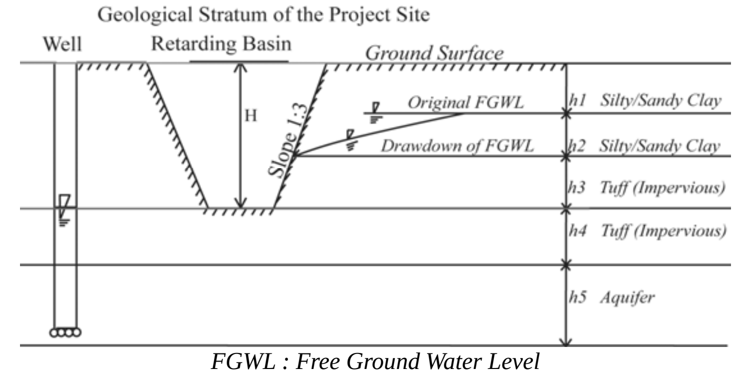
(ii) Intersection of Irrigation Canal

J-1 retarding basin intersects the NIA irrigation canal running through the center of the retarding basin from south toward north. The canal presently supplies irrigation water to the farmlands of about 15 ha located in the downstream of the retarding basin. The intersected distance is about 600 m. However, this irrigation canal is maintained as it is. Conversely, the retarding basin consisting of two hydraulically independent ponds is designed. The ponds are constructed on both sides of the canal.

The retarding basin will not affect the existing function of the irrigation canal.

(e) Groundwater

The geological stratum of the project sites is composed of a surface layer of silty/sandy clay underlain by the tuff. The groundwater is usually extracted from the aquifer existing under the tuff layer. The geological stratum of the project sites is shown at right.



FGWL : Free Ground Water Level

The geological boring was conducted for the three project sites during the period of mid. June to early July of 2008 (rainy season). Thickness of the silty/sandy clay layer and impervious tuff layer of the project sites are shown in the table below, along with the groundwater depth from ground surface and the proposed retarding basin depth.

Table R 2.102 Thickness of Geological Stratum at the Project Site

Item	I-1 R. Basin	B-4 R. Basin	J-1 R. Basin
Silty/Sandy Clay Thickness above GWL(h1)	3 m	3 m	1 m
Silty/Sandy Clay Thickness below GWL (h2)	2 m	1 m	2 m
Tuff Thickness above Basin Bottom (h 3)	4 m	2 m	2 m
Total Excavated Depth of Retarding Basin (H=h1 + h2 + h3)	9 m	6 m	5 m
Observed Groundwater Level Depth in Rainy Season (h1)	3 m	3 m	1 m

Note:FGWL: free groundwater level

The excavation of the retarding basin might lower the groundwater level in the surrounding area. The maximum affected distance (L) from the fringe of the retarding basin is roughly estimated by the following formula.

$L= 3{,}000 \times h2 \times k^{1/2}$

Where, h2: silty/sandy clay thickness between free groundwater level and impervious tuff layer, k: pervious coefficient of silty/sandy clay = 10^{-4} cm/s = 10^{-6} m/s.

The maximum affected distance is estimated at 6 m for I-1 retarding basin, 3 m for B-4 retarding basin and 6 m for J-1 retarding basin. These are considered negligible. On the other hand, all the wells in the surrounding areas of the retarding basins are considered to extract groundwater from the aquifer located under the impervious tuff layer, judging from their well depths.

From the above, it can be concluded that no existing well water uses will be affected by construction of the retarding basin.

(f) Clearance of Riverbank Trees

Construction of the flood water inlet and outlet facilities, revetment and other works clears the riverbank trees growing on their sites. Further, the riverbank trees of the drainage channel flowing through the J-1 retarding basin are also cleared. The strip length of the riverbank trees to be cleared is estimated to be 200 m for I-1 retarding basin, 300 m for B-4 retarding basin and 600 m for J-1 retarding basin. This might decrease the habitats of birds and small animals.

However, the retarding basins are designed to plant trees on almost all their surrounding banks to enhance the landscape/shading and recreation use. The total surrounding bank length is 2.8 km for I-1 retarding basin, 2.0 km for B-4 retarding basin and 2.6 km for J-1 retarding basin.

The above tree planting will mitigate the habitat loss of birds and small animals caused by the riverbank tree clearance.

Endangered/vulnerable species of trees (Kamagong: two tree and Is-is: one tree) are growing on the riverbank of the Julian River. Among them, one Kamagong tree and one Is-is are on the J-1 project site. However, they will not be cleared by designing the layout of J-1 retarding basin properly.

(g) Water Pollution

Most of the construction works are dry works which are executed outside of the river channel. The works which excavate the riverbed are limited to the revetment works at/around the flood water inlet and outlet facilities. The revetment works are executed during dry season when the river channel is dried up. Hence, this work will cause less water turbidity compared to many other rivers.

A small coffer dam enclosing the revetment work site shall be provided to mitigate the river water turbidity as required.

(h) Noise

The existing average noise level during daytime in the surrounding residential areas of the three retarding basins was observed at 60 dB.

The soil excavation works of the retarding basins are conducted by a combination of bulldozer and shovel. The noise generated by bulldozer and shovel is about 105 dB (power level noise). However, the noise level decreases at a high rate according to the distance from the equipment site as follows. For this estimation, see Vol. 1, Chapter 10.

Distance from Equipment (m)	5	10	50	100
Noise Level (dB)	83	77	63	57

The noise level of surrounding residential area during the operation of construction equipment can be estimated by synthesizing the existing noise and equipment noise based on the following formula.

$$L = 10 \log_{10} (10^{(Lo/10)} + 10^{(Le/10)})$$

Where, L: synthesized noise level, Lo: existing noise level of surrounding residential area (=60 dB), Le: equipment noise level reached to the residential area.

The calculated synthesized noise level is shown below.

Distance from Equipment to Residential Area (m)	5	10	50	100
Synthesized Noise Level at Residential Area (dB)	83	77	65	62

As estimated in the above, the noise level may become worse than present in the residences of which distance from the excavation work site is less than 100 m. The residences more than 100 m far away from the excavation work site may not be affected by the operation of construction equipment.

However, the critical fringe area of which excavation work may affect the surrounding residences is limited because;

(i) Residential area closely facing to the retarding basins is comparatively small. The surrounding land is mostly grassland/farmland in I-1 retarding basin, is partly used for factory and partly for open space in B-4 retarding basin, and is still used for farmland/grass land to a considerable extent in J-1 retarding basin.

(ii) The retarding basin area is large. Most of the excavation works are conducted at the sites far from the critical fringe area.

The critical fringe area of which excavation works may affect the surrounding residences is roughly estimated based on satellite images and field reconnaissance as shown in the following table. It is also compared to the total retarding basin area in the same table.

Table R 2.103 Critical Fringe Area of Each Retarding Basin

Item	I-1 R. B.	B-4 R. B.	J-1 R. B.	Total
Critical fringe area of which excavation works may affect surrounding residential area (ha)	5	8	10	23
Total retarding basin area (ha)	40.0	12.2	29.0	81.2
(%)	13	66	34	28

The excavation works within the critical fringe area shall be conducted according to a proper work plan to mitigate the adverse effect on the surrounding residential areas. The work plan will contain the regulation for (i) working time (starting and finishing time of works), total working hour per one day (iii) continuous working days at one place and (iv) no work on Sunday/holidays.

The excavation works in the other areas can be conducted in the ways normally adopted in Philippines.

(i) Traffic Disturbance

Transportation of the excavated soils might cause traffic disturbances on the transportation roads to the spoil banks when the public roads are used for transportation.

According to the information from the Provincial Government and Imus Municipal offices, a large volume of soils will become necessary in the near future for reclamation of the urban/housing developments in the surrounding areas of the three retarding basins. Hence, all the excavated soils can be appropriated for land reclamation of the surrounding areas. As shown in Fig. 2.24 attached, the possible reclamation area (soil dumping area) is estimated to be 167 ha for I-1 retarding basin, 59 ha for B-4 retarding basin and 135 ha for J-1 retarding basin. On the other hand, the required dumping volume of soils are estimated to be 1,900,000 m^3 for I-1 retarding basin, 540,000 m^3 for B-4 retarding basin and 1,000,000 m^3 for J-1 retarding basin.

The required soil dumping area (reclamation area) is calculated to be 95 ha for I-1 retarding basin, 27 ha for B-4 retarding basin and 50 ha for J-1 retarding basin by assuming the average reclamation depth as 2.0 m. The above soil dumping area will be selected from among the possible reclamation area, considering the time-schedules of the retarding basin construction and land development.

A considerable portion of the excavated soils in I-1 and J-1 retarding basins can be dumped on the adjacent land reclamation areas without using the existing public roads and construction of any transportation road is not necessary for this soil dumping as well. The remaining portion of the soils should be transported to the reclamation areas by using the exiting public roads. In this study, it is conservatively assumed that 50% of the excavated soils of each retarding basin shall be transported by using the public roads.

However, all the excavated soils of B-4 retarding basin shall be transported to the surrounding reclamation areas by using the existing public road.

The transportation road, existing traffic volume, additional traffic volume (dump truck), maximum road distance to be used and existing road conditions are shown in the table below.

Table R 2.104 Traffic Conditions of Soil Transportation Roads

Item	I-1 R. Basin	B-4 R. Basin	J-1 R. Basin
Transportation Public Road	Anabu I-A road	Buhay na Tubig road	NIA road
Existing Peak Hourly Traffic Volume (one way vol.)	77 (130) vehicles/hr	386 (655) vehicles/hr	68 (221) vehicles/hr
Additional Traffic Volume of Dump Truck (one way vol.)	26 vehicles/hr	17 vehicles/hr	12 vehicles/hr
Operation Period	240 days/yr for 2.5 year	240 days/yr for 1.5 year	240 days/yr for 2.5 year
Max. Road Section to be Used for Soil Transportation	From project site to crossing with Buhay na Tubig road: 1.5 km	From project site toward southeast: 2.0 km	From project site toward south: 2.0 km
Existing Road Conditions	2 lanes road of 5 m width , asphalt/concrete pavement with partially gravel	2 lanes road of 6 m width, asphalt/concrete pavement	2 lanes road of 6 m width, concrete pavement

Note: Figures outside parentheses are four-wheel vehicle volume excluding tricycle/pedicab and motorbike, while figures within parentheses are total volume including tricycle/pedicab and motorbike.

The degree of road congestion is assessed by an indicator of volume capacity ratio (VCR) which is widely used in Philippines. The VCR is obtained by dividing the actual traffic volume (converted traffic volume into passenger car unit) by the capacity of the road. The conversion rate is usually assumed to be 1.0 for vehicle type I and II (van, jeep, sedan, ordinary car, taxi, jeepny, etc.), 2.0 for vehicle type IV (truck and bus) and 0.75 for vehicle type III and V (tricycle, motorbike, etc.).

On the other hand, the congestion level is usually categorized into six levels as shown in the table below, corresponding to the VCR.

Table R 2.105 Categorized Congestion Level

Category	Characteristics	VCR
A	Condition of free flow with high speeds and low traffic volume. Drivers can choose desired speeds without delays.	< 0.2
B	In the zone of stable flow. Drivers have reasonable freedom to select their speed.	0.2 – 0.45
C	In the zone of stable flow, Drivers are restricted in selecting their speed.	0.45 – 0.70
D	Approaches unstable flow with nearly all drivers restricted. Traffic volume corresponds to tolerable capacity.	0.70 – 0.85
E	Traffic Volumes near or at capacity. Flow is unstable with momentary stoppages.	0.85 – 1.00
F	Congested flow at low speeds. Long queues and delays.	1.00 <

The volume capacity ratios (VCR) of the existing and with project conditions are calculated as shown in the table below.

Table R 2.106 Volume Capacity Ratio (VCR) of Existing and With Project Conditions

Road	Capacity (pcu)	Existing Condition			With Project Condition		
		Peak Vol. (pcu)	VCR	Category	Peak Vol. (pcu)	VCR	Category
Anabu 1-A road	1,440	126.75	0.074	A	178.75	0.124	A
Buhay na Tubig road	1,440	629.75	0.437	B	663.75	0.461	C
NIA road	1,440	191.75	0.133	A	215.75	0.150	A

Note: pcu: passenger car unit

The traffic disturbances due to soil transportation are assessed and necessary mitigation measures are proposed as follows, based on the above analyses and field inspection.

(i) Anabu I-A Road

The road passes through grass/farm land areas. There are no road crossings for the road section of 1.5 km distance. The existing traffic volume is comparatively small. The traffic congestion level is categorized as A for both existing and with project conditions.

Hence, the additional traffic for soil transportation will cause no significant traffic disturbance if a necessary traffic control is performed.

(ii) Buhay na Tubig Road

The road passes through comparatively sparse built-up areas. There are no road crossings for the road section of 2.0 km distance except Anabu I-A road which joins at the southeastern end. Both sides of the road are provided with an unpaved road shoulder of 1-2 m width, respectively.

The traffic was smoothly moving during the traffic observation time although the volume was comparatively large. It was also confirmed by the interviews to local people that the traffic is moving smoothly at a normal day time. The traffic congestion level is categorized as B for the existing condition, however, categorized as C for the with project condition.

The dump trucks for soil transportation will worsen the present situation to some extent. The following measures shall be taken to mitigate this adverse effect.

- Arrange sufficient traffic controllers at the key sites of the road section of 2.0 km.

- Construct a simple pavement of the road shoulders so that tricycles and motorbikes can drive on the shoulder as required.
- Operation time of soil transportation is limited to avoid the peak traffic time in the morning and evening.

(iii) NIA Road

The road passes through comparatively sparse built-up areas. There are no road crossings for the road section of 2.0 km distance. The existing traffic volume of four-wheel vehicles is small. The traffic congestion level is categorized as A for both existing and with project conditions.

A considerable number of tricycles/pedicabs are driving or spotted around the southern end of the transportation road section. However, most of the dump trucks for soil transportation are not necessary to drive up to such a congested area.

Hence, the additional traffic for soil transportation will cause no significant traffic disturbance if a necessary traffic control is performed.

(2) Operation Phase:

(a) Solid Waste Disposal

At present, garbage is illegally dumped in the river channels or public open spaces due to the insufficient garbage collection system of the municipality and the lax discipline of residents. Illegal dumping is frequent in the congested poor areas. However, the three retarding basin sites are presently not being affected by such illegal garbage dumping. It may be due to that the sites are a little distant from the residential area and are well managed by the landowners.

The constructed retarding basins might be subject to people's illegal garbage dumping in their fringe zones which neighbor to the residential area in the future.

It is predicted that the surrounding lands of the three retarding basins will be entirely developed for the subdivisions in the future. They are considered to be above a certain level in sanitary or environmental quality, judging from the completed/ongoing subdivision projects. Illegal garbage dumping in the subdivision areas is considered less, different from the congested poor areas.

Further, some part of the retarding basins is designed to be used for recreation purpose. This will give an incentive to the people to maintain the retarding basins clean. For design of the retarding basins, see Fig. 2.10, Fig. 2.12 and Fig. 2.14 attached.

The responsible organization for the operation and maintenance of the retarding basins shall periodically collect the dumped garbage and transport them to the nearby transfer station of garbage to take part in the new solid waste disposal system of Cavite Province. The new solid waste disposal system is expected to start soon. For the new solid waste disposal system, see Vol. 1, Chapter 6, Section 6.4.

On the other hand, the municipality of Imus had organized a team for the "Save Imus Rehabilitation Project (SIRRP)" in 2005, and since then, various programs of the information and education campaign (IEC) for the cleanup of Imus River have been carried out. The team is composed of governmental and non-governmental members headed by the vice mayor of Imus municipality. The NGO named "Sagip-Ilog Cavite Council" acts as secretariat of the team.

The team shall further promote the IEC to maintain the retarding basins clean.

(b) Water Pollution

Presently, no waste water is discharged to the I-1 and B-4 retarding basin areas, while in the J-1 retarding basin area, waste water of some residential area is drained to the Julian River by a small drainage channel passing through the retarding basin area. This channel is designed to directly drain into the Julian River, detouring around the retarding basin from flood control aspect. Further, each retarding basin is designed to have a low surrounding dike with a small drainage channel.

Wastewater from the surrounding residential areas will not enter the retarding basin but be drained to the river through this small channel. Hence, water pollution of the retarding basins is not predicted.

The overall predicted environmental impact and mitigation measures are summarized in Table 2.15

2.9.5 Future Environmental Conditions without the Project

Flooding conditions of the project area (Imus, Bacoor and Julian river basins) will become worse according to the increase of population and land development in the future under the condition of without project. The predicted flooding area and flooded number of houses in 2020 without project are shown in the table below, compared with the existing conditions.

Table R 2.107 Future Flooding Conditions without Project

Flood Scale	Existing Conditions		Future Conditions in 2020	
	Flooding Area (ha)	Flooded House (No.)	Flooding Area (ha)	Flooded House (No.)
2-year	839	6,911	940	15,653
5-year	1,175	11,459	1,246	23,928
10-year	1,378	14,534	1,435	28,520

The land (grassland/farmland) of three retarding basins with a total area of 81.2 ha will entirely be converted to the built-up area in the future to accommodate the increasing population if the project is not implemented. As a result, requirement of the treatment of public hazards such as wastewater, solid waste, etc. will increase in this area.

Future natural environmental conditions without project (climate, topography, geology, ecology, etc.) of the project sites will scarcely change from the present conditions.

2.9.6 Environmental Management Plan (EMP)

The EMP is an action plan of various key mitigation measures for major identified impacts. The EMP includes the following major component programs: (i) construction management program, (ii) social development program and (iii) environmental monitoring program. Their general contents to be included are described below. The detailed programs will be prepared at the detailed design stage based on the results of the detailed engineering design and consultation of the affected households.

(1) Construction Management Program

The project proponent (DPWH) shall implement the construction works based on the proper program to mitigate the predicted impacts. The proper construction program will include the followings.

Proper scheduling of soil excavation works, proper operation of construction equipment for soil excavation and transportation works, control of dumped soil runoff, control of river water turbidity, careful clearing of riverbank trees, careful disposal of waste (incl. cleared vegetation, solid waste), provision of sanitation facilities for construction camp, arrangement of safety control staffs and others.

(2) Social Development Program

(a) Information, Education and Communication (IEC)

IEC is imperative to obtain the support of, establish the linkage with, and solicit the participation of the stakeholders (not only affected households but also a broader sector of stakeholders) in implementation of the project. The IEC includes the following major information.

- Information dissemination on the results of the EIA study,

- Information on the design of the flood retarding basin and right of way which are finalized based on the detailed engineering design and consultation with the affected households.
- Information on project implementation and monitoring plan

The IEC will be performed in the following manner: (i) distribution of fact sheets, (ii) publication in the local news papers, (iii) discussion in the municipality/barangay assembly meetings and (iv) seminar/conference.

(b) Land Acquisition and Resettlement

The land acquisition and resettlement program shall be prepared and finalized, based on the government guidelines and consultation with the affected households. It shall include an entitlement and compensation scheme which will cover productive land and crops, residential land and house, other structures and loss of employment. Further, it shall include the proposed plan of resettlement site. For the preliminary land acquisition and resettlement program, see Section 2.8.

(c) Employment and Livelihood

Some affected people might lose jobs due to the land acquisition and house relocation. The government shall assist in vocational training and creation/introduction of jobs. For preliminary income restoration program of the affected people, see Section 2.8.

On the other hand, local employment during construction period should be given priority to the directly affected communities. Certain arrangements with contractors shall be made to achieve this local employment. This local employment will include: (i) hiring of the people in construction works and (ii) use of local supplies and services.

(3) Environmental Monitoring Program

The environmental monitoring is conducted to;

- Ensure that the mitigation measures are being conducted as planned.
- Determine the effectiveness of the mitigation measures and recommend for corrective or additional mitigation measures as required.

The major monitoring items include the followings.

(a) Pre-construction/Construction Phase

<u>Social Environment</u>: (i) progress of land acquisition and house relocation, (ii) infrastructure conditions of new settlements and (iii) achievement of income restoration

<u>Natural Environment</u>: (i) erosion of riverbank, (ii) clearing of riverbank trees and (iii) runoff of dumped soils

<u>Public Hazard</u>: (i) river water pollution, (ii) air pollution (iii) noise, (iv) traffic disturbance and (v) solid waste of construction camp site

(b) Operation Phase

Public hazard: (i) illegal garbage dumping into the retarding basin and growth of grass in the retarding basin

The environmental monitoring plan is proposed as shown in Table 2.16.

Usually, a multi-party monitoring team will be established to take charge of the preparation of the final monitoring plan including the conduct of monitoring activities in accordance with DAO 2003-30 of DENR. The team will be composed of (i) project proponent (DPWH) representatives, (ii) DNR-EMB representatives, (iii) LGUs representatives, (iv) NGO, and (v) other stakeholders as required.

The team shall submit the monitoring report to the EMB of the DENR periodically.

2.9.7 Results of Stakeholder Meetings held in F/S Stage and the Countermeasures on their Views

In F/S stage, three (3) Stakeholder Meetings have been organized to disseminate the study and reflect a diverse range of views on stakeholders regarding the contents of priority components for flood mitigation including the construction of three (3) retarding basins in Imus River Basin as well as non-structural measures. Their results and actions taken in the Study are summarized as follows and their minutes are attached as Appendix-9 in Volume IV.

Table R 2.108 Summary of Stakeholder Meetings organized in F/S Stage

No.	Contents	
	Item	Details
4th Stakeholder Meeting	Date:	9:00~12:00, Jul. 12, 2008
	Venue:	Sangguniang Bayan Hall, Imus
	Participants:	Statesman/Administrators: 5; Provincial Officer: 9; LGU Officer: 10 National Gvrnmnt.: 4; Residents: 9; NGO/Academia:2 Media: 4; Study Team/Consultants/Staff: 4; Total : 62
	Agenda:	Presentation of Master Plan Results and selected Priority Project of the Study
	Principle Queries/ Comments	G. Availability of the area whether the retarding basins can be used or not for other purpose.
		H. Concerns regarding erosion of slope in the Retarding Basins
	Action taken in the Study	(Actions for G): Retarding Basins have been designed so as to be used for other purposes in dry seasons.
		(Actions for H): Slope of excavation/embankment of the retarding basins has been set gently taking into geo-engineering consideration as well as usability of the basins for multipurpose use.
5th Stakeholder Meeting	Date:	9:00~12:00, Sep. 30, 2008
	Venue:	Sangguniang Bayan Hall, Imus
	Participants:	Statesman/Administrators: -; Provincial Officer: 9; LGU Officer: 14 National Gvrnmnt.: 9; Residents: 15; NGO/Academia:3 Media: -; Study Team/Consultants/Staff: 12; Total : 62
	Agenda:	Presentation of Progress of F/S (design of retarding basin incl. the EIA and results of flood hazard map production)
	Principle Queries/ Comments	I. Concerning of dry up of existing wells due to construction (excavation) of retarding basins.
		J. Appeal for relocation to nearby location
		K. Dissemination of flood hazard map toward other municipalities
	Action taken in the Study	(Actions for I): Shallow well inventory survey and the evaluation were conducted in detail for impact assessment.
		(Actions for J): Selected and proposed relocation site was considered in nearby area from each retarding basin.
		(Actions for H): Provincial Government prepared another workshop for municipal officers to master development of communal flood hazard map.
6th Stakeholder Meeting	Date:	9:00~12:00, Dec. 9, 2008
	Venue:	Sangguniang Bayan Hall, Imus
	Participants:	Statesman/Administrators: -; Provincial Officer: 7; LGU Officer: 10 National Gvrnmnt.: 4; Residents: 28; NGO/Academia:2 Media: -; Study Team/Consultants/Staff: 6; Total : 57
	Agenda:	Presentation of Draft Results of F/S (design of retarding basin incl. the EIA incl. resettlement plan and results of non-structural measure activities)
	Principle Queries/ Comments	L. Repeating Appeal for relocation to nearby location
		M. Appeal for relocation to nearby location
		N. Availability of fund source for immediate commencement of the priority project
	Action taken in the Study	(Actions for L): Selected and proposed relocation site was considered in nearby area from each retarding basin.
		(Actions for M): Design of retarding basins was considered with affected facilities.
		(Actions for N): Preparation of a resolution by LGUs to National Government such as DPWH and NEDA

Note : *1: Numbering of Stakeholer Meeting applied for running number system from Master Plan.

Chapter 3. Promotion of Community Based Flood Mitigation Activities

3.1 Cleanup Drive of Waterways

3.1.1 Entire Activities

Based on baseline surveys conducted during the last Study Period, majority of the respondents agreed that the public awareness on the necessity of cleanup drive waterways should be enhanced in order to maintain the river flow capacity in Cavite low land areas and at the same time to preserve the appropriate river environment. Hence, the pilot projects for information and education campaign was undertaken by JICA Study Team in collaboration with the relevant government agencies and NGOs to raise awareness of solid waste management related to river cleanups.

The first pilot projects were made for two municipalities of Imus and Kawit during the 2nd and 3rd Field Survey Period from October 2007 to February 2008. Then, the second pilot projects were further expanded to other five municipalities of Tanza, Rosario, Bacoor, Noveleta and General Trias, during the Forth Field Survey Period from April to June 2008 based on the knowledge accumulated in the first pilot projects. These pilot projects are particularly intended for the informal settlers residing along the riverbanks in both municipalities. The photographs of the activities for the pilot projects are as shown in Vol. 4 Appendix 2-1.

Based on the experiences gained through the above pilot projects, the Manual on Community-based Disaster Prevention, Information and Education Campaign on Solid Waste Management related to river cleanups and flood mitigation preparedness has been finally prepared as described in Vol. 4 Appendix 2-2.

3.1.2 First Pilot Projects

(1) Pilot Project in the Municipality of Imus

For the Municipality of Imus, the project targets the selected barangays along the riverbanks, which is approximately within the distance of 20km. Activities of the Pilot Project include Information and Education Campaign (IEC) activities through training of trainers, conduct of community workshop and tree planting. The schedule of Imus project is shown in Table R 3.1 and Table 3.1. The project activities have been supported mainly by a local NGO, the Sagip Ilog Cavite Council, Inc.

Table R 3.1 Schedules of Pilot Project Activities – Municipality of Imus

	Proposed Project Activities	Time Frame
1	Training Program (Module) Development	October 2007
2	Trainers' Training	January 2008
3	Conduct of Community Workshop	February 2008
4	Tree Planting	February 2008

(a) Training Program

The training materials had been prepared with the guidance of the Sagip Ilog Cavite Council (refer to Vol. 4 Appendix 2-3). These materials are intended to serve as a guide to trainers/facilitators in conducting information, education and communication (IEC) activities.

After the preparation of the training materials, training program was conducted on January 11, 08 by the Sagip Ilog Cavite Council and the Municipal Government of Imus. A total of 71 persons participated. Participants were mostly schoolteachers with some barangay officials and LGU representatives.

(b) Community Workshop

The participants of the Trainers' Training together with the staff from Provincial Government – Environment and Natural Resources Office (PG-ENRO), Municipal

Environmental and Natural Resources Office (MENRO) and the NGO-Saguip-Ilog Cavite Council conducted Community workshops in selected barangays for three Saturdays, from February 2 to March 1, 2008,. The schedule and the barangays covered under the community workshops together with number of participants are as follows:

Table R 3.2 Community Workshops in Imus

Date	Barangay Name	Number of Participants
February 2 (am)	Anabu I-A, I-C, I-E, I-F, I-G	51
February 2 (pm)	Anabu II-B, II-C, II-D, II-E, II-F	48
February 9 (am)	Poblacion I-A, I-B, II-A, Tanzang Luma I	45
February 9 (pm)	Palico 1,2,3,4, Tanzang Luma II, III, IV, V, VI	36
March 1 (am)	Toclong I-C, II-A, II-B	40

The morning activities commenced at 7:00 a.m. with a symbolic tree planting in riverbanks or communities followed by the workshops from 9:00-11:00 a.m. On the other hand, the afternoon activities began with the workshops at 2:30 p.m. followed by the tree planting. There was an average of 40 participants per session.

(2) Pilot Project in the Municipality of Kawit

As in Imus, the Municipal Government of Kawit, together with a local NGO-the Kawit Sagip-Ilog (KSI) conducted their activities through their information, education and awareness campaigns. The Pilot Project activities in Kawit focused on the conduct of training programs and development of a comic book to be distributed to the community groups, with the overall goal of further propagating the importance of solid waste management. The work program for the Pilot Project in Kawit is presented in Table R 3.3 and Table 3.2.

Table R 3.3 Schedules of Pilot Project Activities – Municipality of Kawit

Activities	Period/Duration
1. Preparation of Training Material	October 2007
2. Comic Book Preparation	December 2007
3. Trainer's Training	December 2007
4. Printing of Comic Book	January 2008
5. Printing of Materials for Workshop	January 2008
6. Community Workshops	February 2008

(a) Preparation of Training Materials

The training materials had been prepared for both municipalities, as in Imus, with the guidance of the Sagip Ilog Cavite Council (SICC). In addition to SICC's training materials, Kawit Sagip-Ilog (KSI) has also developed the training material, which was combined together with SICC's material (refer to Vol. 4 Appendix 2-4).

(b) Training Program

Two Environmental Educators' Training took place in Kawit under the supervision of the Sagip Ilog Cavite Council, KSI and the Municipal Government. The first one was conducted on November 30, 2007 and the training modules were pilot tested. Another educators' training was organized on January 27, 2008 with representatives from local agencies, senior educators and other community members. The training was conducted in the local language and the representatives from the various agencies were given print outs of the modules used.

(c) Production of the Comic Book

As for the material for the pilot project in Kawit, a comic book was prepared by the local NGO, Kawit Saguip-Ilog (refer to Vol. 4 Appendix 2-5). The comic book presents the historical Kawit and its problems with the solution being developed through the efforts and cooperation of the local government, residents and civil society groups. As this material would be used in the community workshops, a storyline wherein the residents can easily identify was developed.

(d) Community Workshops

The pool of trainers together with the SCCI, KSI and the personnel from the Municipal Government of Kawit organized workshops. As in Imus, these are intended to inform the residents, particularly the informal dwellers on the riverbanks and waterways.

The twenty-three barangays were clustered into six groups in preparation for the workshops. Four workshops in selected barangays in Kawit were conducted. These workshops are intended to further inculcate values on environmental awareness and resource conservation. The invitation was channeled through the local unit of the Department of Education and the various schools to ensure the participation of the parents. The schedule of the workshops is as follows:

Table R 3.4 Community Workshops in Kawit

Date	Barangay name	Participants
February 8	Binakayan, Kanluran, Samala-Marquez, Bisita-Balsahan, Manggahan, Congbalay-Legaspi, Pulborista Tramo-Bantayan, Aplaya	83
February 10	Gahak, Marulas, Toclong	85
February 17	Wakas 1 & 2, Kaingen, Poblacion Tabon 1,2, & 3, Batong Dalig	127
February 23	Potol, Panamitan, Sta. Isabel, San Sebastian	101

3.1.3 Second Pilot Projects

Based on the experiences obtained from the First Pilot Projects in Imus and in Kawit, extension programs to share the experiences obtained was conducted for the other low lying municipalities of Cavite, i.e. in Tanza, Rosario, Noveleta, Bacoor and General Trias.

In addition to the participating organizations supporting the community workshop to date, the extension programs were led by the Provincial Government's project, OPLAN LINIS CAVITE, organized by Cavite Provincial Government – Environment and Natural Resources Office (PG-ENRO). For the Extension Program, Trainer's Training was conducted prior to the individual community workshop at each municipality. Thereafter, community workshop at each municipality was implemented. Table 3.3 and Table R 3.5 present the work schedule for the extension program. The program was undertaken from May to June 2008.

Table R 3.5 Extension Program Activities

	Project Activities	Date
1	Training Program (Module) Development	April 2008
2	Trainer's Training	May 13-14, 2008
3	Community Workshop – Tanza	May 20, 2008
4	Community Workshop – Rosario	May 27, 2008
5	Community Workshop – Bacoor	June 3, 2008
6	Community Workshop – Novaleta	June 6, 2008
7	Community Workshop - General Trias	June 11, 2008

(1) Program Development

The Oplan Linis Cavite has prepared the training module for the trainer's training program as well as the training program schedule. These materials were intended to serve as a guide to trainers/facilitators in conducting information, education and communication (IEC) activities during the individual community workshop to be held in their respective municipalities.

(2) Trainer's Training Program

After the preparation of the training materials, an intensive trainer's training program was conducted during May 13-14, 2008 by the Oplan Linis Cavite and the Provincial Government of Cavite. About 40 persons participated, including 5 representatives from various sectors from each Municipality for the extension program.

(3) Community Workshops

For the remaining days of May and June 2008, the participants of the Trainer's Training at each Municipality together with Oplan Linis Group as well as the staff from Provincial Government's Environment and Natural Resources Office (PG-ENRO), Municipal

Environmental and Natural Resources Office (MENRO) conducted Community Workshops at their respective municipalities. Followings are the description of the Community Workshop held at each municipality.

(a) Municipality of Tanza

Applying the skills acquired during the trainer's training program, i.e. strategies in choosing the target community, Barangay Santol was selected as the target community for the Municipality of Tanza. Due to the overflow of Canas River, the Community was severely affected by the flood during Typhoon Millenio. Preparatory meetings with municipality staff and barangay officials were held during 15-16 May 2008, and, then, the community workshops were held for the stakeholders of Barangay Santol at the venue of Santol Elementry School. The number of participants was 34, and the date of each workshop is as listed below:

Table R 3.6 Community Workshop Activities – Tanza

	Workshop Activities	Date	Responsible Inst.
1	Meeting with Barangay Officials	May 15, 2008	MENRO, Pastoral Council, BHW
2	Preparatory Meeting	May 16, 2008	MENRO, Pastoral Council, BHW
3	Community Workshop	May 20, 2008	MENRO, Pastoral Council, BHW
4	Tree planting Activity	May 20, 2008	MENRO, Pastoral Council, BHW

Note: MENRO: Municipal Environment and Natural Resources Office
BHW: Barangay Health Workers

At the end of the Community Workshop, the plans and programs of Barangy Santol were identified to have a sustainability of the non-structural measures of the study. The participants suggested various strategies to help solve the flooding problem of their barangay more particularly in the issue of illegal dumping of solid waste into the rivers and other waterways. In conclusion, in order to have proper information to the community regarding the solid waste management and existing laws and ordinances, all the eight streets of Barangay Santol (Purok levels) took household meetings during the last week of May, 2008. Programs such as segregation training were also conducted during the Purok household meetings as well.

After the Community Workshop, all the participants to the Workshop proceeded to tree planting activities organized by the Municipal Government. Trees were planted along the banks of Canas River.

Barangay ordinance is being developed and planned to pass before the June of 2008. Contents of the ordinance include "not to use plastic bag" but to use re-usable basket, etc., which is based on the awareness against solid waste from the Community workshop conducted in the municipality.

(b) Municipality of Rosario

Municipality of Rosario is located to the right bank of Canas River, which floods very often. Barangay Wawa III is one of the very first communities affected by floods whenever there is heavy rainfall. Moreover, out of the 94,000 residents in the Municipality (year 2007), approximately 11,000 persons live in the Barangay. Due to these backgrounds, the Barangay Wawa III was selected as the target community of Rosario. Five times of community workshops were held for the Barangay at the venue of Covered court, Barangay Hall, Wawa III. The number of participants was 54, and the date of each workshop is as listed below:

Table R 3.7 Community Workshop Activities - Rosario

	Workshop Activities	Date	Responsible Inst.
1	Identification of the Pilot Barangay	May 17, 2008	LGU
2	Discussion with the Pilot Barangay	May 23, 2008	LGU, Wawa III
3	Preparatory Meeting	May 26, 2008	LGU, Brgy
4	Community Workshop	May 27, 2008	LGU, Brgy
5	River Cleanup Activity	May 27, 2008	LGU, Brgy

Similar to the workshop in Tanza, problems related to the solid waste management in the Barangay were identified and considerable solutions were proposed. It was concluded, among others, that barangay officials meeting, consisting of 20 barangay captains were called by the Municipal Government to share the information provided by the JICA Workshop.

(c) Municipality of Bacoor

Throughout the project, the Study Team has been working together with several NGOs in the Study Area. Saguip Ilog Cavite Council, Sagip Ilog Kawit and Oplan Linis Cavite are some of the NGOs, which the Study Team worked together.

In Bacoor, there are many active NGOs in the area and many of which are very supportive to the municipal government. During the Community Workshops, several NGOs in the area, such as Strike Foundation, Inc. and Universal Peace Foundation, have cooperated in the activities. Coordination with NGOs is lead by the municipal government and the Study Team's Community Workshops was effectively implemented in the Municipality.

Five times of community workshops were held for the stakeholders of Panapaan IV, Municipality of Bacoor at the venue of Learning Center, Panapaan IV. The number of participants was 49, and the date of each workshop is as listed below:

Table R 3.8 Community Workshop Activities - Bacoor

Workshop Activities		Date
1	Meeting w barangay official, Brgy – Panapaan IV	June 1, 2008
2	Study Team Meeting on Community Workshop	June 2, 2008
3	Conduct of Community Workshop	June 3, 2008
4	Eco Tours to Brgy Molino 5	June 6, 2008
5	Tree planting Activities	June 7, 2008

(d) Municipality of Noveleta

Four times of community workshops were held for the stakeholders of Barangay San Antonio I at the venue of Social Center. The number of participants was 76, and the date of each workshop is as listed below:

Table R 3.9 Community Workshop Activities - Noveleta

Workshop Activities		Date
1	Briefing of Brgy. Council - Brgy San Antonio	May 26, 2008
2	Preparatory meetings	June 2 and 4, 2008
3	Conduct of Community Workshop	June 6, 2008
4	Clean-up Drive	June 6, 2008

Community workshop in Noveleta presented an example of close coordination between the provincial and municipal government. The workshop was attended by three staff from Provincial Government of Cavite, including Environmental and Natural Resources Officer of the provincial Government. Mayor of Noveleta lead the discussion throughout the workshop.

Oplan Linis Cavite of the Provincial Government worked in close coordination with the Municipal Government of Noveleta, also in the afternoon of June 6, 2008. Clean-up activities were held in Barangay San Antonio I with more than 100 personnel participating in the activity. Provincial Government of Cavite, through Environmental and Natural Resources Office, assisted in their activities by providing dump trucks and support staff during the exercise.

(e) Municipality of General Trias

Five times of community workshops were held for the stakeholders of Barangay Bucao I at the venue of Municipal Hall. The number of participants was 54, and the date of each workshop is as listed below:

Table R 3.10Community Workshop Activities – General Trias

	Workshop Activities	Date
1	Dialogue with Barangay Bucao I	May 21, 2008
2	Identification of participants for workshop	May 26, 2008
3	Pre-planning for the workshop	May 29, 2008
4	Unveiling of Sign Boards	June 11, 2008
5	Conduct of the Workshop	June 11, 2008

Activities for the Municipality of General Trias commenced with the unveiling of sign boards prepared along the riverbanks, where garbage has been dumped into the river frequently. Signboards called for the importance of keeping the river clean by not throwing garbage into the river. After the ceremony, the participants moved to the municipal hall where the community workshop was conducted. Action plans formulated during the workshop included drafting and passing of barangay ordinance for the environmental protection of river.

3.1.4 Evaluation of the Pilot Projects

(1) Criteria for Evaluation

The results of the aforesaid pilot project are evaluated based on the following criteria, which were set up with referring to the "Guide for Project Evaluation by JICA, Feb. 2005".

(a) Relevance:
Evaluate whether or not: (i) the target effects of the project could accord with the needs of the project beneficiaries, (ii) the project was the appropriate solution against the major problems and issues, (iii) the target effects of the project are in consistency with the development policy of Philippines and/or Japan, and (iv) the approaches taken for the project implementation area are judged to be appropriate;

(b) Effectiveness:
Evaluate whether or not the project could contribute to the benefit of the target beneficiaries and/or society;

(c) Efficiency:
Evaluate whether or not the cost invested and/or manpower committed to the project implementation is efficiently used;

(d) Impact:
Evaluate the long-term and/or indirect positive and negative impacts brought by the project implementation,

(e) Sustainability:
Evaluate whether or not the effects of the project could be sustainable after completion of the Study.

(2) Results of the Evaluation of the Pilot Projects

The results of the implementation of the pilot project are evaluated as below:

(a) Relevance

A large volume of the garbage is being dumped into the rivers and the drainage channels in the lowland area in particular, which is densely packed with the houses. The dumping garbage remarkably reduces the flow capacity of the rivers and drainage channels causing the serious flood overflow. The major factors for dumping of the garbage would be attributed to: (i) the inadequate garbage collection system and (ii) the lack of awareness of the residents on necessity to keep clean the rivers and/drainage channels. Of these the factors, the item (i) would be remarkably improved through the on-going project for the new solid waste management system by the Provincial of Cavite.

According to the results of the interview survey by the Study Team, however, a considerable number of the residents revealed that they would continue to dump their home waste into the rivers and/or drainage channels near to their houses even after completion of the above new solid waste management system.

In due consideration of the above current status of the study area, the information and education campaign (IEC) for cleanup of the waterways would be one of the important issues for flood mitigation in the study area. The Medium-Term Philippines Development Plan 2004-2005 also highlighted the proper maintenance of the rivers/drainage channels including removal of the garbage therein as one of the important tasks for flood mitigation. Thus, the pilot project implemented through the Study could be in consistency with the national development policy.

(b) Effectiveness

The pilot project was provisionally planned to firstly target two communities, and then, spread over other ten communities. It was further planned that the target communities would be set up at the level of the barangay (the minimum administrative unit in the Philippines).

In accordance with the results of discussions with the Provincial Government of Cavite, however, the target extent of pilot project was expanded to the level of the municipality from the said barangay level. The Municipality covers some hundred barangays within its administrative boundary. As the results, the objective area of the pilot project covers the whole of seven (7) municipalities located in the low land part of the study area.

The above expansion of the objective area of the pilot project could enable the IEC for more comprehensive administrative extent. At the same time, however, it led to a disadvantage such that the less percentage of the residents to the whole in the municipality could attend to the IEC in the project as described below:

- The pilot project firstly aimed training the leaders for the IEC for cleanup of the waterways. A variety of officials of the municipalities, the core members of NGOs and barangay captains could attend the training. Thus, the necessary knowledge for IEC could be diffused among more comprehensive groups of leaders as compared with those at barangay level as originally targeted.
- The pilot project secondly aimed at executing IEC for cleanup of the waterways for the residents through opening of the workshops/seminars, distribution of the IEC materials such as comic book and outdoor training for the actual cleanup of waterways. The number of residents, who attended the IEC, was about 400. This number of the attendants of the residents is still extremely small as compared with about 1 million of residents, the whole number of residents in the objective municipalities. Accordingly, the further IEC is required to spread the awareness on the necessity of cleanup of waterways among the more residents.

(c) Efficiency

The pilot project required about 1 million pesos (about 3 million yen) in total for its implementation. Of the cost, about 650,000 pesos (about 2 million yen) was borne by JICA and the remaining was shared by the Provincial Government and the relevant municipalities.

The Provincial Government has allocated about 35 million pesos as the annual budget for maintenance of the public facilities including cleanup drive of the road, parks and other public spaces (called "Oplan Linis"). The above cost of 1 million pesos for implementation of the pilot project is judged to be not small amount as compared with the annual budget of the Provincial Government for maintenance of the public facilities.

However, the cost for the pilot project was used for completion of: (i) training of the leaders for the IEC and (ii) preparation of materials such as leaflets and pamphlets for enlightenment of the residents on cleanup of the waterways. Accordingly, the necessary cost required to the further activities for IEC is limited to opening of workshop/seminars for enlightenment of the residents and the additional printing of the IEC materials. From this point of view, the cost spent for implementation of the pilot project is judged to counterbalance with the outputs of the pilot project.

In addition, the notable efficiencies in the approaches to the pilot projects are as described below:

(i) On the presentation of the IECs

The concepts were presented in an easy and accessible manner. The use of Filipino language in the IECs ensures that the general public is able to understand the issues being presented. Understandably there are some terms that are not easily translated in the vernacular. In such cases, local language explanation was made.

(ii) On targeting the right audience for the workshops

While the workshops for the barangays have been well attended, the majority of the attendees were the barangay officials and personnel. Whereas the participation of the barangay leaders is important, it would have been more useful if more of the informal residents participated.

(iii) On the use comic book as a public awareness tool

The comic book is seen as a reading material that is accessible and widely read by the masses. However, the preparatory period of the comic book was rather short and the trial use of the material has been hardly made by the target audiences such as residents and informal settlers. The comic book might have been an appropriate medium but the design should have been pre-tested and revised accordingly. Given the limited time available, the effect of the comic book should be evaluated in the future.

(d) Impact

The Provincial Government (PG-ENRO), the Municipality (MENRO), the NGOs and the residents had jointly undertaken the IEC for cleanup of rivers/drainage channels stating from the preparatory works. Such cooperative activities have never been made, and the lessons learned through implementation would greatly contribute to promotion of the cleanup of the waterways, which could lead to proper preservation of the channel flow capacity and reduction of the flood channel overflow.

(e) Sustainability

The Provincial Government of Cavite has determined to continue the IEC for cleanup of waterways and appointed the PG-ENRO and the MENROs as the implementation agencies. The necessary cost for the IEC would be covered by the project cost of the “Oplan Linis”, which is now in progress as the cleanup drive for the roads, parks and other public open spaces.

Moreover, the Provincial Government has scheduled to establish the Flood Mitigation Committee (FMC) and complete the necessary budgetary arrangement for establishment of FMC by March 2009. The FMC would function to take leadership, coordinate and monitor the activities for the IEC.

The sustainability of the IEC for the cleanup of the rivers and drainage channels would be ensured by the above organization-setup, which would promise the maintenance of the necessary flow capacities of rivers and drainage channels and protection against channel overflow by the flood.

3.2 Flood Warning and Evacuation

3.2.1 Summary of Activities

A substantial part of the study area is currently exposed to the risk of river overflow even in the event of a probable flood of 2-year return period. Hence, it is important to mitigate flood damage by non-structural measures such as the flood warning and evacuation system.

However, there is no reliable flood warning and evacuation system in the Study Area. Therefore, during the Study, pilot communities were selected, a prototype of flood hazard map was made, community disaster prevention activities such as evacuation drills were carried out, and the Flood Disaster Preparedness Manual that describes the objective, procedure of flood warning and evacuation as well as the required activities was made. The implementation schedule of such activities is as shown in the table below.

Table R 3.11 Schedule of Pilot Flood Warning and Evacuation Activities in the Study

Activities	Aug				Sep				Oct				Nov			
Collecting data	■	■						■	■							
Selection of Target Barangays	■															
Checking of Evacuation Center		■														
Making of Flood Hazard Map (Draft)			■	■												
Preparation of Map Exercise					■											
Map Exercise in 3 Barangays						△△△										
Field Reconnaissance		■			■											
Preparation of Seminar and Drill							■									
Seminar and Evacuation Drill in 3 Barangays								△△△								
Modification of Hazard Map								■								
Preparation of Flood Prevention Manual								■	■	■						
Trainer's Training on Flood Hazard Map																△

3.2.2 Selection of Pilot Community

The Municipality of Kawit was selected as the pilot municipality in the conference among the representatives of the Provincial Government, the Provincial Government - Environment and Natural Resources Office (PG-ENRO), and the Provincial Disaster Coordinating Council (PDCC). Then, in the meeting with the Mayor, Vice-Mayor, Councilors, the representative of the Engineering Office (EO) as well as the Action Officer of the Municipal Disaster Coordinating Council (MDCC) on August 7, 2008, three (3) barangays were selected as the pilot communities: Potol-Magdalo, Gahak and Manggahan-Lawin.

Potol-Magdalo is affected by the river overflow of San Juan River and/or the Ylang-Ylang River, Manggahan-Lawin is affected by the overflow from Imus River, and Gahak suffers from inland water and overflow of small drainages.

3.2.3 Map Exercise

The map exercise is one of the risk communication tools or methods. It is a kind of training where the danger area or situation under the scenario or assumption of a calamity is plotted and/or written on a map. The features of the map are: the problem can be made visible, it can be played easily like a game, and it can be conducted using cheap materials.

The map exercise in this Study was carried out as the half-day workshop for the residents and as preparatory works for development of the flood hazard map.

(1) Objective

There is a limit to the approach done only by government and researchers as well as the JICA Study Team. The residents have the best knowledge on the characteristics of the area. They know well where the dangerous area is, where the safe area is, who you are in the locality and what the problem is. In addition, ownership can be fostered because the community and the persons concerned are the main players. The objectives of the government side and the community side are as follows, respectively:

(a) Government

The government side can obtain detailed flood information from the residents and compare the image/simulation result and the actual condition through the map exercise activity. Moreover, it can identify/recognize urgent transportation routes and evacuation centers in connection with the flood relief plan/flood prevention plan, and it can contribute quick responses against disasters and reflect on the effectiveness of such plans.

(b) Community

The residents may find difficulty in reading a map. However, they might be able to understand and locate where they live and clarify where the evacuation center is through this map exercise activity. They might also be able to identify where the flood prone area is and where the dangerous area is. Generally, therefore, it would be easy for the residents to understand the flood hazard map and the awareness of disaster prevention will rise.

(2) Community Workshop

The Philippine side with support from the JICA Study Team conducted three (3) community workshops and the first one was in Gahak on September 9, 2008, as summarized in the table below.

Table R 3.12 Workshops Conducted on Map Exercise

Pilot Community	Date	Time	Participants	
			Government	Community
Potol Magdalo	September 10, 2008	9:00-12:00	11	52
Gahak	September 9, 2008	9:00-12:00	9	37
Manggahan-Lawin	September 10, 2008	14:00-17:00	9	18

(3) Contents and Procedure

The procedure and contents of the map exercise are as follows:

- Explanation: Explanation of Importance of Map Exercise and the Procedure
- Grouping: Making 3 groups (7 to 10 people each) and selection of group leaders
- Task 1：Draw the lines of rivers and roads, putting marks of government facilities and evacuation centers as landmarks
- Task 2：Draw the lines from participant’s house to evacuation center
- Task 3：Discussion on the questions in each group and explanation of the result by the group leader

The details of the contents are as described in the Annex to the Flood Prevention Preparedness Manual.

(4) Result

The MDCC arranged the meeting and presided over the workshops. The Municipal Mayor of Kawit visited the activity, the Vice-Mayor took part in the activities and personnel of the EO provided support to the group work. In addition, PG-ENRO and PDCC also took part in the activities and supported the group work of the community. In general, the Municipality of Kawit joined the activities positively.

In the map exercise the residents were trained to get used to read the map and express their knowledge on the flood hazard areas and the evacuation routes on the map. Group discussions were also carried out based on the knowledge derived through the map exercises. The questions and results are as summarized in Table 3.4. There was a case where they missed the point of argument so that the JICA study team explained the result that had to become a model answer during the discussion in the seminar that was held later.

As the results of map exercise, the residents could well understand the information given from the flood hazard map developed. At the same time, the useful information on the flood hazard are and eligible evacuation route were obtained from the residents and incorporated into development of flood hazard map.

3.2.4 Development of Flood Hazard Map

(1) Objective

As mentioned before, floods might occur while the project is being conducted because the completion of structural measures takes a long time and requires a huge investment. The main reason for the loss of human life during a disaster is that no appropriate evacuation directive is given to the residents. The lack of directives would result in the following consequences:

- Wrong evacuation / No safe evacuation / People do not know what to do
- Wrong perception of safety behind structural measures
- Poor knowledge on the present danger and hazard / No technical capability
- No warning / Warning ignored

The Flood Hazard Map is an effective flood prevention measure to lessen damage. Flood hazard maps are prepared aiming at the prevention of loss of human life during floods by providing flood and evacuation information to the residents. However, it should be noted that these maps do not prevent floods.

(2) Contents

The flood hazard map contains information about risks of floods. It shows the extent and degree at which an area is prone to a particular hazard. The hazard map also shows the areas generally safe or unsafe from flash floods, the various river systems and areas likely to be affected by floods, and evacuation information.

The JICA Study Team developed the draft flood hazard maps for Kawit and the pilot barangays based on the information given from the residents/the relevant officials through the above map exercise and the hydraulic simulation as shown in Fig.3.1 and Fig.3.2. The information presented in the hazard map contain the following items:.

- The purpose and usage of the flood hazard map written in Filipino language,
- “What to do in the event of flood” as an essential point before and during floods (written in Filipino language),
- The possible flood inundation area and inundation depth in the recurrence probability of 5-year return period,
- Flood prone area delineated in the map exercise,
- The location of evacuation centers and evacuation routes,
- The emergency goods that evacuee should take
- The contact telephone numbers in emergency including those for the police station, the fire station, the “Cavite Rescue 161”, the office of the disaster coordinating council, the disaster operation center and the office of MERALCO, and
- The location and photograph of landmarks such as the school, the municipal hall, the barangay hall and the chapel

3.2.5 Seminar on Hazard Map and Evacuation Drill for the Residents

(1) Objective

The hazard map and evacuation drill aimed to decrease the community's vulnerability to flood disasters by explaining the mechanism of floods and obtaining a clearer understanding of the flood hazard map. Awareness of disaster prevention and disaster mitigation will improve through this activity, and it leads to the avoidance of casualties in the event of flood, that is, building the community's coping capacity[1] during disaster.

(2) Conduct of Hazard Map Seminar and Evacuation Drill

The hazard map seminar in which the mechanism of floods in the area and the flood hazard map were explained was conducted as a part of the Information and Educational Campaign (IEC) about one week after the map exercise workshop. The evacuation drill was carried out at the same time. The seminar was conducted mainly by the Philippine side with support from the JICA Study Team which explained the mechanism of floods. This activity was implemented, as follows:

Table R 3.13 Hazard Map Seminar and Evacuation Drill

Pilot Community	Date	Time	Participants	
			Government	Community
Potol Magdalo	September 17, 2008	9:00-12:00	16	39
Gahak	September 20, 2008	9:00-12:00	9	44
Manggahan-Lawin	September 17, 2008	14:00-17:00	7	35

(3) Program and Contents

The program and contents of the Hazard Map Seminar and Evacuation Drill are as summarized below:

Hazard Map Seminar (Awareness Program):

- Flood Mechanism in Cavite and Community
- Explanation of Flood Hazard Map and how to use it
- Explanation of Map Exercise Activity

Evacuation Drill:

- Confirmation and suggestion on discussion result of Map Exercise
- Evacuation Drill (movement to evacuation center)
- Wrap-up

(4) Result

PG-ENRO explained what Flood Hazard Map is. The Barangay Chairman reported on the map exercise activity, and barangay tanods and rescue personnel guided the participants on the way to the evacuation center. Moreover, the Kawit MDCC and personnel of the EO actively took part in all the activities, that is, the Philippine side participated positively.

During the walk to the evacuation center, the participants were able to check, confirm and/or verify the existence of hazards along the evacuation route such as manholes and road-side drainages. The Flood Hazard Map had become more effective by the verification.

[1] UN International Strategy for Disaster Reduction (UN-ISDR) defined the "Coping Capacity" as below:
The means by which people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster. In general, this involves managing resources, both in normal times as well as during crises or adverse conditions. The strengthening of coping capacities usually builds resilience to withstand the effects of natural and human-induced hazards.

3.2.6 Training on Flood Hazard Map for the Government Officials

(1) Objective

The know-how on development of Flood Hazard Map is transferred to the government officials through this training. The participants conduct mapping exercise and develop a tentative draft flood hazard map, and then they can understand the procedure. These draft hazard maps shall be subjected for further validation upon the participants return to their Municipalities through re-echoing of the training activities. Final expected output is a continuous developing of Flood Hazard Map.

(2) Conduct of Training

The training on Flood Hazard Map was conducted to key persons who had to develop a Flood Hazard Map of Cavite Low-land Area at Old Session Hall in Cavite Provincial Capitol bldg. on November 26, 2008.

As summarized below, 45 participants conducted this training. The participants were counter-part personnel from Cavite Provincial Government and DPWH Cavite office, Municipal Engineering Office (MEO), Municipal Plannning and Development Office (MPDO), Municipal Environmental and Natural Resources Office (MENRO) and MDCC.

Table R 3.14 Number of Participants of Training

Cavite Provincial	Bacoor	Kawit	Imus	General Trias	Noveleta	Rosario	Tanza	DPWH Cavite	JICA & JICA Study Team
10	4	3	3	4	4	7	4	2	4

(3) Contents and Program

The training on Flood Hazard Map is a 1-day seminar-workshop in which the steps of map exercise and hazard map seminar taken in the three pilot barangays of Kawit was imitated through direct consultation with the invited participants as follows:

<u>In the morning (10am to 12nn)</u>

- Explanation of Flood Hazard Map and how to use it
- Flood Mechanism in Cavite and each Municipality
- Report on Map Exercise Activity in Kawit

<u>In the afternoon (1pm to 3:30pm)</u>

- Explanation and Execution of Map Exercise

Each Municipality had selected their target barangay in advance and they practiced on the satellite image map which is provided by JICA Study Team as a Map Exercise. And then they developed prototype of flood hazard map by overlaying with the flood inundation area simulated by JICA Study Team.

(4) Result

Provincial Government undertook this training from the preparation stage. JICA Study Team explained flood mechanism in Cavite and reported the activity result of Kawit, and PG-ENRO explained what a Flood Hazard Map was and how to conduct Mapping Exercise.

The presenter explained and confirmed each Municipality the cause of floods by using animation of flood simulation result and the participants systematically understood flood mechanism.

During Mapping Exercise JICA Study Team and Municipality of Kawit and PG-ENRO who had experienced same activity in Kawit guided and supported the activity of each Municipality. After the exercise they discussed on some questions and presented their result as shown in Table 3.5 and they were able to share the information each other.

Mapping Exercise can be conducted continually by themselves because it is not difficult. As for a Flood Hazard Map, JICA Study Team had already given the necessary data in GIS and Auto-CAD and JPEG format and it is expected to be developed by each Municipality.

3.2.7 Flood Disaster Preparedness Manual

Based on the evacuation system proposed in the Master Plan and the information obtained through the IEC activity in the pilot communities, the Flood Disaster Preparedness Manual was prepared. This manual describes the objective and procedure of flood warning and evacuation, as well as the required activities. (Refer to Appendix 8, Vol. 4.)

(1) Objective

There is no consistent flood warning and evacuation system in the Province of Cavite. The Flood Disaster Preparedness Manual was therefore prepared to guide the provincial and municipal governments of Cavite whenever a flood disaster is expected, and also for the IEC in normal time., The manual should be modified accordingly, if found necessary to update information and data.

(2) Related Laws and Regulations

Presidential Decree No. 1566, dated June 11, 1978, which is known as the decree for Strengthening the Philippines Disaster Control, Capability and Establishing the National Program on Community Disaster Preparedness, aims to strengthen the disaster management capabilities of the government (disaster preparedness and response) from the national down to the barangay level.

The roles of the DCCs and the leadership at each level as defined in PD 1566 are strengthened by Republic Act No. 7160, which is otherwise known as the Local Government Code of 1991. RA 7160 provides the authority and responsibilities of the local government units (LGUs) to develop disaster prevention and management programs.

Presidential Decree No. 477, which is known as the decree on local fiscal administration, prescribes the budgetary requirement that two percent of the estimated revenue from regular sources shall be set up to cover unforeseen expenditures arising from natural calamities, etc.

The Provincial Government of Cavite ordered the activation and reorganization of the Provincial Disaster Coordinating Council in 2007 through Executive Order No. 97.

(3) Contents of the Flood Disaster Preparedness Manual

The Flood Disaster Preparedness Manual consist of six (6) chapters as listed in the table below.

Table R 3.15 Contents of the Flood Disaster Preparedness Manual

Chapter	Title	Contents
Chapter 1	Introduction	Background, Objective, Flood History in Cavite, and Hydro-Meteorological Conditions in Cavite
Chapter 2	Disaster Preparedness in Cavite	Related Laws and Regulations, Flood Risk Area, Procedure of Flood Warning and Evacuation, Flood Warning Code and Communication Network among DCCs
Chapter 3	Community-Based Flood Warning and Evacuation	Barangay, Organizational Setup and Tasks of BDCC
Chapter 4	Evacuation	In Normal Time, In the Event of Flood
Chapter 5	Flood Hazard Map	Importance, Objective, Contents
Chapter 6	Public Awareness	Objective, Map Exercise, Seminar and Evacuation Drill, Others

3.2.8 Evaluation of Activities

The results of the aforesaid pilot project are evaluated based on the criteria as described in the foregoing subsection 3.1.4 (1).

(1) Relevance

The Study Area has experienced the large river overflow flood four times since 2000, and several hundred thousand peoples were affected by each of the floods. Such frequent river overflow could be attributed to the extremely small river flow capacities. Thus, a substantial part of the study area is currently exposed to the risk of the frequent and disastrous river overflow. The flood calamities would be further aggravated due to complex factors such as the progress of encroachment to the flood hazard area and the increment of peak discharge due to the increase of urban population and the expansion of built-up area.

In spite of the risk of the floods as described above, the residents have not been adequately provided with the information for flood evacuation such as the extent of the flood hazard area and location of the eligible flood evacuation routs/evacuation centers. Under the conditions, the pilot project, which aims at establishment of flood warning and evacuation system, is judged to be in consistent of with the needs of the residents, and urgently required.

The national development plans in Philippines such as Medium-term Philippine Development Plan 2004-2010 as well as the Medium-term DPWH Infrastructure Development Plan 2005-2010 also take up the development and diffusion of the flood hazard map and establishment of the flood warning and evacuation system as one of the national important policies. Thus, the pilot project is in line with the national development policy.

(2) Effectiveness

The disaster information that residents obtain through the TV, radio and newspapers is deemed to be rather fragmentary and not always useful during the actual flood. The Provincial Government and municipalities have established the disaster coordinating committees (the PDCC and MDCCs) in order to safely guide the residents for evacuation from the flood. However, the committees have neither developed the flood hazard map nor established the definite process for flood warning and evacuation, yet.

Taking the above current status into account, the pilot project aimed at developing flood hazard map and establishing the definite processes for flood warning and evacuation for the selected three (3) barangays as the pilot communities. At the same time, the transfer of relevant knowledge to the officials of the LGUs as well as the residents was made as a part of the scope of the pilot project.

The workshop/seminar, the map exercise and the field drill for flood evacuation were undertaken several times in the pilot project. It is judged that the above objectives/scopes of the pilot project could be fully achieved through these activities.

(3) Efficiency

The pilot project has been executed by one Japanese expert in collaboration with several officials of LGUs for 3-month period. The cost required to execution of the project is estimated at about 360, 000 pesos (about 1 million yen) in total. Since the objective areas of the pilot project was limited to three (3) barangays, the said manpower committed and cost invested to the pilot project were made extremely small as compared with other similar projects.

In spite of the limited manpower and project cost, however, the project was efficiently performed completing all works as per the original schedule, although it took a rather long time to collect the necessary basic data. The works performed in the project include the workshops/seminars, the map exercise and the field drill for flood evacuation as described above.

The JICA Study Team refrained from using technical terms as much as possible in workshops/seminars and tried to prepare easy materials for the residents to understand. Use of Filipino language used in the workshops and seminars enabled the local residents to understand the presentations. The number of map exercises and seminars were originally scheduled to be two (2) times, but it was judged to be in adequate on the way of the pilot project and increased to six (6) times. The residents of 225 man-days in total participated in the activities.

(4) Impact

With implementation of the pilot project, the flood warning and evacuation system together with the flood hazard map is expected to gradually spread over the whole municipalities in the study area. As the results, the residents as well as the officials of the LGUs would raise the awareness on the risk of flood and the consciousness not to reside in the flood hazard area, which would lead to the proper land use in the study area.

The development of the hydrological gauging network for flood warning and evacuation is now in progress through the financial assistance by the United Nations Development Programme (UNDP). The flood hazard maps, the "Flood Disaster Preparedness Manual" and other outputs of the pilot project are expected to contribute to the successful implementation of the said development of the hydrological gauging network.

(5) Sustainability

The Provincial Government plans to continue the activities taken in the pilot project after completion of the Study, and appointed the PDCC, the MDCCs and the BDCCs as the execution bodies for the project.

Moreover, the Provincial Government has scheduled to establish the Flood Mitigation Committee (FMC) and complete the necessary budgetary arrangement for establishment of FMC by March 2009. The FMC would function to take leadership, coordinate and monitor the activities for the development of flood hazard map and establishment of the flood warning and evacuation system.

The sustainability of the activities taken in the pilot project would be ensured by the above organization-setup, which would promise continuation of development/updating of the flood hazard map, and the information education campaign/transfer of knowledge for flood warning and evacuation.

3.2.9 Problems and Recommendations

(1) Evacuation Center

The MDCC of Kawit had already identified 49 facilities as candidate Evacuation Centers. Twelve (12) of these facilities might be inundated deeper than 0.25m and two (2) facilities might be inundated deeper than 0.50m under a 5-year flood probability condition, as shown in Table 3.6.

Evacuation centers are not selected in consideration of the flooding condition. The eligibility of each facility has to be evaluated by the number of possible capacity for evacuated population and by the criteria mentioned in Sector 9.5.6 in Vol. 1. In that case, the flood simulation result by the JICA Study Team can be used.

(2) Accuracy of Flood Hazard Map

The Flood Hazard Map contains the flood inundation area simulated by the JICA Study Team and the information on evacuation centers submitted by the MDCC of Kawit. The Study Team had confirmed the locations using GPS.

However, the simulation result does not take into consideration the micro-topography of the flood plain such as road embankment and local hollow because the flood plain was modeled with square cells with the size of 100m. Therefore, the flood inundation area and depth have to be further compared and modified by field inspection.

The inspection, however, was not conducted during the study period. Hence, it is necessary for each municipality to execute confirmation works. The confirmation works would require adequate knowledge on hydrology and flood simulation, and the acquisition of GIS Software that would also require technical support.

(3) Public Awareness

The significant points regarding this public awareness activity are as follows:

(a) Clarification of Purpose and Sharing

The JICA Study Team thought that public awareness was an easy theme. However, the resident participants might not have understood why they were doing the activity and they might not discuss this matter effectively to others. It is important to disseminate the objective persistently.

(b) Importance of Facilitator

A facilitator is important in discussions or workshops. The facilitator would guide and prod the participants to discuss the topics deeply especially when they do not have enough time to do it.

(c) Application of Mass Communication Media

The most popular tool at present for the residents to obtain disaster information is the TV or radio. In such a background, providing information upon recognition of river information, educational campaign and information dissemination during disasters over a wide range becomes possible through mass media. The hazard map and photographs of activities can be published in the newspapers.

(4) Operation of Proposed Activities

The minimization of disaster damage could be achieved with the interaction of three (3) factors: disaster prevention capability, disaster mitigation capability (community capability) and optimum rehabilitation. No activity before flood, during flood and in normal time has been done because no flood warning and evacuation system has been established, although some approaches to rehabilitation after a disaster is conducted through the MDCC.

In case of flood disasters, the disaster prevention capability improves the efficiency of the structural measures such as river improvement, retarding basin and flood regulation pond that the JICA Study Team had already proposed in Master Plan study.

Disaster mitigation capability is improved by activities such as the disaster prevention plan, the development of evacuation system, and the development of human resources by training and education. Since the community-based activities described in this chapter have just started in Cavite, using the Flood Disaster Preparedness Manual and operation of the contents proposed in Sector 9.5 in Vol. 1 is important for the improvement of disaster mitigation capability.

(5) Further Technical Assistance from JICA

An utmost effort was made, in the pilot project, to efficiently achieve the transfer of knowledge on simulating of the flood hazard area to the officials of LGUs concerned. Nevertheless, the knowledge may have not been adequately transferred, because the pilot project was limited to three (3) months, only. In order to strengthen the knowledge on development of the flood hazard map in the aspect of the hydrological simulation in particular, the further technical assistance would be preferably recommended. The principal objectives for the further technical assistance are as enumerated below (refer to Vol. 4 Appendix_10):

(a) Simulation of the potential flood inundation areas,

(b) Plotting of the simulated potential flood inundation area on the topographic maps with use of the GIS system,

(c) Inputting of the necessary information to be presented in the flood hazard map, and

(d) Methodologies on dissemination and use of the flood hazard maps among the communities including the map exigencies for the residents.